# THE DESIGN AND CHARACTERISTICS OF LOW COST PRODUCTS

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## ABSTRACT

Low cost products and services are nowadays present in most sectors. However a clear definition of what makes a low cost product seems to be missing. This article proposes a state of the art on low cost products (through the study of a sample of 50 products recognized as "low cost") and aims to develop a framework to classify them through their design principles, to identify their main characteristics, how they emerge, how they are managed, as well as the impact they have on markets.

One of the main conclusions of this work is that two main low cost models should be distinguished. They are labeled i) 'low cost adaptation', where the classical products are striped naked of their non-essential functions to reduce costs, following a functionalist design approach; and ii) 'smart low cost design', that develops a less costly new product from scratch answering to consumer needs, and that can be linked to innovative design theories. These two models should not be mixed up with cost efficiencies models, which are also aimed at reducing costs, but are not a company's main strategy. The studied products show that 'smart low cost design' products are more innovative than 'low cost adaptation' products. The second model is richer and uses elements of the first one.

Furthermore, similar effects on the market are observed for both low cost product models, like the creation of demand and the overall price reduction, but the second model seems to have a stronger impact.

This work illustrates that a low cost approach can be used as a design tool.

## INTRODUCTION

Product costs have always been a central issue. In an era of economic crisis and acknowledgment of the needs of the base of the pyramid, this concern has been the basis for the development of new offers. Research about emerging markets and how to produce products for the base of the pyramid are subjects that have increasingly been discussed in the last years (Prahalad and Allen, 2002; London et al., 2010). Affordability seems to be one of the keywords when addressing emerging markets and the bottom of the pyramid (Anderson and Markides, 2007; Hart and Christensen, 2002). One of the solutions to attain this affordability seems to be developing low cost products. Low cost products and services have already been widely discussed in literature, a great number of articles having been written about the low cost airlines or about hard discounters in retail. (e.g. de Wit and Zuidberg, 2012; Basker, 2005)

But these are only two of the most known examples, low cost products and services are flourishing: From low cost flights to hard discount stores, passing through newspapers and hairdressers, low cost products and service offers can be found in almost every sector, and low cost seems to be a definition for several different kinds of products.

When comparing two low cost products, like an Easyjet low cost flight and Embrace, a low cost incubator, we identify several differences not only in their targeted markets when compared to the markets of their non-low cost counterparts, but also in their approach to the product functions. While the Easyjet low cost flight attracts many former non-consumers, but nevertheless tries to attract the price-sensitive consumers of the incumbent, the Embrace incubator is mainly aimed at parents instead of being aimed at hospitals. And while the

Easyjet flights mainly focus on removing non-essential functions, also called 'frills' to reduce costs, the Embrace incubator actually adds functions that are important for its clients, like portability (Radjou et al., 2012). This and similar comparisons lead to the hypothesis that not all low cost products follow the same model.
This article is built on the theory that two distinct models for low cost products and services exist, and tries to find evidence for these models through multiple case studies.
50 different products and services that were called low cost in the medias or in the literature or that had a radically lower cost than its concurring offers were studied. The main sources used were articles, books, websites on the products and the authors tested some of the products that were available.
The article starts by exposing the literature fragmentation and how they support the intuitive motivation for this article, the hypothesis that more than one low cost model exists. Afterwards, the research questions that will be addressed are stated and through the study of the 50 identified products we try to confirm the hypothesis of the existence of two design models. The main managerial implication of this work is that the products in the two different models are not achieved through the same design principles, knowing which model is targeted from the beginning of the product design is crucial. Since the intensity of the impacts on the market observed for the two models is different, it is also important to study them separately.

## LITERATURE REVIEW

### Literature fragmentation: different aims and supports

Two distinct literature currents linked to low cost products seem to exist: one mainly destined to managers about understanding the low cost business models and "how to fight low cost competitors" (Kumar, 2006; Ryans, 2009) and one for a broader public, including social entrepreneurs and NGOs, besides the managers, on how to innovate for the base of the pyramid (Ray and Ray, 2011; Prahalad and Hammond, 2002; Nakata and Weidner, 2012).
In addition to that, low cost products are also discussed in connection to disruptive innovations and disruptive technologies, as one possible form of disruption, the lower cost being one of the attributes that can attract customers to accept the degradation of other product functions (Christensen, 1997).
Finally some particular cases, like the hard discounters or low cost airlines, are discussed in the specific literature of some business sectors where low cost products had an important impact. These articles study particular cases, and often refrain to comparing products in other sectors, limiting themselves to the studied sector, offering for example studies comparing the different strategies for low cost airlines (Lin, 2012; Guillen and Lall, 2004).

### Multiple definitions in the literature

This literature fragmentation seems to be a reason why all these products described as low cost are not studied through the same framework, since the aims and the supports of these literatures are very different. On one extreme we have a description of an observed phenomenon and advice on how to handle it, while on the other one we have a social approach on how to provide meaningful and needed products and services.
One observation that can probably be linked to this lack of common framework is that definitions of what makes a low cost product or service are hard to come by and are even sometimes contradictory. While for Combe (2008, p2) low cost is a model that produces "*less expensive products or services whilst satisfying minimal and unconditional consumer demands*", taking in account the 'value for money'; for Karnani (2006) low cost products always have a cost-quality trade-off, and therefore a worse quality than the 'regular products'.

Existing definitions also tend to describe only a part of the existing low cost products. They focus on one cost reduction strategy, like 'no frills' for Combe (2008), and do not take into account that most low cost products combine several cost reduction strategies (like delocalising to cheaper countries, mass production to achieve economies of scale, dematerialisation, outsourcing, amongst others).
In the airlines sector, for example, low cost carriers offer a 'no frills' service, but they go well beyond striping away non-essential functions. They have specific business models, where operational efficiency, ancillary revenues, point-to-point flights, using less congested airports and dematerialisation are as important as not offering a free meal (Guillen and Lall, 2004; O'Connell and Williams, 2005). And although incumbent companies have recently adopted some of these cost reduction strategies, that still does not make them low cost companies.
The same can be pointed out for hard discount retailers. Their lower costs do not only come from the reduced number of articles sold, nor only of the change of product display in the stores, but from a different business model with changed supply chains, different relationships with suppliers and even different location criteria than regular retail stores. (Kumar, 2006; Colla, 2003) And, as Kumar (2006) points out, their quality can be as high as (or even higher than) regular products quality: several private-label products sold by Aldi, a German hard discounter, have bested branded products in competitions and taste tests.
Although these multiple definitions do not prove that two models exists, they are indicate that a more detailed study of these products is pertinent.

**Ambiguity between 'Low cost' and 'low price'**

In addition to the above-mentioned divergences in definition, low cost and low price seem to be two concepts that are often mixed up by customers and even in the literature. In business and marketing literature, the low cost competitors are described as those that offer "good enough" products and services at very attractive prices (Ryans, 2009) or companies that offer products and services at prices dramatically lower than the prices established businesses charge (Kumar, 2006). This can probably be explained by the fact that the price is what the consumers and the competitors see, and ultimately what affects purchasing decisions. However, it is important to point out that not every cheap product or service should be labelled as low cost. Due to airlines yield management (or to sales in retailing) a regular product can have a lower price at a certain moment than a low cost product (Piga and Bacchus, 2006). Besides that, other price-reduction mechanisms, like government subventions or ancillary revenues exist, and they do not always affect the cost of the product. It is important to keep in mind that low cost products, in the way the expression is used in this article, should have significant costs reductions.
This point also reinforces the motivation to further study low cost products to get a clearer vision of what they are, because a part of the products called 'low cost' might actually not have lower costs, but only be perceived as such due to a lower final price paid by the customer.

**Multiplicity of the sources of cost reduction**

In several cases, a change of technological paradigm can be the source of the important cost reduction. One interesting example is the 'Transmilenio', the 'low cost metro' built in Bogotá: a mass transit transport system that has similar capacity and service levels as an underground metro system, but is bus-based. This bus rapid transit (BRT) service had a capital cost of a little more than 10% of the estimated cost of the equivalent heavy rail (Cain et al., 2007).
In addition to these radically changed products, the so-called "basic versions" of several products are often classified as low cost, too. An example is the mobile phone service offered

by several companies (like Free) that does not include a mobile phone and is classified in France as low cost, opposing the classical bundled option.
It is important to have in mind that the change in the technological paradigm is not the only way to innovate. Changes to the business model are often important innovations, eventually as important as innovations to products and services (Yovanof and Hazapis, 2008) and can turn a 'regular product' into a low-cost one. An example are the models based on sharing, were costs are reduced for each person, like shared taxis. Different combinations between product changes and business model changes can be found in low cost products.
An interesting example for business model innovation is IKEA, the Swedish furniture retailer. IKEA's success cannot be explained only by its attractive but simple product design and lower cost from global sourcing. The company managed to reduce its costs (and its prices) by changing the entire shopping experience and the relationship with customers and suppliers. Making the customers part of the production process for instance, by letting them transport and assemble their furniture themselves, was a part of this business innovation that allowed to create value for customers and to reduce costs (Normann and Ramirez, 1993). It is interesting to remark that this business model change had a strong impact on the product design: the furniture is designed so as to be easy to assemble and the pieces easy to handle and transport.
Williamson and Zeng (2009, p.69) also draw attention to the evolution of strategies to produce low cost products, by stating that "the first wave of emerging giants offered low-cost products and services primarily by utilizing relatively inexpensive personnel, but the second generation has developed an additional competitive edge through cost innovation."
The existence of several approaches to attain lower costs and the possibility to combine them is another element that reinforces the hypothesis of different models behind the low cost products.
All these elements lead us to formulate the hypothesis for this work: *There are two different models behind low cost products.*

## RESEARCH QUESTIONS

The hypothesis of the existence of different low cost models leads to several research questions, the ones that we try to address in this article are: What are the different existing low cost models and what are their main characteristics? What are the reasons why one or the other low cost model is chosen? How do the low cost products emerge? Which are the main conditions for the realisation of these models? How are they managed? What are the main changes brought forward by these products in the markets?

## METHODOLOGY AND MATERIALS

To explore and hopefully identify the existing low cost models, 50 products and services were studied (the full list can be found in appendix 1). Information about these products has been collected through articles, press releases and use of the products. A systematic analysis of the data was conducted, following classic methodologies used in multiple-cases studies (Eisenhardt, 1989).
These cases were chosen through two different methods. The first group of cases was chosen for its recurrence in the literature, it is a group of thoroughly discussed products and associated business models. The second group of cases was chosen for the innovation associated to the product.
For each case studied we looked at the kind of change made (technical system change, business model change or a combination), the sector in which the product is, the cost reduction strategies employed, the way these products interact with the customer's environment and constraints and if there are already studies on the impact of the product in the market.

## PROPOSED MODELS

### Low cost and operational effectiveness

Although there are many cost reductions adopted throughout the industries, not every cost reduction will be treated by us as a low cost model (see Figure 1). As Porter (1996) states, operational effectiveness is necessary in most industrial sectors, but is not a strategy, because it does not assure long-term competitive advantage. In the low cost models, the cost-reduction is a clear strategy adopted by the company and that defines each step of the product life cycle. The cost-reduction in these models is also combined to a client utility evaluation, and additional utility might be added, even if it increases cost, if this is considered to sufficiently improve client utility.

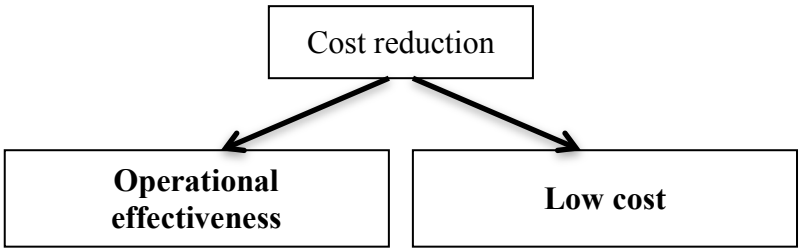


Figure 1: Cost reductions can be divided into operational efficiency and low cost models

As can be seen in Figure 2, in operational effectiveness, the aim is to reduce cost/price without changing the client value.

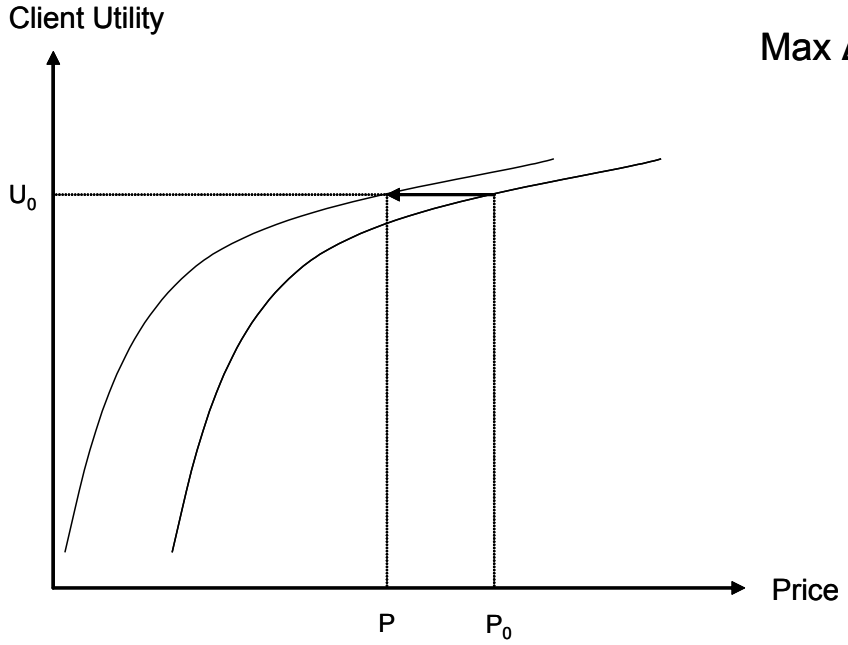


Figure 2: Effect of operational effectiveness

### Theoretical framework

Special attention has been given to the design principle behind these products, which was used to classify the products into two groups. Each product was linked to one of two different design theories: to innovative design theories (Hatchuel and Weil, 2003), or to systematic design theory (Pahl and Beitz 1988).

In the introduction of their work, Pahl and Beitz (1988, p1) state: "*The main task of engineers is to apply their scientific and engineering knowledge to the solution of technical problems, and then to optimize those solutions within the requirements and constraints set by material, technological, economical, legal, environmental and human-related considerations*." This is an approach we had identified in some of the studied products, the technology for the product being defined beforehand, and the low cost product evolving afterwards, by adapting the solution. Cost is in this case a validation variable.
In innovative design theories, as described by Hatchuel and Weil (2009) on the other hand, the researched property of 'having a lower cost' can be integrated in the conception phase as a concept, and allow the development of radically different products through new knowledge development. This was observed when the technology behind the product was radically changed, mostly when the cost constraint was so important that the current product simply could not be adapted to achieve it.
Several definitions of innovativeness can be found in literature, as stated by Danneels and Kleinschmidt (2001), with different approaches to from whose perspective innovativeness is measured and of what is new. The number of evaluated parameters
We used the identity of objects as defined by Masson et al. (2010) to describe the innovativeness of the low cost products. In their discussion on the shift of the identity of an object, Masson et al. (2010, p29) draw attention to "*the new value spaces, new features, new technologies and new functions, new business models and new forms of market relations*" that emerge and are linked to this shift. The products of our case studies were classified according to their shift in four essential parameters that are part of the object's identity: the technological paradigm, the functions, the business model and the client value.
Based on 21 different studies Garcia and Calantone (2002, p113) state that "… product innovativeness is a measure of the potential discontinuity a product (process or service) can generate in the marketing and/or technological process" The chosen classification is consistent with the aspects Garcia and Cantalone (2002) state product and service innovativeness should take into account, since it makes a combination of the micro and macro perspective (by looking at the client perspective and the market perspective) and because it models marketing and technological discontinuities (through the change in the business model and the change in technological paradigm).
The theoretical framework led us to identify two main models, as described below.

**Model 1 – Low cost adaptation**
In the first model, called 'low cost adaptation', and associated to systematic design theory, the starting point is an existing product. The main functions of the product are identified and the product is then striped naked of all the functions considered "non-essential", in order to reduce costs. As much already existing technology and elements as possible are used to further diminish development costs.
An example of low cost adaptation is Renault's Dacia Logan X90. The Logan platform was not designed specifically for the car, it was a 'carry over' from other existing products. Moreover, several of the car's components are 'borrowed' from other models, like the door handles, and their development had already been fully amortized. The car was also simplified, removing some non-essential functions (Jullien et al., 2006).
These kinds of products are often associated to the 'core function' or to 'no frills'.
We can furthermore distinguish two different approaches to the product utility in these products; these approaches to the product utility will be called utility parameters. The utility parameters were identified through the literature review, however due to their transversal nature, the language used is not uniform. For that matter we defined two utility parameters: the function removal, where the product ceases to have one function and this function can not

be recovered by the client; and the negative transfer, where the client has the possibility to have the same or a similar function as in the original product, but he needs to use his own means to get it. One example of function removal would be the removal of the camera in a cell phone. Negative transfer can be illustrated by low cost airlines not offering free meals in the plane. The customer can still get a meal by bringing it from home or by buying it in the plane or at the airport, but needs to mobilize his own resources to get it.
The function removal is often described in literature as a 'no-frills' approach (Döring, 2009) and the negative transfer is sometimes referred to in the ancillary revenues strategy of low cost airlines, and sometimes as part of the 'no-frills' approach (). The classification into utility parameters allows avoiding this ambiguity concerning 'no-frills'. These two utility parameters can be found in table 1.

Table 1: Utility parameters of the low cost adaptation

| Utility Parameters | Definition | Examples |
|---|---|---|
| **Function removal** | The product ceases to fulfil a function its regular version fulfilled | No camera in a cell phone |
| **Negative transfer** | The client can have the same or a similar function fulfilled by the product if he uses his own resources to get it | Low cost airlines' paid meals |

**Model 2 – Smart low cost design**
In the second model, which will be referred to as 'smart low cost design', the starting point is a concept, an idea of what functions the product should fulfil, associated to a cost-target. This model is associated to innovative design theories.
An interesting example of this kind of innovation is the Tata Nano. When developing this low cost car, the Tata engineers did not start from an existing car to try and reach the defined price target. This approach was classified as impossible by the designers. Instead, they looked at the potential customer demands – a sub-compact car for manoeuvrability, with low cost throughout the whole life-cycle and with adequate seating and luggage space – and started designing a new product that would fulfil these demands, as well as the set price target of $2500 (Ray and Ray, 2011). During the innovation process, some of the car fundamentals were changed: the Tata Nano does not (in many aspects) look as what people might expect a car to look. It only has one rear-view side mirror and only has one windshield wiper instead of two (Ray and Ray, 2011). Besides that, it has a smaller engine (only 624 cc) than other cars classified as low cost and is less fuel consuming (the Dacia Logan 1.2 has a 1149 cc engine).
This kind of low cost product is often associated to disruptive innovation (in the sense of Christensen et al. (2001), "cheaper, simpler and more convenient products or services"), social innovation, frugal innovation or jugaad innovation (Radjou et al. 2012). The designers try to go beyond the existing products and to create a new answer for the customer demands.
We can distinguish two different utility parameters in the 'smart low cost design' products: the positive transfer, where a part of the functions can only exist through the client's co-production, but as opposed to the negative transfer, this transfer is organized by the former producer and he gives the client all the means to allow him to produce this function; and the creation of new functions. One example of positive transfer is given by the self-assembly of IKEA furniture, made accessible to clients by re-designing furniture for easy assembly and by giving clients assembly instructions. The creation of new functions can be seen in the Nokia 1100, which is particularly resistant to heat and dust (Radjou et al., 2012).

Once again the utility parameters were named to take into account different definitions found in the literature. Moscoso et al. (2011) speak of 'putting your customer to work' for the positive transfer and Porter (1996) of 'doing it yourself' for the customers. The creation of new functions (like robustness, portability or ease of use) is described by Rao (2013) as 'frugal features'. Other authors like Immelt et al. (2009) only cite these as priorities for the development of the new product. These utility parameters can be found in table 2.

Table 2: Utility parameters of the smart low cost design

| Utility Parameters | Definition | Examples |
|---|---|---|
| **Positive transfer** | Part of the functions can only exist through the client's co-production, but this co-production is organised by the former producer | Self-assembly at IKEA |
| **Function creation** | Adds a new function to the product | Heat and dust resistance in the Nokia 1100 |

**Comparing the two low cost models**

The approach to the question on how to maximise the client utility over price (or cost) of each of the proposed models is different: while the first model (low cost adaptation) tries to minimize the loss of utility for the customer (ΔU), for the maximum cost (and therefore price) reduction, the second model (smart low cost design) fixes a cost (and therefore a price) for the product and tries to create the greatest possible utility associated to this price (see Figure 3). It is important to point out that the utility creation in the second model can go beyond the utility associated to a classical product.

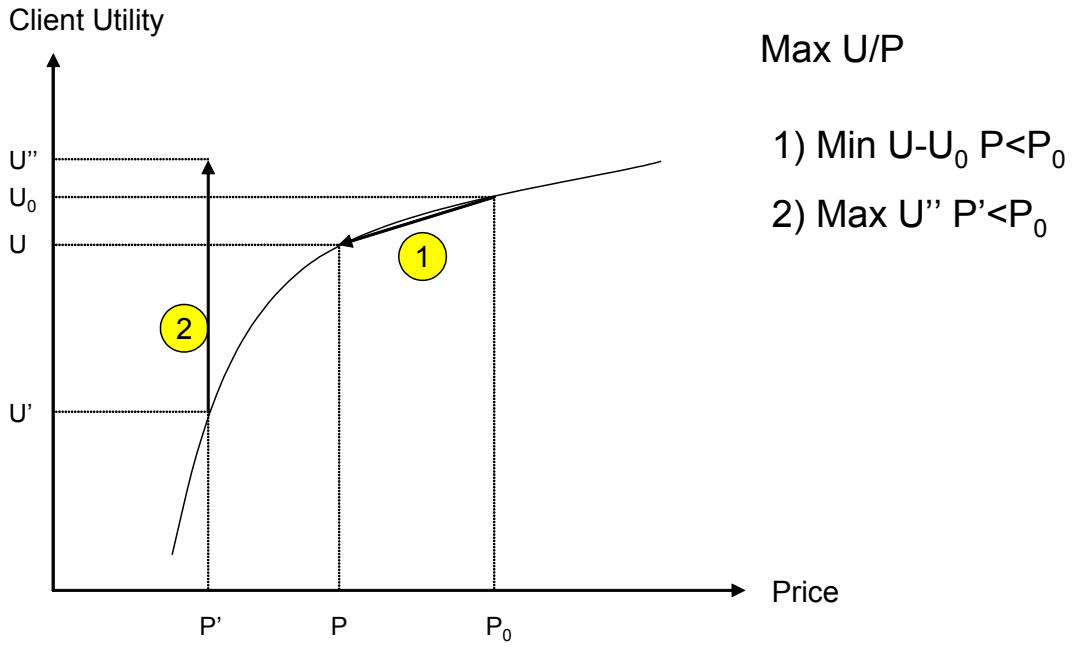


Figure 3: Maximisation of client utility over price for both low cost models

The table 3 recapitulates the main characteristics of each one of the proposed low cost models and compares it to operational effectiveness.

Table 3: The two low cost models compared to cost effectiveness

| | **Operational effectiveness** | **Low cost adaptation** | **Smart low cost design** |
|---|---|---|---|
| **Starting point** | Existing offers | Existing offers | Function the product should fulfil |
| **Approach** | Identify potential cost reductions that do not change the offer | Identify core functions and strip product naked of 'non-essential functions' | Design a new product or system that fulfils client demands and the set cost target |

**MATERIAL ANALYSIS**

The studied products were classified according to their utility parameters – function removal, negative transfer, positive transfer and function creation – and according to their innovativeness – change in the technical paradigm, change in the business model, functions improvement and value improvement for the client.

Contrary to what our theoretical framework supposed, several products combine more than one utility parameter. The function removal and negative transfer, used to describe products in the 'low cost adaptation' model can be found in several of the 'smart low cost design products'. The ChotuKool, produced by Godrej&Boyce, and sold for US$65 is an example of low cost refrigerator that combines two utility parameters. It has a function creation – portability and adaptation to intermittent power supply available in India (Govindarajan et al, 2012) – and a function removal – the temperature inside the fridge is not the same as in a regular refrigerator.

To describe the innovativeness we used the number of parameters of the product's identity that had changed, going from 0 to 4. The low cost airlines for example, that changed only the business model will have an innovativeness of 1, while the MittiCool, the low cost refrigerator, that changes the business model, the technical paradigm and improves client value and functions will have one of 4. By using this system we give the same value to all four of the product parameters, all items are assumed to be equally important and relevant.

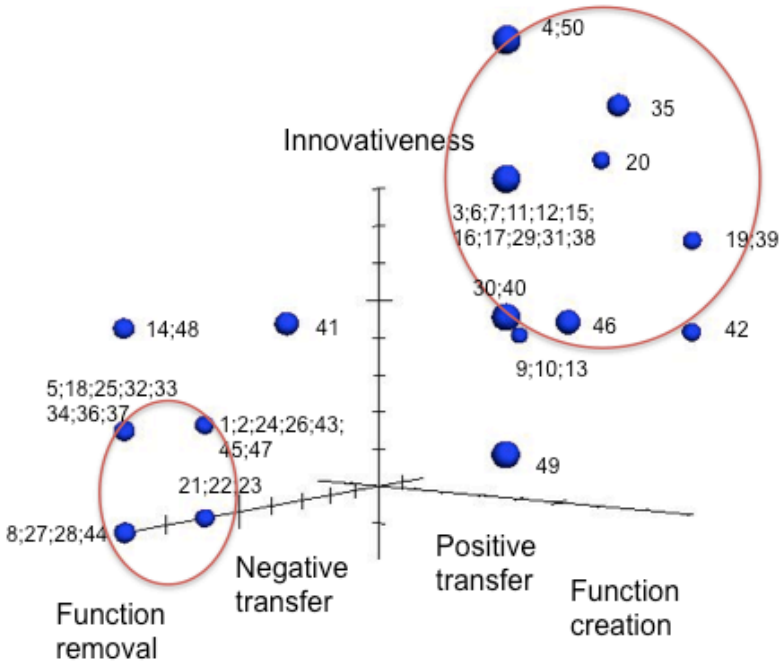


Figure 4: The 50 products classified according to their utility parameters and innovativeness (the products' names can be found in appendix 1)

The Figure 4 plots the studied products according to its innovativeness and utility parameters. We can clearly identify two main zones where the products are located, which confirms our hypothesis of the existence of different design models for low cost. These zones are delimited by the innovativeness of the products: the function creation and positive transfer, independently of the function removal, produce more innovative products. Function removal and negative transfer alone have relatively poor innovativeness performances.
Representation in figure 4 was chosen since it allows a clear visualisation. However, this representation might not be accurate, since the parameters utilized are correlated. A principal component analysis was done to verify that there are really two groups, as can be identified on figure 5. The principal components and the variance explained by them can be found in tables 4 and 5.

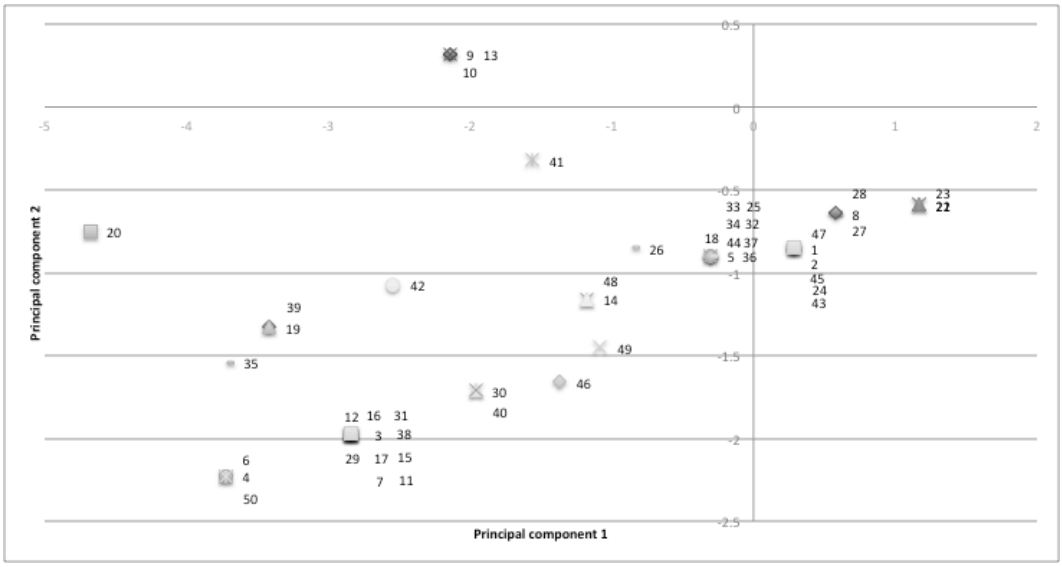


Figure 5: Principal component analysis

Table 4: Component matrix

| Component | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| **Function removal** | 0.58 | -0.64 | 0.3 | -0.41 |
| **Negative transfer** | 0.59 | 0.05 | -0.79 | -0.14 |
| **Positive transfer** | -0.38 | 0.84 | 0.09 | -0.36 |
| **Function creation** | -0.78 | -0.55 | -0.19 | 0.02 |
| **Innovativeness** | -0.88 | -0.26 | -0.21 | -0.23 |

Table 5: Total variance explained

| Component | Total | % of Variance | Cumulative % |
|---|---|---|---|
| **1** | 2.22 | 44.47 | 44.47 |
| **2** | 1.48 | 29.69 | 74.16 |
| **3** | 0.80 | 15.97 | 90.13 |
| **4** | 0.36 | 7.29 | 97.42 |
| **5** | 0.13 | 2.58 | 100.00 |

## FINDINGS AND IMPLICATIONS

It remains unclear through the examples studied if the emergence of a low cost product is possible in all kinds of markets. Although Ryans (2009) declares that low cost products rarely appear in markets that are not yet mature, this study found no evidence to support this. It is also impossible to state if some markets are more adapted to receive one or the other kind of low cost product, since in some markets both models exist. The examples studied seem to cover a broad spectrum of products and services in several different sectors. Some sectors have seen an appearance of several different low cost products, based on the different models. (Table 4)

Table 4: Examples of low cost products in both models

| Classical product | Cost efficiency | Low cost adaptation | Smart low cost design |
|---|---|---|---|
| **Car** | Taylorism, JIT, global sourcing | Dacia Logan X90 | Tata Nano |
| **Cell phone** | Economies of scale, global sourcing | Simplified phone models (“no-frills”) | Grameen village phone |
| **Appliances** | Economies of scale | Haier’s smaller microwave owens | Mitticool, Chotukool |

The study of several products showed that, contrary to what our theoretical framework indicated, most of the products in the ‘smart low cost design’ model also use some of the utility parameters of the ‘low cost adaptation model’, as could be seen in Figure 4. The more innovative products seem to be developed by the smart low cost design model and through a combination of function creation and function removal. This leads to the assumption that to attain a more innovative product, designers should focus on a ‘smart low cost design’ approach, trying to create new functions, but keeping in mind that some functions can be removed. This approach allows a trade-off between the functions, which is not the case in the

‘low cost adaptation’ model, where the only allowed trade-offs are between costs and functions.
The simple removal of functions does not redefine the object identity, and can be achieved through a classical managerial model, in the ‘smart low cost design’ however, we have a greater change in the identity of the object through the removal and creation of functions, which needs a richer managerial model, as is often the case when innovative design activities are taken into account by management (Masson et al., 2010).
These two different models could be used as devices to explore new product design. In a
The effects on markets of low cost products and services observed in the cases studied are similar for both models, however the cost reduction (and therefore also the price reduction in most cases) achievable by the smart low cost design model seems to be higher, and this increases the intensity of certain effects.
The Tata Nano’s price, for example, is less than 50% of the price of the Dacia Logan X90 (around 2500 US$ for the first against 6000 US$ for the second). Although in this case the low cost adapted model seems to have had a greater market success than the smart low cost design model, many authors believe that this is linked to the particularities of the Indian car market and the high pre-launch expectations that accompanied the Tata Nano’s launch. (Eyring, 2011) And as the authors having followed the Tata Nano’s evolution have stated, even though the sales of this car did not reach the expected level, this car already had a clear impact on its market and might continue its evolution like other disruptive products. (Eyring, 2011; Kaul, 2012) And the market is surely evolving; several companies in the same sector have announced their entry into low cost cars development.
If it is to early in several markets to evaluate the long-term impact of the low cost products, some more mature markets, like the airline market, can give us an idea of how a low cost product can affect a market. The first point observed by Dresner et al. (1996) is a decrease of prices of the incumbent companies. The price decrease affects not only the flights with the same inbound and outbound airport, but also those with a potential replacement airport. The price change however seems to be strongly linked to the context and route, while Dresner et al. (1996) observe an 35 to 40% price decrease on some routes, the reduction observed by Fageda and Fernandez-Villadangos (2009) was of only 6.5%. Kumar (2006) states that, a classical approach by incumbents who feel threatened by low cost entrants is to set off price wars. It is therefore not unreasonable to expect the prices of a sector to be globally affected by the low cost offer, even if this offer is not a perfect substitute for the existing offers.
Another fact observed by Dresner et al. (1996) is the attraction of former non-consumers to the market by low cost products. Attraction of new consumers is also one of the main goals of most products developed for the base of the pyramid (Prahalad and Hammond, 2002). A study by the ELFAA (2004) shows that, in the airlines sector, the new demand creation by the low cost airlines was of 59% of the passengers flying with them. The low cost ultrasound developed by GE Healthcare also created new demand, since its price made it accessible for other applications (like in emergency rooms to identify ectopic pregnancies; at accident sites to check for fluid around the heart; in operating rooms to place catheters for anaesthesia) and to new markets, like rural china (Immelt et al, 2009).
The same phenomena of new customers and broader application is being observed for products such as the Haier washing machine, which was used in China by the customers for unexpected uses like cleaning vegetables and turning yak milk into butter (Abonyi, 2012; Radjou et al. 2012). In these two cases, the broader application found by the customers was integrated by the company, extending the products usage possibilities. This is a clear example of how the cooperation with new users can spur innovation, since their needs are different than those of the customers targeted by the regular products. Although the main objective of

these low cost products was not the development of new functions, but to offer a product to former non-consumers, these products led to the development of new uses.
The study of low cost products through the lenses of these two models also allowed the identification of new chains of actors, especially in the products following the 'smart low cost design' model. This change lowered cost and often allowed other advantages when compared to the established product. The emergence of collective usage as a means to reduce costs for each of the users is not a new phenomenon; agricultural cooperatives have rested on this principle for very long. But collective usage has been spreading to new personal objects lately, like portable phones in the case of the Grameen village phone. In this particular case, a new actor was introduced, the "Village Phone Ladies", who were responsible for renting out the telephones (Seelos and Mair, 2007).
When taking the user's point of view, there are clear differences between the models. The 'smart low cost design' products are often more interesting, because beyond being more accessible (due to their lower price) they often achieve to create more utility and help to reduce usage constraints, like eliminating the need for electrical power (seen in the case of the Mitticool (Radjou et al., 2012)) or creating new usages for one of the user's assets (like for a cell phone in the case of taggatitude, that allows payments through the cell phone).

## CONCLUSION AND FURTHER RESEARCH

Several products are today classified as low cost, but this research shows that these products do not all follow the same model, and suggests a possible classification in two distinct models, called 'low cost adaptation' and 'smart low cost design'. These models differ in their approach to the cost/client utility proposition and in their design principle.
This research further points out through an empirical basis that the 'smart low cost design' allows the development of more innovative products. This model also uses the utility parameters of the first model, combining function creation and function removal. An example is the solar bottle bulb (Isang Litrong Liwanag), a system that allows the diffusion of the sunlight inside buildings, combining a new function (working without electrical power) with the removal of a classical function (working independently of the outside conditions) (Radjou et al., 2012). These products also seem to allow more radical cost changes. This in turn makes it harder for incumbent competitors to evict the new product through price wars, allowing a real competitive advantage.
The fact that both low cost models seem to be widely represented and the great number of differences identified between them, suggest that the studies in low cost products could be enriched in studying these different models separately. The lack of a theoretical framework and of separate studies of the different approaches makes it hard for product designers to have a clear view of the effects and implications of each model. The framework proposed here allows a more structured approach to low cost product development, allowing designers to better target the wanted model.
The findings of this study are based on a restricted number of examples. Further research should broaden the set of products and services studied to confirm the results. Although a little more than half of the products studied (55%) were classified as in the 'smart low cost design', it is impossible to say if indeed this model is the most successful and/or the most commonly adopted today, since there might have been a bias introduced by the research method used to collect the cases studied. A quantified and statistically significant study should be made to verify this point.
Another point that should be broadened is the impact these products have on markets over time, since many products are recent and data on their impact is incomplete.
Finally, this study was based on existing low cost products, which are today commercialized. A number of attempts to develop low cost products did not lead to product launches or led to

products that were abandoned shortly after their launch. The analysis of these 'failed attempts' could allow a better view of success factors for a low cost product.

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## APPENDIX 1 - STUDIED PRODUCTS TABLE

| | Product | Company or developer | Sector | Model 1 | Model 2 | Function removal | Negative transfer | Positive transfer | Function creation | Technical system change | Business model change | Customer value creation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | **Low cost airlines** | Ryan Air, Easy Jet, Southwest | Airlines | x | | x | x | | | | x | |
| 2 | **Hard discount retailers** | Lidl, Aldi, Wall Mart | Retail | x | | x | x | | | | x | |
| 3 | **Transmilenio** | City of Bogotá | Transport | | x | x | | | x | x | x | |
| 4 | **Tata Nano (low cost car)** | Tata | Automobile | | x | x | | | x | x | x | x |
| 5 | **Dacia Logan X90 (low cost car)** | Renault | Automobile | x | | x | | | | | x | |
| 6 | **Mitticool (low cost refrigerator)** | Mansukh Prajapati | Household goods | | x | x | | | x | x | x | x |
| 7 | **Chotukool (low cost refrigerator)** | Godrej& Boyce | Household goods | | x | x | | | x | x | | x |
| 8 | **Low cost haircut** | Tchip, Self'Coiff | Services | x | | x | | | | | | |
| 9 | **Low cost furniture** | IKEA | Household goods | | x | | | x | | | x | x |
| 10 | **Mobile phone payments** | Tagattitude | Banking | | x | | | x | | x | | x |
| 11 | **Swach water filter** | Tata | Household goods | | x | x | | | x | x | | x |
| 12 | **Baby warmer** | Embrace | Health care | | x | x | | | x | x | | x |
| 13 | **Mobile Product Authentication** | Sproxil | Services | | x | | | x | | x | | x |
| 14 | **Single dose** | Procter&Gamble | Personal goods | x | | x | | | | | x | x |
| 15 | **Solar bottle bulb (Isang Litrong Liwanag)** | A liter of light | Utilities | | x | x | | | x | x | | x |
| 16 | **Vscan (portable Ultrasound)** | GE Healthcare | Health care | | x | x | | | x | x | | x |
| 17 | **Nokia 1100 (cell phone)** | Nokia | Telecommunication | | x | x | | | x | x | | x |
| 18 | **Eye surgery** | Aravind Eye Hospital | Health care | x | | x | | | | | x | |
| 19 | **Pellets cooking system (biomass stove)** | BP, First Energy (India) | Household goods | | x | | | | x | x | | x |
| 20 | **Revolo** | KPIT Cummins | Automobile | | x | | | x | x | x | x | x |
| 21 | **Low cost hotel** | Formule 1, Etap Hotel, Motel 6 | Hotel | x | | x | x | | | | | |
| 22 | **Internet banking** | Bursorama, ING direct, Fortuneo | Banking | x | | x | | x | | | | |

| | Product | Company or developer | Sector | Model 1 | Model 2 | Function removal | Negative transfer | Positive transfer | Function creation | Technical system change | Business model change | Customer value creation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **23** | **Low cost insurance** | Amaguiz (Groupama); Idmacif (Macif); Directassurance (AXA) | Insurance | x | | x | x | | | | | |
| **23** | **Telecommunication service** | NRJ, Virgin, Breizh | Telecommunication | x | | x | x | | | | x | |
| **25** | **Clothing** | DPAM | Personal goods | x | | x | | | | | x | |
| **26** | **Low cost car rental** | Ucar | Services | x | | x | x | | | | x | |
| **27** | **Microwave ovens** | Galanz | Household goods | x | | x | | | | | | |
| **28** | **Dust (low cost car)** | Renault/Nissan | Automobile | x | | x | | | | | | |
| **29** | **Mac400 (handheld electrocardiogram)** | GE Healthcare | Health care | | x | x | | | x | x | | x |
| **30** | **Washing machines** | Haier | Household goods | | x | x | | | x | | | x |
| **31** | **Aakash (low cost tablet)** | Data Wind | Technology | | x | x | | | x | x | | x |
| **32** | **Dentistry** | Addentis | Health care | x | | x | | | | | x | |
| **33** | **Cleaning services** | Anett | Services | x | | x | | | | | x | |
| **34** | **Free newspapers** | Metro, 20 minutes | Journalism | x | | x | | | | | x | |
| **35** | **Free internet news** | Mediapart, blogs | Journalism | | x | | x | | x | x | x | x |
| **36** | **Silicones** | Xiameter (Dow Corning) | Construction & Materials | x | | x | | | | | x | |
| **37** | **Heart surgery** | Doctor Shetty 'Health City' | Health care | x | | x | | | | | x | |
| **38** | **Palliative care** | Kerala's neighbourhood network | Health care | | x | x | | | x | x | x | |
| **39** | **Solar power for rural poor** | SELCO | Utilities | | x | | | | x | | x | x |
| **40** | **Foetal heart monitor** | Siemens | Health care | | x | x | | | x | x | | |
| **41** | **Telecommunication service** | Grameen village phone | Telecommunication | | x | x | | x | | | x | x |
| **42** | **Batteries** | BYD | Batteries | | x | | | | x | x | | |

| | Product | Company or developer | Sector | Model 1 | Model 2 | Function removal | Negative transfer | Positive transfer | Function creation | Technical system change | Business model change | Customer value creation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **43** | **Low cost train** | SNCF | Transport | x | | x | x | | | | x | |
| **44** | **Funeral services** | Ecoplus Funeraire | Services | x | | x | | | | | x | |
| **45** | **Real Estate** | Efficity | Services | x | | x | x | | | | x | |
| **46** | **Low cost gym** | Curves | Services | x | | x | x | | x | | x | |
| **47** | **MOT (technical control)** | CTEasy | Services | x | | x | x | | | | x | |
| **48** | **Advertising** | TV lowcost | Services | x | | x | | | | x | x | |
| **49** | **Gilette Guard (low cost razor)** | P&G | Personal goods | x | | x | | | x | | | |
| **50** | **Low cost rocket launch** | Space X | Aerospace | | x | x | | | x | x | x | x |