

Evaluation of Environmentally Friendly Product Attribute – Results of an Empirical Research

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Abstract: Experts have difficulties in measuring the utility of green product attributes for consumers. In this article I try to show an example of measurement of the importance of green product attribute with conjoint analysis. One of the main advantages of CVA analysis is that it measures the relative importance of product attributes and the utility score for each individual separately, which means it makes it possible to express numerically the importance of environmentally friendly product attributes relatively objectively and to form respondent groups based on these scores. Using the model of purchasing exercise book made of traditional versus recycled paper gives us indications, how important green product attribute is for different consumer groups.

Keywords: conjoint analysis, environmentally friendly product attribute

1 Aim of the Research

Despite of the very intensive communication campaigns in connection with environmental problems (such as green-house effect, global warming, waste-management) in the last decade, there are still only a few consumers who consciously put this view into practice. Moreover, experts have difficulties in measuring the utility of green product attributes for consumers. In this article I try to show an example of measurement of the importance of green product attribute with conjoint analysis.

In the international literature we can find different approaches of environmentally friendly behavior based on the complexity of areas which are examined within this concept. Basically, we can differentiate two main groups of them: one-dimensional approaches and multi-dimensional approaches. The former ones focus only one type of green behavior such as waste disposal or purchase of special green product, while multi-dimensional approaches try to cover all of the relevant topics such as environmental activism, environmental citizenship and support of public policies, green purchase, waste disposal (for more details see

Stern, 2000). In this study I tried to mix these approaches by screening respondents based on the multi-dimensional approach and measuring a special purchase decision as a one-dimensional concept at the same time.

The main question is, whether the green attribute of a product does play role in buying decisions or not, and if it does, to what extent can it influence buying decisions. It is also interesting that at the price of which product attribute can play environmentally friendly product feature remarkable role. To know this, I used conjoint value analysis (CVA) to explore utility scores of each product attribute. The concept conjoint analysis is described by Hair et al (1998, p. 392) as follows: *“Conjoint analysis is a multivariate technique used specifically to understand how respondents develop preferences for products or services. It is based on the simple premise that consumers evaluate the value of a product or service by combining the separate amounts of value provided by each attribute.”*

Moreover, as I have mentioned earlier, environmentally friendly behavior is a complex concept, therefore I compared the results of environmentally friendly and non-environmentally friendly consumer groups based on their utility scores and relative importance of product attribute.

2 Research Background

2.1 Conjoint Analysis

The name conjoint analysis comes from the expression: “consider jointly”. The consumer must evaluate a mass of product attributes at the same time, and as a result of these evaluations, researchers are able to indentify indirectly and objectively which product attributes play an important role in buying decisions and which attribute-combinations the ideal product has. This method makes the examination of cross-effects of different product attributes possible, as these trade-offs are typical in our everyday decisions.

The main advantage of the conjoint method over other statistical analyses is that it examines the main reasons behind purchase decisions of products/services in a more or less “natural” situation (Scipione, 1994, p. 228). One of the main advantages of CVA analysis is that it measures the relative importance of product attributes and the utility score for each individual separately, which means it makes it possible to express numerically the importance of environmentally friendly product attributes relatively objectively and to form respondent groups based on these scores.

2.2 Tested Product and its Attributes in the Model

To make the pro-environmental motivation absolutely clear, my aims were to (1) choose a product with environmentally friendly product attributes, one whose purchase would not be governed by other motivations (mainly economical reasons), and (2) to choose a method which could measure the importance of these product attributes relatively objectively.

While choosing the product used in the test, I tried to select a product which neither directly influenced the health of consumer (e.g. bio products) nor financial benefited the consumer, but rather caused definite positive change in the state of the environment, even if that product might be less pleasant or convenient to use (e.g. a notebook made of recycled paper which does not have as white paper as non-recycled ones have).

This approach helps me to avoid the typical problem of confusion of self-interest motivations (lower cost, higher level of convenience, improved health) with altruistic, pro-environmental motivations. Therefore, I tried to minimize the self-interest motivations behind the potential choice of an environmentally friendly product with the careful selection of the tested product.

In the same way, I took care to avoid that that financial, cost-saving motivations would take a large role in the buying decision process (e.g. the purchase of energy- and water-conserving washing-machine). Moreover, my intention was that the buying process would not require expert, special knowledge from the customers, and that the modelled situation would be familiar to the respondents. I felt it more proper to choose a product of which demanded no high involvement or high risk, as routine decisions are the majority of those in our everyday life.

Another point of view came from Peattie's (2001) typology, in which he differentiated the win-win type of green buying decisions, which can be described as having a high level of conviction and a low level of compromise. Therefore, these are the purchase situations most likely to be realised.

On the basis of all of these, I chose the case of purchasing an exercise notebook made of recycled paper instead of traditional paper. The research question is the following: Is there a significant difference in the evaluation of green product attribute between those who said to be environmentally friendly in general and those who are not?

After choosing the test product, the next step was to select the product attributes to take part in the analysis. The general suggestion is that the product attributes should be independent from each other as much as possible, because the majority of conjoint methods handle the attributes together. As a consequence of this independent characteristic, product attributes must be freely combined. If the utility function of an attribute is not linear, then there should be three or more product category levels. For example, a customer may prefer a medium-sized car

over a small or large one. (Malhotra, 2002) The price may show a similar non-linear feature, if some kind of paradox effect exists (e.g. snob or quality effect).

Product attributes can be measured on metrical or non-metrical scales; however, levels of them cannot overlap. Using too many product-attributes not only increases the number of show cards unnecessarily, but also decreases the accuracy of the estimation of utility scores, while increasing artificially the importance of these attributes.

The selected group of product attributes influences the content validity of the model to a high extent: the model must include all those attributes which play important role in the buying decision, because the model counts their importance relative to each other. Though a high number of product attributes represents reality much more faithfully, customers take into account only a few of them in real life – especially in the case of low involvement decisions. For that very reason, and because respondents have to make decisions repeatedly during the test, including every product attribute seems to be unnecessary and too burdensome for the respondents. Even in the case of using computer programs, experts suggest including a maximum of six product attributes in a model, because increasing the number of product attributes may increase the show card number exponentially.

Moreover, the number of product attributes selected must be reconciled with the characteristic of the given conjoint method: the CVA model is ideal in the case of a maximum of six attributes, but if more than 6 attributes must be included, then the ACA, adaptive conjoint analysis, is the appropriate method. Though nowadays adaptive conjoint analysis and choice-based conjoint methods are very popular, in my research CVA proved the better choice, because there were not too many product attributes in the model; however, the importance of each product attribute for each individual is a very important output as a dependent variable.

After choosing the product attributes (price, cover, pattern of pages, environmentally friendly or not, type of stitching and number of papers), the levels of these attributes were designed. This must be done carefully, as the number of attribute levels may influence the relative importance of each: for example, if there is not too much difference between price levels, it will not be important factor in the customers' decisions. Therefore it is vital to use authentic levels of attributes as much as possible (Malhotra, 2002). During modelling, we must make an effort to have a very similar number of levels of each product attribute in order to avoid the distortion of the importance scores.

Based on the market supply of exercise books and the characteristic of the CVA method, respondents met with the following product attributes and levels in the test:

Table 1
 Product attributes and levels used in conjoint analysis

	Product attributes				
	Price ¹ (HUF)	Covering	Pattern of pages	Environmentally friendliness	Type of binding and number of papers
Level 1	180	Simple	Lined paper	Not environmental friendly	Spiral, 70 pages
Level 2	268	Environmental graphic	Graph paper	Recycled paper	Bound, 60 pages
Level 3	568	Colorful, modern graphic			

In the interviews respondents were asked to imagine that they needed an A4 size exercise book because they were attending a course in which this size was prescribed by the teacher.

For designing stimuli, pairwise comparison and full profile method can be used. Pairwise comparison means that respondents have to fill in a matrix with ranked order numbers, which contains the levels of two product attributes. The essence of full profile method is that respondents evaluate product-descriptions which include each attribute. There are three different methods of evaluation: making the rank order of each product according to their own preference, they can give points to all of these combinations on a Likert-scale, or they can evaluate pairs of these products and they can choose between them. While rank-ordering may seem very difficult to the respondent if more than 15 stimuli have to be evaluated, some still argue that this method reflects human behaviour more than ordering scores according to product attribute combinations, where given scores are independent from each other. Therefore, I used full-profile method with product comparisons in my study.

¹ The difference in price levels included in the model were significant, which gave high importance to the price, though these price levels reflected the real prices on the market in August, 2007. 100 % distribution was also hypothesized in the model.

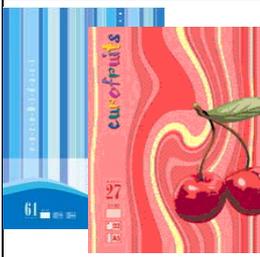
		OR		
Lined pages Sprial, 70 pages 265 HUF			Graph pages Bound 60 pages Made of recycled paper 568 HUF	
I would surely buy the product on the left 1	I would rather buy the product on the left 2	I would rather buy the product on the right 3	I would surely buy the product on the right 4	

Figure 1

An example to the show card used in the analysis

Based on the formula², in this study 24 comparisons were needed, which is just below the acceptable number of cards (literature suggests a maximum of 30 comparisons in the case of a full-profile method.) Show cards were shown in rotated order to the respondents – using rotation makes it possible to eliminate the systematic bias coming from the order.

2.3 Sample Description

In order to make the statistical comparison practicable 102 environmentally friendly and 102 non-environmentally friendly persons has been chosen based on a 25 item scale³. These persons were 18-65 years old budapest-dwellers and were selected randomly by the interviewers⁴ - as we had no a priori information of the demographic profile of environmentally friendly consumers. The same location of them means by and large similar external facilities to carry out environmentally friendly actions.

² Number of show cards needed = (total number of product attribute levels– number of attributes + 1) * 3

³ See more details in Melinda Majlath: Environmentally Friendly Behaviour: Consistent of Not? Sustainable Consumption Conference 2008, 8th, October, Academic Conference Proceedings Edited by Edina Vadovics and Emese Gulyás http://www.greendependent.org/konferencia/SC_2008_Proceedings_final.pdf, 118-133.

⁴ With birthday key. Interviewers made the recruitment from 20 different starting-points of the town and they chose every 15th flat.

During face-to-face in-home interviews respondents evaluated conjoint cards and then respondents were asked to judge the statement list related to psychographic variables. Socio-demographic questions closed the interview.⁵

3 Environmentally Friendly Product Attribute is Significantly More Important for Green Consumers

Conjoint analysis was conducted by CVA modul, Sawtooth software. The three most important results of analysis are: (1) importance scores, which show the weight of different product attributes in purchase decisions, (2) utility scores, which show the attractiveness of the levels of the given attribute and can be added, so they can measure the relative probability of buying, and (3) the product attribute-combination of the ideal product (Scipione, 1994).

I was able to use as the input of conjoint analysis the answers of 185 respondents after data cleansing. The fit of the model is good: R^2 is 0.72 and the proportion of the correct classification of the holdout card is 76%. The effectiveness with which the model measures attributes is very high: 99.65.

The most important product attribute for each behavioural group was price: this is not surprising, especially given that the price level used in the analysis was relatively high in line with real market prices. Despite this, the environmentally friendly respondents assigned significantly less importance to price – and this lower importance was compensated for by the higher importance of the environmentally friendly product attribute.

Pricing is one of the most problematic areas of the green marketing-mix because green costs are typically externalities, and therefore it is difficult for these added expenses to gain acceptance by consumers within the scope of full-cost pricing. This kind of pricing would be only successful if producers used the same method for pricing and consumers were ready to pay more for environmentally friendly products – argue some experts (Menon et al, 1999). A widely known example of this paradox is the case of bio products. Bio fruits and vegetables can be priced as high as five times that of traditional fruits and vegetables, meaning their volume and turnover do not greatly increase on eco markets.

According to Fuller (2000), if consumers understood the real eco-cost of products, the majority of environmental problems would be solved by themselves. However, this could only with difficulty be realized without the massive intervention of

⁵ Originally the questionnaire consisted of more parts than what are analyzed in this article.

governments, while experience tells us the short-term view of producers would probably prevent this intervention.

Vágási (2000) argues that environmentally conscious pricing means that less polluting products should be cheaper while the prices for non-environmentally friendly products should be artificially increased by taxes. In this event, internalization of externalities would be used again. However, carrying out these suggestions requires a precise assessment of the environmental impact of products as well as the numerical expression of these, a task which faces difficulties mentioned earlier.

In the ranking of importance, price is followed by the cover of the exercise book, though the relative importance of the cover is only half that of price. The other three product attributes influenced the decisions at only 27%. The type of binding, the number of pages and the type of paper have similar values, at 10% weight in the modelled purchasing decisions. The environmentally friendly product attribute, the recycled paper, is significantly preferred by environmentally friendly respondents, and thus it is a third aspect in decisions, while for the other respondent group this attribute rated only 6%. Lined or graph paper is the least influencing factor in these buying decisions for both respondent groups.

Despite the significant differences, the results show that the purchase of exercise books is mainly dictated by their price and covers; environmentally friendly product attributes can play a role only at the third level of importance. The relative importance of product attributes included in the test can be seen in the next figure.

Maybe at first sight the difference between the decisions of environmentally friendly and non-environmentally friendly respondents seems to be tautology, but I would like to explain why it is not so unambiguous. In the screening questionnaire, environmentally friendly behaviour was explored in its complexity, without consideration as to motivation, and respondent groups were formed according to the results of this questionnaire. However, in the conjoint analysis, only the buying decision was tested, and the environmental friendly attribute of the product was definitely not connected to other motivations (financial or health aspects).

From this part of the results of conjoint analysis, we can come to the conclusion that though the environmental friendly product attribute is relatively more important for those who behave pro-environmentally in other situations, it can compete only with secondary attributes. However, for a not negligible group of respondents, the green product feature gains importance irrespective of price; this result implies that there are individuals who are willing to pay more for environmentally friendly products.

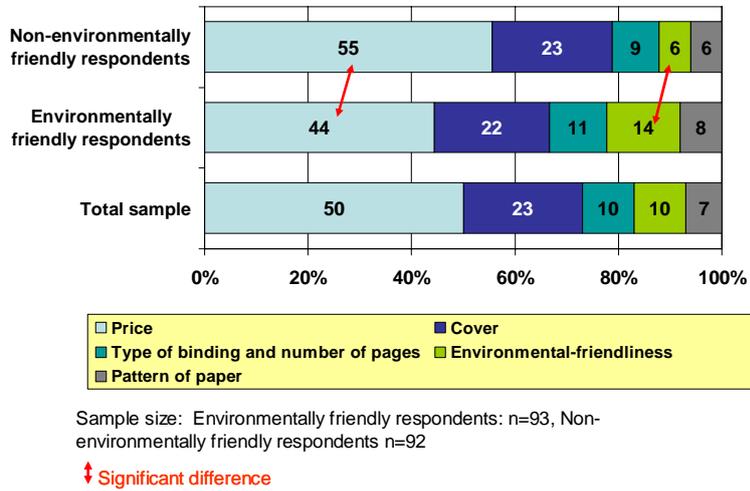


Figure 2
 The relative importance of product attributes

It is worth taking a closer look at the deviation of the relative importance of the type of paper. As environmentally and non-environmentally friendly individuals were included in the sample by the same probability, the expectation was that there would be noticeable differences in the evaluation of the environmentally friendly product attribute (the detailed analysis of which can be seen later).

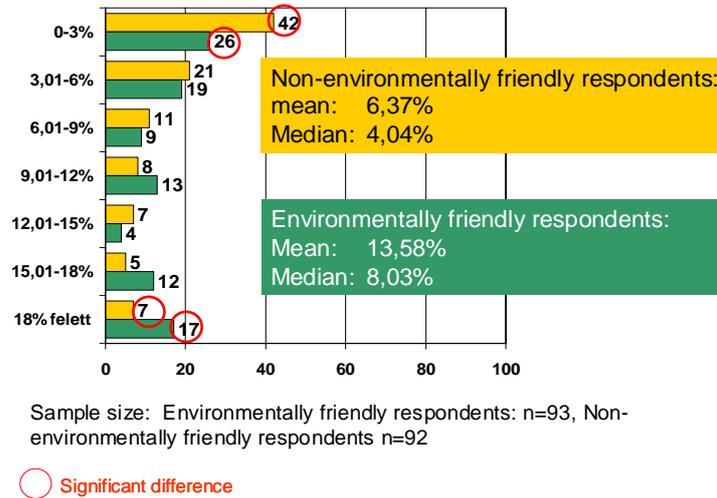


Figure 3
 Distribution of the relative importance of environmentally friendly behaviour in the sample

We cannot ignore the fact that for almost half of the respondents, the environmental friendly product attribute influences the decision by less than 6%, meaning they do not take it into consideration at above the average level. The mean was increased by those few respondents who ranked as extremely high the importance of the recycled paper (in the case of 7 respondents, we could identify it at above 50% relative importance)⁶. This means that in general, the environmentally friendly product attribute can influence buying decisions only to a small extent – it can play role only if price, cover and binding are the same.

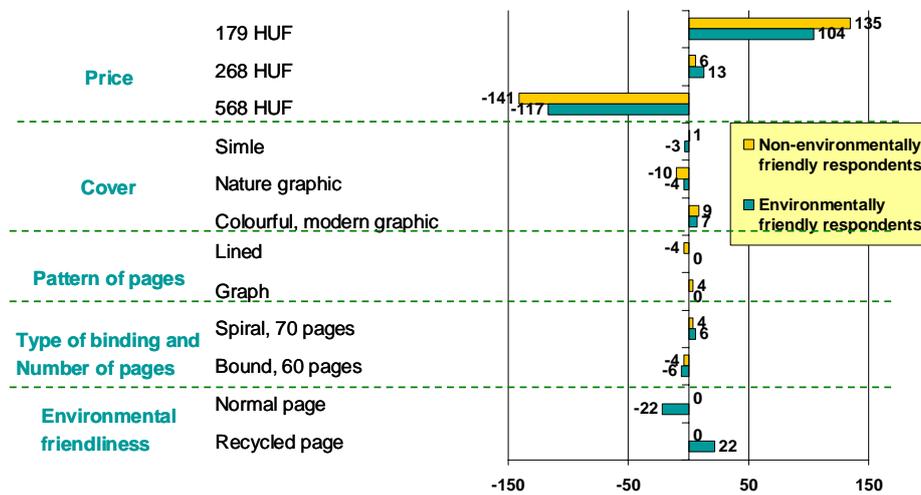
4 Green Product Attribute is Preferred only by Green Consumers

Another important output of the analysis is the utility scores of the different levels of product attributes, which help to give a total utility score for a given attribute combination for each respondent based on the additive model, and to identify the ideal attribute combination. The conjoint model supposes perfect rationality on the part of the consumers: the respondents will choose the product with higher utility.

The figure below shows the results: it is striking that a low price has the highest utility score, and comparing this with the most preferred levels of the other attributes, the difference is even more pronounced. In practice this means that the ideal exercise book is first of all cheap. Any other preferred product attribute-level has only one-fifth of the utility of low price. The most preferred product, therefore that with the highest utility score, is a graph paper spiral exercise book which costs 179 HUF and has modern, colorful cover –the utility of which can be increased through recycled paper, and this only for environmentally friendly respondents.

According to the results, recycled paper can contribute to the utility of the product attribute combination only secondarily for environmentally friendly respondents, but cannot increase the utility for non-environmentally friendly consumers.

⁶ Excluding these extremely high scores, the average is 9.18 in the environmentally friendly group st.d is 8.73, and the difference is still significant: (t: -2,433, df 155, sign 0,016)



Sample size: Environmentally friendly respondents: n=93, Non-environmentally friendly respondents n=92

Figure 4
 Utility scores of product attribute levels *

*importance of recycled paper for non-environmentally friendly respondent +0,0024;
 utility of lined paper is 0.48 for environmentally friendly respondents.

Conclusions

With the help of conjoint analysis, I managed to quantify the role of the environmentally friendly product feature in the choice between products in the case of a given product. Important aspects in the selection of the tested product were: that it should be characterised by low purchase risk; that the recognition of the environmentally friendly product feature should not require any special expertise; that it should be a situation that the respondents had probably met in their life; and that the environmentally friendly feature of the product should not be associated with motivations deriving directly from other advantages (e.g. health or financial savings). So I chose the case of the purchase of exercise book made of recycled versus traditional paper.

The results of the conjoint analysis showed that the two most important product features impacting the buying decision are price (50%) and the pattern of the cover of the exercise book – within the given conditions. The relative weight of the environmentally friendly product feature is about 10%; and though the values were heavily scattered, most of the respondents gave a value of about 0-3% to it. Unfortunately, this means that the recycled paper represent added value for the consumer only in the case when the price and the cover meet their expectations.

In the given purchase situation the consumers with environmental friendly behaviour in the wider sense attached significantly higher importance to the

environmentally friendly product feature (14% versus 6%) than those defined as non-environmentally friendly. This mainly goes together with the relative depreciation of the importance of price (44% versus 55%) – still price has the highest priority among the factors used for the decision.

I would like to stress again that I purposely chose a specific product for the research, in a sense that the environmentally friendly product feature was not associated with other direct benefits, which is why it received such a low value. If we were to talk about a beauty product made from only natural ingredients, so that it would not directly adversely affect the consumers' health and that "incidentally" its production generated no environmental pollution, the relative importance attributed to the natural ingredients would be much higher. In the same way, in the case of energy-saving light bulbs a higher importance would be attributed to the energy-saving feature – but not necessarily owing to environmental protection. Probably in this case relative importance of green attribute would be higher.

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