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CONJOINT ANALYSIS:
THE EXAMPLE OF
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ANALYZING CUSTOMER VALUE USING CONJOINT ANALYSIS: THE EXAMPLE OF A PACKAGING COMPANY

Andrus Kotri*

Abstract

The fulfillment of customers' wishes in a profitable way requires that companies understand which aspects of their product and service are most valued by the customer. Conjoint analysis is considered to be one of the best methods for achieving this purpose. Conjoint analysis consists of generating and conducting specific experiments among customers with the purpose of modeling their purchasing decision. This article will give an overview of the method and apply it to an Estonian packaging company. As a result of the empirical study the author is able to estimate the value creation models of 34 respondents (customers) both on a group and individual basis.

Keywords: customer value, conjoint analysis, market research methods

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INTRODUCTION

Satisfying customers' wishes is a challenge for many companies in the today's rapidly changing and keenly competitive environment. A thorough knowledge of customer needs is even considered to be the foundation on which a company is built (Mohr-Jackson, 1996). In pursuit of continuously offering better products and at the same time making profit, companies have to implement well thought-out strategies. Given price and cost constraints, a company can't completely satisfy all its customers' wishes. Consequently an important task of a company's marketing department is to create a profit maximizing bundle of product or service attributes or in another words a profit maximizing value proposal. The main question which has to be answered is — how to use the limited resources of the company in product and service design and development to maximize its profit.

Marketing specialists refer to conjoint analysis as one of the best methods for investigating and analyzing customer needs. Conjoint analysis means constructing and conducting particular experiments among consumers in order to model their decision making process. As the name suggests, potential customers are asked to make judgments about the attributes that affect their purchase decisions conjointly, rather than evaluate each attribute individually. Analysis allows finding out which product attributes create most value to a customer and how customers are likely to react to different product configurations. This information can lead to the creation of optimal value propositions.

Despite the extensive use of the method in American, Western-European and Scandinavian companies, conjoint analysis is relatively unknown to Estonian marketing practitioners and theorists. Using the method requires thorough knowledge of statistical data analysis which may be the reason why it is not yet in common use. The marketing research companies Emor AS and Turu-Uuringute AS are the only users of conjoint analysis in Estonia, though their know-how originates from foreign partners.

The aim of present article is to analyze the applicability of conjoint analysis for researching and prioritizing the needs of an Estonian packaging company's customers. Considering the novelty of the

method in Estonian marketing practice and also the complexity of the method the first objective is here to explain the concepts, calculations and logic behind the method. Major advantages and disadvantages of the method are also discussed. After this theoretical discussion, the article presents the application of conjoint analysis for collecting data about and analyzing the needs of Estiko-Plastar's customers. The final part discusses the implications and value of the results to the company.

THE CONCEPT OF CREATING VALUE TO THE CUSTOMER

For understanding customer needs and studying them systematically it is necessary to be familiar with the concept of creating value to the customer. Walters and Lancaster (1999) have stated that value is created by any product or service attribute, which motivates the customer to buy the product and takes him closer to achieving his goals. Attributes of a product or service that create value to customers can be divided into (Woodall, 2003):

- 1) factors that enhance customer's benefits or help to satisfy his needs,
- 2) factors that decrease customer's costs.

Cost can be defined in the broadest sense as everything the customer has to give up in order to acquire the benefits offered by the supplier. Costs can be monetary as well as non-monetary (time spent, aggravation, risk). Benefits can be affected by a variety of factors. Ferrell (1998) brings out the following main factors as benefits: product quality, customer service quality and experience based quality (table 1). Band's approach (1991) is essentially the same, but he also includes customer service personnel compliance to customer expectations because it is often found that customers can easily perceive the difference between the adequacy of company's processes and the behavior of service personnel (e.g. Rosen, Supernant, 1998). Additionally it is also often pointed out that brand can create value to customers (Best, 2002). And of course there usually are industry specific factors that customers perceive as valuable.

Table 1. Distinguishing the sources of benefits to customer

Source of the benefit	Example
product quality	functionality, reliability, additional features, customization based on customer needs, aesthetics, warranty, ease of use
quality of customer service processes	after sales support, delivery time, reliability of delivery, information about product, responsiveness in case of emergency, product return and compensation policy
quality of customer service personnel	communication, quality of responses to requests, friendliness, professionalism, looks, helpfulness when solving problems
brand image	main perception dimensions: sincerity, excitement, competency, maturity, vitality
emotions based quality	atmosphere of the sales place, PR, promotion events, emotions generated during service: trust, pleasure

Source: adapted from Ferrell *et al.*, 1998; Band, 1991; Best, 2000; Walters, Lancaster, 1999; Woodall, 2003.

Customers usually name many factors as needs. It is reasonable to organize them into a hierarchic structure — as the first order, secondary and if necessary also the third level needs. The first level captures the five to ten most general factors or customer needs. The second level shows in further detail what it takes to satisfy the first order needs. The number of secondary factors identified in previous researches has been between 30 and 100 (Hauser, Clausing, 1988). For example if the product of interest is a passenger car then the first order customer need could be low petrol consumption. In greater detail, the corresponding secondary needs are low petrol consumption in town traffic and low petrol consumption on the highway.

Although customers wish all their needs would be satisfied at once, it is company's objective to understand which needs are most important for the customer. This understanding enables a company to use its scarce resources in an optimal way, thus creating the most value for the customer. Clearly company has to make trade-offs in the performance levels of attributes which are related to

each other. Returning to the example of a car — it is obvious that customers wish a car which consumes very little petrol and would have at the same time rapid acceleration (powerful engine). However, the engineering reality is that both goals can't be completely achieved simultaneously. So it is necessary to know quite exactly which attribute creates more value for customers. The importance of low fuel consumption or rapid acceleration to customer may depend on customer-specific conditions like driving style, driving environment, income etc.

To estimate the importance of customers' needs most frequently simple 5- or 7-point rating scales are used. Often, the result is that customers consider most of factors identically "extremely important" (Gale, Wood, 1994). Returning to the car example, if one would ask a customer to estimate the importance of "petrol consumption" and "rapid acceleration," customers might state that both factors are extremely important to them. (And they are not lying, it is just the fallacy of the research method). As a result the car company would not be able to make a reasonable trade-off along these factors in designing its value proposal. That is why more innovative companies are beginning to use more sophisticated methods, like conjoint analysis for studying customer needs.

Conjoint analysis allows defining customer needs more accurately than it is possible with using simple questionnaires. Rather than ask about the importance of attributes individually, the research setting is made quite close to actual decision making in a real market: where the customer's task is to rank the different product alternatives which are offered to him and pick out the one that creates most value for him. Whereas ranking is based on personal preference to different attributes of every product alternative.

Many studies confirm, that compared to other wide-spread customer needs research methods (like: evaluation of single product attributes importance by rating scale or percentage; rank ordering of product attributes; multidimensional measurement etc.) the results obtained with conjoint method are more detailed, reliable and easier to understand (Pullman, Moore, 1999; SPSS..., 1997). Based on the analysis of more than 300 applications in the literature which aimed to learn customers' needs, Anderson (1993)

concludes that conjoint analysis was the most successful in comparison to other methods (table 2).

Table 2. The success rate of different methods for learning customer needs.

Method	% of successful applications
The estimates of company's employees	55%
Open-ended questions in the questionnaire	66%
Benchmark (learning from competitors)	67%
Focus group estimates	70%
Observing the customer when using product	72%
Using rating scale or constant sum direct evaluations	75%
Conjoint analysis	85%

Source: Anderson *et al.*, 1993.

USING CONJOINT METHOD FOR ANALYZING VALUE CREATED TO CUSTOMER

Conjoint analysis uses customer's preference-estimations towards a set of experimental product concepts as an input. Hypothetical product concepts are presented as the descriptions of the products in the form of a bundle of particular product attributes. Concepts are shown on "concept cards" (Dahan, Hauser, 2002). Based on data gathered with conjoint analysis it is possible to find the utility of the examined product attributes to a particular customer and thereby calculate the relative importance of different product attributes (Green, Krieger, 1991).

Because of the complexity of the conjoint method there are various approaches to data gathering as well as to data analysis available to a researcher. In order to construct the appropriate framework and substantiate the chosen approach for investigating Estiko-Plastar's customers' needs the different conjoint techniques and phases are

next analyzed. A more detailed discussion about the conjoint method is presented by Green and Srinivasan (1978; 1990).

In table 3 the main conjoint analysis phases are pointed out together with the most commonly used alternative approaches. It is important to clarify that the stages are not independent; decisions made in every phase affect the next phases and next decisions (Gustafsson *et al.*, 1999)

Table 3. Main phases and alternative approaches of conjoint analysis.

Phase	Alternative approaches
1. choosing the product attributes to be investigated	customer needs vs. interests of the company; less than 7 or more than 7 parameters
2. choosing the data gathering method	full-concept or paired comparison
3. composing the concept cards (in full-concept approach)	all possible combinations or certain choice amongst them
4. choosing the presentation format of product attributes	graphical or verbal (paragraphs or keywords)
5. assigning a measurement scale	ranking, rating scale or paired comparison
6. data gathering	mainly interviewing personally or in groups
7. modeling the preferences	vector, ideal-point or part-worth model

Source: adapted from Smith, 2005; Gustafsson *et al.*, 1999; Dahan, Hauser, 2002.

In data gathering phase, each subject is asked to rank a set of concept cards based on purchasing preference. Every card describes an existing or hypothetical product in terms of a bundle of product attributes. An example of a concept card is illustrated in Figure 2.

Regression can be used to analyze the data to determine the part-worth utilities for different product attributes (more precisely, to certain attribute levels). Part-worth utilities are used to determine the relative importance of different product attributes to the customer (Green, Krieger, 1991). As customers' needs and preferences usually vary to a quite large extent the conjoint analysis is applied on an individual

customer level. Every subject's needs are modeled by an individual utility function — the functional form of the model is the same for all subjects, but the parameters of the function (betas) will differ. An aggregate model (using one model for all subjects) is also possible. However an aggregate model is likely to mask differences in preferences for different market segments. Individual models or models for separate market segments are likely to have greater predictive validity than aggregate models (using one model for all subjects) (Green, Srinivasan, 1990).

Choosing the product attributes to be investigated

To create concept cards it is necessary at first to choose the five to ten most relevant product attributes, preferably corresponding to the customer's most important needs; though company's intention for altering certain product attributes may also be decision criteria. The number of product attributes examined is limited in conjoint method. Greater numbers of product attributes necessitates a greater number of concept cards (in order to get reliable estimates of utility function parameters). At the same time the number of concept cards that a respondent can effectively rank is quite small. In different studies it is found that the tolerance level of a respondent is between 12–30 concept cards and 6–8 product attributes, depending on the motivation and product awareness of the respondent (Oppewal, Vriens, 2000). That is why the correct choice of product attributes is often considered the most demanding phase of conjoint analysis (Walley *et al.*, 1999).

For initial identification of customer wishes different techniques are used. The easiest perhaps is to use information gained from past customer interactions. Mail questionnaires, focus groups and in-depth interviews can also be used (Chan, Wu, 2002). It has been stated that for finding out 90–95% of all customer needs concerning a product, an experienced interviewer needs to make about 20–30 in-depth interviews with customers (Griffin, Hauser, 1993). However, the majority of studies have been limited to 5–17 inter-

views (Pullman *et al.*, 2002). Aaker (1997) has tackled in more detail the issue of the number of respondents.

In addition to picking out the most relevant product attributes, the examinable performance levels for every attribute have to be determined. A majority of studies have used 2–4 performance levels for every attribute (Oppeval, Vriens, 2000). Two criteria are usually kept in mind when choosing the product attributes and their performance levels (Gustafsson *et al.*, 1999):

1. The attribute levels should describe as closely as possible the real-life situation facing customers; attributes should be closely related to those products that are available to customers.
2. It is worthwhile to include factors which are considered to be company's key competencies in gaining a competitive edge.

Choosing the data gathering method

As an alternative to the rank-ordering of concept cards (described previously), it is also possible to gather data for conjoint analysis using a paired comparison exercise. Using this approach, a customer is asked to choose between two attributes which are presented with specific attribute levels (Green, Srinivasan, 1978). Using the car example: which is more preferred: "petrol consumption" of 6 liters/100km or "acceleration" of 7 sec. from zero to 100 km/h. Although the paired comparison exercise is less troublesome for respondents (Walley *et al.*, 1999) and it can also be used in the form of mail questionnaire, the paired comparison approach has also several disadvantages. The main deficiency is the higher divergence of the research situation from real life decision making — consumers are not in real life comparing only two product attributes, but entire products (the whole bundle of product attributes). Another shortcoming is the large number of questions (paired comparisons) that are needed for analysis. Therefore paired comparison approach is justified mostly when the number of product attributes is large and it is not possible to apply the full-concept method.

Composing the concept cards

In the full-concept approach, it is practical to use only small part of all possible concept card alternatives. In an experiment with, for example, six product attributes where each attribute has three performance levels the number of alternative concept cards is $3^6=729$. Most researchers have used only the minimum amount of concept cards that is needed to estimate efficiently the main effect of different attributes on the dependent variable (consumer's stated purchasing preference). Normally, possible interaction effects are omitted from analysis, assuming they are not strong (Gustafsson *et al.*, 1999). It has been found (Dahan, Hauser, 2002) that in conjoint analysis the gain from including interaction variables in the model and raising thereby the descriptive power of the model will not compensate the loss in predictive power of the model. The procedure of orthogonal design* (also called partial factorial planning) allows to reduce the number of concept cards in the case presented above from 729 to 18, which is enough to estimate efficiently (with sufficient reliability) the main effects. A more sophisticated manual design of concept cards is needed when some product attributes are technically closely related. In the car example a concept of "rapid acceleration" and "low petrol consumption" would sound really unbelievable. Which basically means that the researcher has to pick an orthogonal plan, which does not include technically unfeasible product concepts. (There is always more than one orthogonal plan possible.)

Choosing the presentation format of product attributes

As the next step one has to choose which format is used to present the product concepts. It is possible to employ product descriptions in text paragraphs which can give a complete and realistic picture of the product, but these may make the comparison of information in the descriptions difficult (Walley *et al.*, 1999). Also the small

* Orthogonal means here, that the impact of each attribute/ variable is measured independently from changes in other attributes/ variables.

number of paragraphs that can be read and sorted through by respondents makes the parameter estimates unreliable. It is more common to use a systemized format which presents product attributes as keywords in columns (as an example see figure 2). Keywords are easily comparable and do not include as much rhetoric (Gustafsson *et al.*, 1999). Pictorial presentations or actual product prototypes can also be used for presenting visual attributes, but are nevertheless seldom employed (Jaeger *et al.*, 2001).

Data gathering

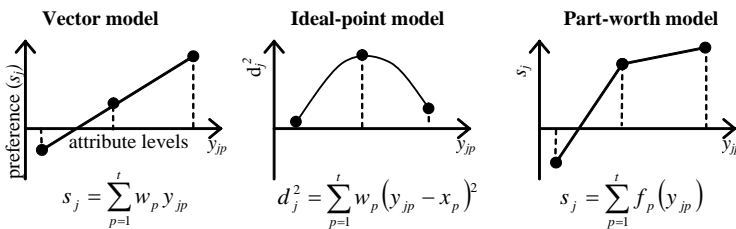
The procedure of sorting concept cards is usually perceived by respondents as complicated and tedious. Consequently data are best gathered through personal or group interviews. In the interview each respondent is asked to look through all the concept cards as possible products on sale and rank them according to their personal purchasing preferences. Interview helps to avoid distrust, give guidelines, control the ranking process and eventually get better data. The advantage of conjoint analysis compared to usual interviews is that it does not ask the respondent directly “what is the importance of different product attributes for you.” Rather the importance is based on sequential choices made in ranking of the cards. This method can therefore minimize response error. For example, a respondent who is asked “how important is it that your car has low emissions” might, because of social pressures, say that it was more important than it really was. However, in conjoint analysis, the importance would be inferred from the rankings and the respondent is not directly asked the question.

Modeling the preferences

Consumers needs and preferences are usually modeled by using one of the following three utility function forms: vector model, ideal-point model or part-worth model. As can be seen in figure 1 the part-worth model is most flexible and vector model most rigid in terms of the shape of the preference function. But, at the same time, the number of parameters to be estimated increases in the

opposite direction (Green, Srinivasan, 1978). If the actual preference function is linear, then vector model can give results with highest statistical reliability. Therefore it is always useful to find out *a priori* the actual shape of preference function. In the case of car's "petrol consumption" one can usually expect a fairly linear utility function — the larger the consumption is, the less utility it creates. In case of car body length on the other hand one can expect that there is only one level that is preferred by the consumer (neither too short nor too long is good).

It is common to estimate the preference functions in conjoint analysis by ordinary least squares regression (Smith, 2005). Research has shown that the efficiency (predictive power) of this technique is often quite similar to more complex techniques like Logit, Monanova, Linmap etc., but the results are easier to interpret (Oppewal, Vriens, 2000).



where

- t – number of product attributes,
- j – number of concept card,
- y_{jp} – level of p -th product attribute in the j -th concept card,
- s_j – consumer preference toward j -th concept card,
- w_p – partial utility parameter of the p -th product attribute
- x_p – ideal point of the respondent (ideal level of p -th attribute),
- d_j^2 – negatively related to consumer's preference for j -th concept card (basically $-s_j$),
- f_p – part-worth function of p -th product attribute.

Figure 1. Preference function forms (Green *et al.*, 1978; Smith, 2005).

The aim of the conjoint analysis is to predict consumers' purchasing patterns, so the model's predictive power is more important than its statistical significance. It has to be noted, that

usually the micro-models' statistical characteristics can be attacked by critics. But, on the other hand, this method produces significantly more accurate results than any alternative research method (Green, Krieger, 1991). To assess the model's validity, the correlation between predicted rank order of cards and actual (consumer given) rank order of cards is used (Green, Srinivasan, 1990; Hagerty, 1985). In different studies the average correlation has been between 0,7–0,8 (Oppewal, Vriens, 2000), though Jaeger (2001) has also achieved correlations of 0,99.

Finding the relative importance of product attributes

Based on the utility attached to product attributes' single performance levels the global utility (relative importance compared to other attributes) of every attribute can be calculated. The ratio of particular attribute's utility to the sum of all the attributes' utility is used to reveal the global utility of a particular attribute by the equation below (Smith, 2005), where O_p is the relative importance of the product attribute; $\max u_p$ is utility of the attribute's most preferred level and $\min u_p$ is utility of least preferred performance level of the attribute.

$$(1) \quad O_p = \frac{(\max u_p - \min u_p)}{\sum_{p=1}^t (\max u_p - \min u_p)}$$

The implementation of conjoint analysis can be greatly assisted by modern software packages. Advanced statistical software usually has conjoint analysis specific functions and can fulfill the necessary data processing operations smoothly. So carrying out the analysis should be feasible also to people who don't have a detailed knowledge of statistical data processing.

IMPLEMENTING CONJOINT ANALYSIS IN ESTIKO-PLASTAR

To analyze the applicability of conjoint analysis in a business-to-business setting Estonia's leading packaging material producer Estiko-Plastar (E.P.) was selected. This company's main activity is the production of printed and non-printed plastic bags and plastic film for different packages (in rolls). The company's turnover in 2005 was 13,2M EUR whereas majority of it came from sales of bags and film made from polyethylene. About 75% of E.P.'s production is sold in Estonia. The largest export countries are Latvia, Lithuania and Finland (AS Estiko-Plastar...2004). The company is especially interesting because it operates in business markets and most of its production is made by order (Kotri, Miljan, 2004). This may be a challenge for conjoint analysis which is mostly applied in consumer markets and with fairly standardized products. This also gives a unique opportunity to test the flexibility of conjoint analysis method in a typical business market.

To identify the broad range of E.P.'s customers' needs the results and interview protocols from a study performed a year before, in 2003, were used (Kotri, 2003). Primary interviews with 8 customers were carried out using the critical incidents technique; questions to the customers had the form: "What have you especially liked about a plastic package and its supplier," and "What have you especially disliked about a plastic package and its supplier." More than 50 customer needs and wishes emerged. In discussion with E.P.'s sales personnel the needs/ value creating factors were grouped to 22 secondary and 11 primary need dimensions based on consensus. The corresponding structure of value creating factors is brought out in appendix 1.

Secondly a questionnaire-based customer needs and satisfaction study was used to pick out 7 most important product and service attributes to be used further in the conjoint analysis. The customer satisfaction study had also been performed a year before, in 2003. Importance of the 22 secondary needs (as well as customer satisfaction) was measured on simple 10-point scale. In selecting the 7 most important attributes, E.P.'s key success factors and sales

managers' opinions were also taken into account — the factors coincided to a large extent with attributes considered as most important by customers. The major value creating attributes were: quality of plastic material, quality of welding, delivery time, quality of printing, price level, sales manager's proficiency and production flexibility.

Next the correlation among 7 product attributes was studied relying on the data from the 2003 customer study. Though the association of product attributes wouldn't violate any assumptions of conjoint method *per se*, the accurateness of utility parameters estimations would still be reduced. Because of small amount of data and presumption of non-normal distribution, Spearman's R was used. It turned out that the correlations between product attributes are, for the most part, not significant (in table 4). However, because of moderately high correlation, the attributes "quality of plastic material" and "quality of welding" were consolidated into a more general attribute — "quality of plastic material and welding." There is a common sense reason for this: it is very difficult for the customer to differentiate between these factors. For example, if a plastic shopping bag (or any other plastic bag) tears from the bottom it is almost impossible for a non-expert to say if it was caused by defects in plastic material or welding. Nevertheless these are two totally separate value creating operations in the production process of E.P.

Table 4. Correlation between importance estimates given by customers to product attributes.

Attributes	Material quality	Welding quality	Delivery time	Printing quality	Price	Salesman proficiency	Flexi-bility
Material quality		0,54**	0,07	0,38	0,46*	0,04	0,32
Welding quality	0,54**		0,11	0,35	0,25	0,24	0,20
Delivery time	0,07	0,11		0,42*	0,16	0,24	0,52*
Printing quality	0,38	0,35	0,42*		0,56*	0,16	0,54*
Price	0,46*	0,25	0,16	0,56*		0,05	0,30
Salesmen prof.	0,04	0,24	0,24	0,16	0,05		0,34
Flexibility	0,32	0,20	0,52*	0,54*	0,30	0,34	

** significant at 0,01 level

* significant at 0,05 level

As the number of most important value creating factors could be narrowed down to only 6 it was decided to employ in conjoint analysis a full-concept approach (procedure of ranking cards). Because most of E.P.'s production is made to order, there are no standard product attribute levels, which would apply in relation to all customers. (E.g. print quality of 30 dpi is totally unacceptable for some customers, while more than enough for others.) Consequently it is not possible to determine the specific attribute levels to be included in the analysis. A somewhat more general "market average" level was chosen as a reference base. The attribute performance levels were chosen to reflect the differences in the offerings in the real market, in an effort to help to assure a high validity of responses as proposed by Pullman (2002). Price difference of $\pm 40\%$ from market average is not real, it was reasonable to stay in the $\pm 10\%$ range. The same procedure was repeated for each individual attribute to find valid performance levels. Finally the product attributes and the attributes' performance levels that were included into the analysis were following.

1. Quality of plastic material and welding:

- a bit lower than market average (at times low quality),
- market average,
- a bit higher than market average (practically always high quality).

2. Delivery time (order fulfillment time):

- 14 days,
- 21 days,
- 30 days.

3. Quality of printing:

- a bit lower than market average,
- market average,
- a bit higher than market average.

4. Price:

- 10% lower than market average,
- market average,
- 10% higher than market average.

5. Sales manager's proficiency:

- not very proficient and poor communication,
- very proficient and good communication skills.

6. Production flexibility:

- relatively rigid, can satisfy only 60% of our special requests,
- quite flexible, can satisfy almost all (95%) of our special requests.

To reduce the number of concept cards before data gathering, the orthogonal planning procedure was executed. The number of concept cards was reduced from 324 to 18, which still makes it possible to effectively estimate the main effects. The corresponding orthogonal plan is in appendix 2.

Concept cards with two data columns were used to study the value creating factors (figure 3). The left column stated the attributes and the right column the corresponding performance levels according to orthogonal plan.

Plastic packaging supplier no.1	
Plastic material and welding quality	a bit lower than market average (at times low quality)
Delivery time	14 days
Printing quality	market average
Price	10% higher than market average
Sales manager's proficiency	not very proficient and poor communication
Production flexibility	relatively rigid, can satisfy only 60% of special requests
Preference...	

Figure 2. One of 18 concept cards presented to customer (hypothetical concept no. 1).

The task for respondents was to simply order the 18 cards by purchasing preference. The preference to every card could have also been estimated with points (eg. on 7-point scale), which would have captured more information in every answer. But as stated by Gustafsson (1999) this may also make responses less consistent and unreliable. For a consumer it is easier to decide which value offering is preferred rather than to say how much one offering is better than another.

Because of the troublesome nature of the card ranking procedure, in-depth interviews were carried through with customers in their working places. Because of the time and effort required to conduct these interviews, the sample was limited to 36 of E.P.'s most important customers*, who represent more than 70% of E.P.'s turnover. These customers were active in different industries — from peat, textile and foodstuffs production to retailing. 30 customers were located in Estonia and 6 in Latvia. 29 interviews were made in Estonian language and 7 in Russian. For the Russian language interviews, the concept cards were translated into Russian. Respondents were people who made purchasing decisions for the customer. They were interacting regularly with packaging material supplier and had a clear picture of the customer company's needs and limitations. Interviewees were working as purchasing managers or as higher managers.

Care was taken in present study to avoid pitfalls pointed out by other researchers (e.g. Jaeger *et al.*, 2001). To prevent mistakes like overvaluation of attributes presented in the upper part of concept cards, all the six attributes and their performance levels were first introduced to interviewee. After that interviewee was given 18 concept cards and asked to order them by the company's preference by asking "Which of those hypothetical suppliers would you like to see knocking on your door?" The initial sequence of cards was random. For helping interviewees to divide the task into more easily manageable stages, they were asked to sort first the cards into three piles (most attractive, intermediate and least attractive product concepts) and only then rank-order every pile. Despite these techniques and support from the interviewer, two customers still couldn't cope with the task; after about 20–30 minutes of trying, they got really frustrated and gave up. Also many of the respondents who completed the task successfully said that it was quite difficult and without support they would have probably given up. Therefore 18–20 concept cards and 6–7 product attributes can be considered as a maximum load that can be utilized in similar research settings (business market, not precisely defined attribute levels, respondents were managers, interviews at workplace, no direct rewards to respondents).

* E.P.'s total customer base exceeds 1000

For modeling the preferences of responded customers the part-worth function model was used. Although the most and least preferred attribute levels were *a priori* known for all the attributes (it is obvious that higher quality is always preferred to average and average to lower) one can't assume that the preference function is linear. Based on existing information the ideal-point model can be dismissed as well. Comparing also the predictive power of different models the part-worth function model proved to be more precise than vector or ideal-point model.

To estimate the part-worths and relative importance of product attributes the SPSS software package was used. The ordinary least squares method was chosen as estimation method. In equation 2, the dependent variable is the customer's preference rank given to a concept card and independent variables are product attributes' different levels.

$$\begin{aligned}
 S = & B_0 + B_{11}(\text{low material } q.) + B_{12}(\text{average material } q.) + B_{13}(\text{high material } q.) + \\
 & + B_{21}(14 \text{ day delivery}) + B_{22}(21 \text{ day delivery}) + B_{23}(30 \text{ day delivery}) + \\
 & + B_{31}(\text{low print quality}) + B_{32}(\text{average print quality}) + B_{33}(\text{high print quality}) + \\
 (2) & + B_{41}(10\% \text{ lower price}) + B_{42}(\text{average price}) + B_{43}(10\% \text{ higher price}) + \\
 & + B_{51}(\text{not proficient salesman}) + B_{52}(\text{proficient salesman}) + \\
 & + B_{61}(\text{rigid production processes}) + B_{62}(\text{flexible production processes})
 \end{aligned}$$

The B parameters of independent variables show the part-worths (utility) of different product attributes for a particular customer (Orme, 2002). From the part-worths the relative importance of different attributes can be found. Results of the analysis are brought out in the following section and in appendix 3.

To check the part-worth models' predictive power the correlation between actual rank of concept cards and predicted rank was found for every respondent's model. Correlation coefficients varied between 0,72 and 0,99; the average was 0,91 — which gives reason to believe the models are quite good. (Correlations in other conjoint studies have been between 0,7 and 0,8.) Data were analyzed closely after every interview, on the same day. The customer's verbal responses about their most important factors were found to be consistent with the results of the conjoint analysis on the individual level, thus indicating fair validity of the method.

RESULTS OF CONJOINT ANALYSIS IN ESTIKO-PLASTAR

Based on the part-worth utilities and equation number 1, it was found that on average the most important attribute for E.P.'s customers is the plastic material and welding quality. It can be seen from figure 3 that almost 24% of average customer's purchasing decision depends on the quality of plastic material and welding. This result is logical because the plastic package is the core product. Next in importance are the price and delivery time attributes, which form 21% and 19% of average customer's purchasing decision. The relative importance of the six attributes to all customers are on the individual level shown in appendix 3.

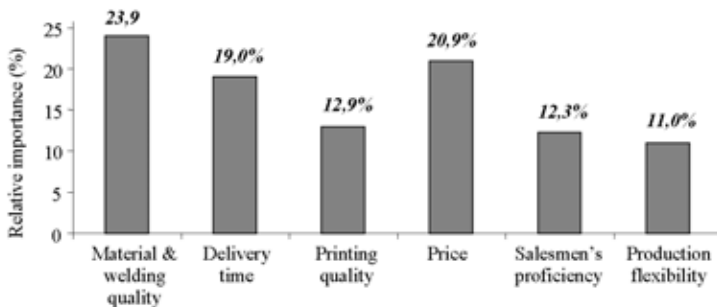


Figure 3. Average relative importance of product and service attributes of E.P.'s value proposal.

The average part-worth functions for six attributes can then be used to understand how a change in an attribute's performance influences the value created for customers. From figure 4 it can be seen that raising the quality of "material and welding" from low level to average level creates more value to a customer than raising the material quality by same interval from average to higher. An analogous graph describes the "printing quality" value function for customers. Such differences in attribute levels utility elasticity can be interpreted in context of Kano satisfaction theory that differentiates product attributes as hygiene factors and motivating factors (Kano *et al.*, 1984). Improving the performance of hygiene factors won't increase considerably the utility further from certain

performance level. At the same time “delivery time” is a motivational factor where improving the performance (to shorter delivery time) increases the customers’ utility in a straight line, without a breaking point.

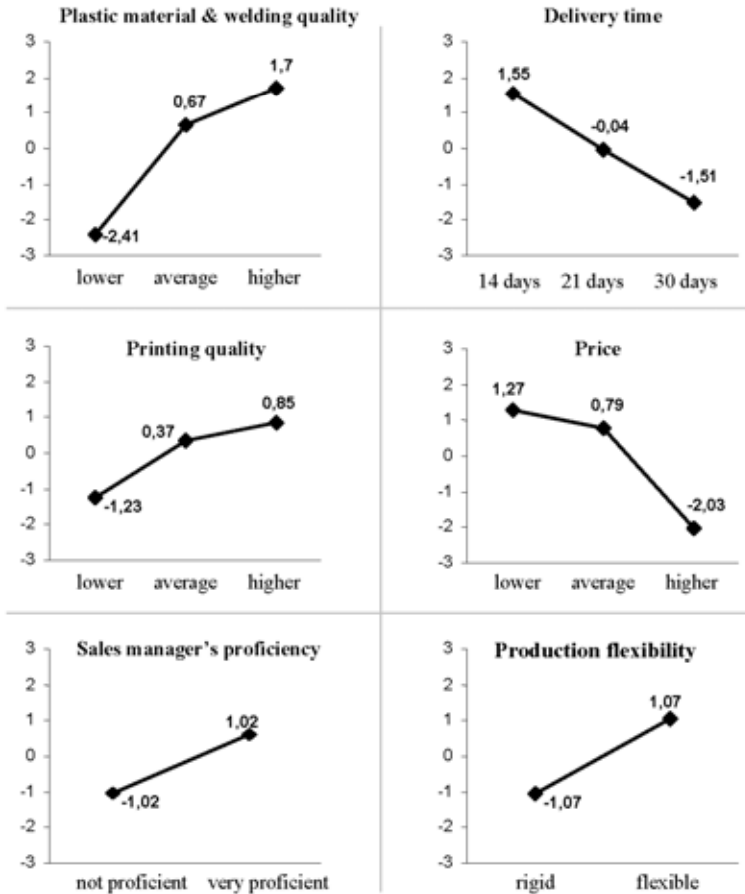


Figure 4. Average part-worth functions for Estiko-Plastar’s product and service attributes’ performance levels (results significant at 0,05 level).

This information can be used to identify the parts of E.P.’s value proposal where making changes can give best or worst results for

the company. With “price,” it turns out that increasing the price to 10% higher than market average would destroy disproportionately more value to customer than a price decrease of 10% lower from market average could create. In conditional utility units the price increase would reduce the value created to customer by 2,82 units; a price decrease of same magnitude would create only 0,45 points of utility. In practice E.P. is considered to have prices close to market average, so a price increase of 10% would almost certainly have tragic consequences for the company. At the same time there is not much point in lowering the prices either as the additional value created by 10% lower price would be only 0,45 utility points. It would be smarter to reduce, for example, delivery time which would create an additional value of 1,51 utility points.

As it was initially decided to analyze both sales manager’s professionalism and production flexibility on only two performance levels, the results can’t be as detailed as with other attributes. Yet comparing the utility scores it turns out that not higher professionalism (2,04 points) nor higher flexibility (2,14 points) would increase the value to customers as much as improving the bad quality of plastic material (4,11 points) or shortening the 31 day delivery times (3,06 points).

But the averaging of consumer needs and relying on average part-worths may lead to incorrect conclusions if consumers are not homogenous. Therefore the conjoint analysis results were further processed by k-means cluster analysis to check for possible sub segments with different needs. For cluster analysis the attributes’ relative importance values were used because it has been found that they discriminate customers with similar needs better than part-worths or even the ranking of cards (Green, Srinivasan, 1978). Four segments emerged in the analysis. In table 5 the average importance of the attributes for segments are summarized to show how can conjoint analysis be used for identifying market segments. As can be seen the customers were far from having homogenous needs, segments emerged with following distinctive needs:

- 1) short delivery times,
- 2) professional sales manager and flexible of production,
- 3) good quality of plastic material with reasonable price,
- 4) good quality of print and good quality of plastic material.

Table 5. Attributes' importance in four different needs based customer segments.

Product/ service attribute	Relative importance				
	average n=34	segment 1 n=11	segment 2 n=7	segment 3 n=10	segment 4 n=6
Material and welding quality	24	19,8	14,3	35,5	23,6
Delivery time	19	37,7	12,7	8,1	10,2
Print quality	13	9,8	10,2	8,6	28,9
Price	21	15,2	14,9	32,9	18,4
Proficiency of sales manager	12,3	7,6	29,8	7,0	9,0
Production flexibility	11	9,9	18,0	7,8	9,9

As an interesting observation it was noticed, that even customers who belonged to the same industry and who could have been expected to share similar needs belonged sometimes to totally different needs' segments. For example dairies could be found in second, third and fourth segment. On the face of it different companies belonged to one segment. For example the fourth segment "good quality of print and plastic material" includes dairies, peat producers and candy producers that share a similar distinctive need. The common need is of course that all those customers' products have to look very attractive on store shelves. This result was also confirmed by E.P.'s sales managers, who agreed that customers who seem similar on the surface have often different needs.

Considering modern consumers' high expectations and the large number of alternative suppliers that all aim to fulfill customers' needs, it is quite obvious that ignoring different needs or "averaging" them will sooner or later lead to a shrinking customer base. Conjoint analysis helps to avoid that by giving firm standing to micro segmentation and pointing out the individual needs of every studied customer (like in appendix 3).

ADVANTAGES OF THE CONJOINT METHOD AND ITS LIMITATIONS

As seen, conjoint analysis is a method that can help in making optimal pricing and product development decisions. Thus it enables to estimate the value created to customers with remarkable accuracy. It is also useful for market segmentation decisions and other improvements that create value for company. The main advantages of conjoint method are summarized in the following figure.

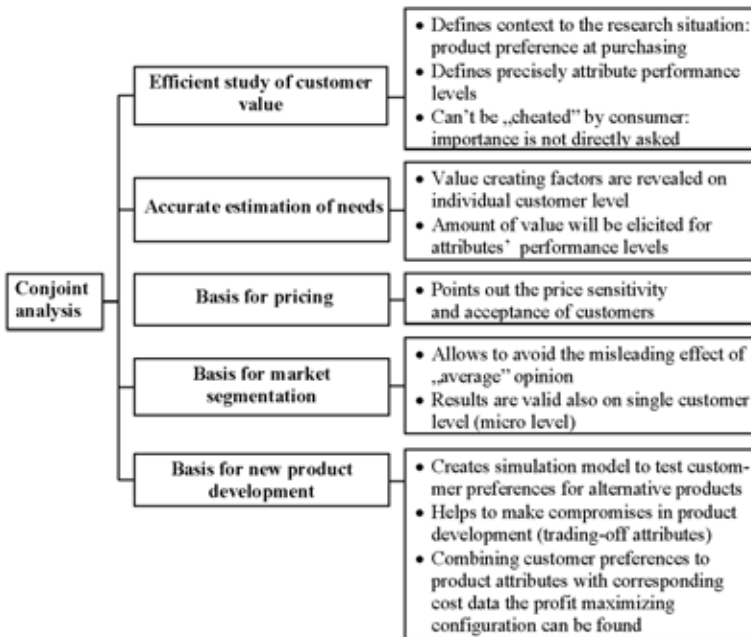


Figure 5. Advantages of conjoint analysis method.

Conjoint analysis's virtue compared to many other methods is that it defines precisely the performance levels of studied product attributes. Whereby ensuring that respondents and researchers understand the research question more clearly. The situation faced by respondents is very similar to their actual purchasing situation.

Comparing the concept cards is analogous to comparing the products in the real market.

Conjoint analysis allows measuring and analysis of consumer preferences even for individual respondents. In addition, the segmentation and clustering of customers is possible also when the sample is very small. In practice it allows companies to analyze the needs of very small consumer segments and create attractive value offerings. This can be especially appealing for mass-customizers and companies embarking on 1-to-1 customer relationship strategies.

The results of conjoint analysis give a good picture about the importance of different product attributes in creating value for customers. Using this information, it is possible to develop optimal product configurations or service packages. Models based on the results of conjoint analysis allow predicting the response of the market to changes in existing product configurations (or price) before the actual decision is made.

Conjoint analysis is based on the assumption that consumers' purchasing behavior follows the compensative value model. This means that the utility from product's benefits and costs can be simply summed together (as higher performance of one attribute compensates for low performance of another). This is also sometimes considered as a limitation to conjoint method, because the purchasing decision may also follow, for example, an exclusion or magnified compensative model. However, Green and Srinivasan (1990) have concluded that conjoint analysis' predictive validity is quite high even when the consumer actually follows different decision rules other than compensative.

As previously discussed, another shortcoming of conjoint method (especially the full concept approach) is the small number of product attributes that can be effectively analyzed. To overcome it, a bridging technique can be used (Dahan, Hauser, 2002). To put it simply, bridging means creating several concept card sets, which analyze different attributes, but share a common "anchor attribute" in every set that makes the results and utility functions comparable. Oppewal and Vriens (2000) talk about a successful example where even 28 product attributes were included to conjoint analysis in four card sets.

CONCLUSION

Knowing customer needs and designing accordingly appealing value proposals is a crucial success factor in today's competitive markets. The aim of consumer research is to shape such a value proposal that would maximize the market share or profit of the product, giving guidance to the company about how to best use its limited resources. The present article has discussed the potential of using conjoint analysis, which is relatively unknown in Estonia, for analyzing and measuring consumers' needs. A theoretical framework was applied in prioritizing an Estonian packaging material producer's customers needs and corresponding product attributes.

Conjoint analysis consists of planning and implementing experiments among consumers in order to model the consumer purchasing decision and to understand which factors create value for the customer. Conjoint analysis embodies more than seven major phases: it starts by selecting the product attributes or factors which fulfill customer needs and finishes with stating the relative importance of different attributes to customer. All the major phases were discussed in the paper, to point out the alternative approaches that a researcher could take, with the aim of creating a suitable framework for implementing the research in the case of Estiko-Plastar.

For performing the conjoint analysis in the study of Estiko-Plastar's customers needs, the full concept approach was chosen. As the result of preliminary analysis and structuring of customer needs, the six most important product and service attributes were selected for further analysis. Based on the chosen performance levels of those six attributes 18 complete configurations (concepts) of different plastic packaging offerings were produced using the orthogonal design procedure. During personal in-depth interviews with the 36 most important customers of Estiko-Plastar, the customers were asked to rank the different concepts (presented on separate cards) based on their purchasing preference. After analyzing the data by using regression, the relative importance (and utility) of different product and service attributes for each customer was found.

It appeared that the most important attribute of Estiko-Plastar's value offering is the quality of plastic material and welding, that determines 24% of average customer's purchasing decision. The next most important attributes are price (21%) and delivery time (19%). Going more detail by examining attributes utility functions it was found which changes in the current offering would have the largest impact on customer value. Most value could be created by improving material quality or shortening the delivery time. On the other hand, significant value would be destroyed by raising the price above market average level or lowering the material quality below market average. Because the utility functions were quite different in comparing the aggregate model to the individual models, it was clear that "value" consisted of different attributes for different customers. So conjoint analysis results were further processed by cluster analysis to identify sub-segments based on different needs. Four quite distinctive segments emerged.

Possibly the most important limitation of the conjoint method is that the implementation is quite complicated if more than 7–8 customer needs/ product attributes are involved. Also it is easier to use simple, but less reliable point-scales. In using conjoint analysis, the current study suggests that three rather than two levels for each product attribute should be used. The results are much more informative for three attribute levels, allowing to differentiate hygiene factors and motivating factors among all value creating factors.

For further development of present study the information about the costs associated with improvements in attribute levels should also be identified. It is often the case, that the most preferred product configuration discovered by conjoint analysis would maximize company's market share (sales) but not profit. For combining the utility of product attribute levels and the costs of attaining each level the *quality function deployment* (QFD) method could be used. It systemizes the relationships between product attributes and production processes, and thus costs. This facilitates finding profit maximizing product attribute bundles.

In conclusion, it can be said that conjoint method helped to analyze and prioritize the needs of Estiko-Plastar's customers with con-

siderable accuracy. This helped to understand what factors created value for individual customers and to predict how customers would react to changes in Estiko-Plastar's existing value proposal. So a sound basis was created for making reasoned decisions about the company's value proposal and marketing strategy.

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KOKKUVÕTE

Kliendile loodava väärtuse analüüs eeliskombinatsiooni meetodil: pakenditootja näide

Tänapäeva konkurentsitihedatel turgudel on tarbijate vajaduste tundmine ning sobiva väärtuspakkumise kujundamine ettevõtete jaoks üheks võtmeguriks edu saavutamisel. Vastavate tarbijauuringute eesmärgiks on ettevõtte müügiedu maksimeeriva toote ja teenuse kujundamine; andes juhiseid ettevõtte piiratud ressursside parimal moel kasutamiseks. Käesolevas artiklis selgitati erinevaid võimalusi Eestis vähelevinud eeliskombinatsiooni meetodi kasutamiseks tarbijate vajaduste mõõtmisel ja analüüsil kilepakenditootja AS-i Estiko-Plastar näitel.

Eeliskombinatsiooni meetod seisneb spetsiifiliste eksperimentide kavandamises ja läbiviimises tarbijate seas, selleks et modelleerida tarbijate ostuotsustusprotsessi. Eeliskombinatsiooni meetod koosneb enam kui seitsmest olulisemast etapist alates uuritavate kliendivajaduste väljavalimisest, kuni tarbijate osakasulikkusfunktsioonide täpse modelleerimiseni. Lähtuvalt artikli eesmärgist analüüsiti iga etapi juures põhjalikumalt ka uurija ees seisvaid alternatiivseid valikuid, selleks et luua metoodiline raamistik eeliskombinatsiooni analüüsi rakendamiseks.

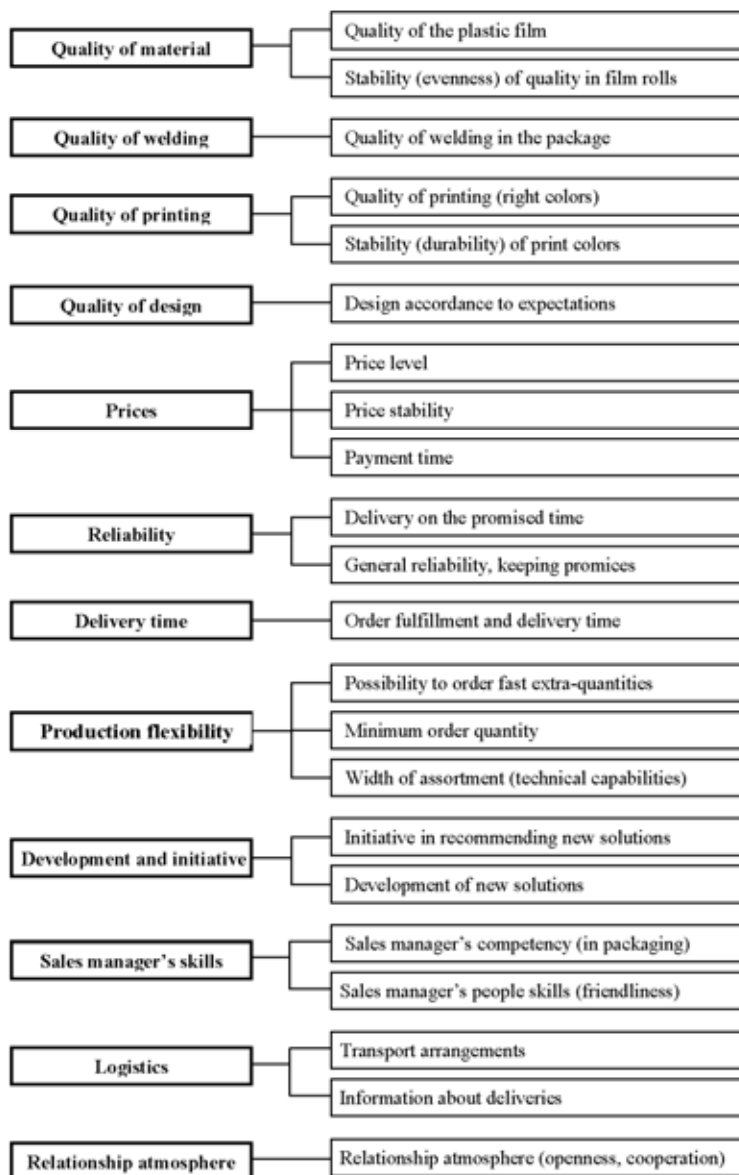
Uuringu teostamisel Estiko-Plastaris otsustati kasutada täiskontseptsiooni lähenemist. Seega valiti esialgse kliendivajaduste analüüsi ja struktureerimise tulemusel välja 6 olulisimat toote ja teenuse omadust, mille erinevate tasemete (*performance levels*) lõikes klientide vajadusi täpsemalt hinnati. Kasutades ortogonaalse disaini protseduuri koostati valitud kuue omaduse erinevate tasemete baasil 18 erinevate omadustega kilepakendi pakkumist, mis kanti 18-le kontseptsioonikaardile. Personaalsete intervjuude käigus paluti 36-l Estiko-Plastari kliendil kontseptsioonikaardid personaalse ostueelistuse alusel järjestada. Analüüsides saadud andmeid regressiooni meetodil (iga vastaja lõikes eraldi) leiti iga kliendi jaoks erinevate toote ja teenuse omaduste suhteline tähtsus.

Selgus, et Estiko-Plastari väärtuspakkumise keskeltläbi olulisim omadus on klientide jaoks kilematerjali ja keevituse kvaliteet, mis määrab keskmise kliendi ostuotsusest 24%. Tähtsusetl järgnevad pakkumise hind (21%) ja tellimuse täitmise tähtaeg (19%). Tuues omaduste lõikes välja osakasulikkusfunktsioonide kujud, leiti tegurid mille abil õnnestuks Estiko-Plastari klientidele enim väärtust luua. Kuna osakasulikkused olid üksikute vastajate tasemel üpris erinevad, siis viidi eeliskombinatsiooni analüüsi tulemustega läbi ka klasteranalüüs, mille abil tuvastati neli erinevate vajaduste alusel eristuvat kliendisegmenti.

Kokkuvõttes võib öelda, et eeliskombinatsiooni analüüs võimaldas Estiko-Plastari klientide vajadusi ja vastavaid tootomadusi märkimisväärse täpsusega prioritseerida, mõista üksikute tegurite väärtust erinevatele klientidele. Samuti prognoosida, kuidas reageeriks tarbijad olemasolevas väärtuspakkumises muudatuste tegemisele. Seega loodi alus argumenteeritud otsuste vastuvõtmiseks ettevõtte väärtuspakkumise ja turundusstrateegia kujundamisel.

Appendix 1

Structure of Estiko-Plastar's customers' needs



Appendix 2

**Product concepts used in conjoint analysis
(orthogonal plan)**

Concept card no.	Quality of plastic material and welding	Order fulfillment time	Print quality	Price	Sales manager's proficiency	Production flexibility
1	1	1	2	3	1	1
2	1	1	1	1	1	1
3	1	2	3	1	1	2
4	1	3	3	2	1	1
5	1	3	1	3	2	2
6	3	2	3	3	1	1
7	3	3	2	3	1	1
8	3	3	1	1	2	1
9	3	2	1	2	1	2
10	2	3	2	2	1	2
11	3	1	3	2	2	1
12	2	1	1	2	1	1
13	1	2	2	2	2	1
14	2	2	2	1	2	1
15	2	3	3	1	1	1
16	2	2	1	3	1	1
17	2	1	3	3	2	2
18	3	1	2	1	1	2

* 1,2,3 — performance levels of product attributes

Appendix 3

**Segmenting respondents into
4 groups based on distinctive needs,
gray marks most important need(s)
that characterize(s) the segment**

<i>Customer nr. (disguised)</i>	<i>Material and welding quality</i>	<i>Delivery time</i>	<i>Printing quality</i>	<i>Price</i>	<i>Salesmen's proficiency</i>	<i>Production flexibility</i>
18	20,2	37,4	3,9	25,7	8,2	4,7
5	19,2	28,8	4,4	17,7	18,8	11,1
16	32,5	33,9	11,7	7,2	4,5	10,2
24	13,2	49,6	12,4	8,5	8,1	8,1
1	12,9	49,4	7,6	17,5	4,6	8
7	3,8	34,5	6,9	28,4	5,8	20,7
31	5,5	65,8	3,7	1,8	6,9	16,4
10	37,5	32,5	7,5	2,5	6,3	13,8
22	17,5	33,3	16,7	30	0	2,5
28	26,5	28,7	20,1	15,1	8,6	1,08
33	28,8	20,2	13,3	13,2	12,2	12,2
13	23,6	2,2	7,4	8,8	29,8	28,3
21	11,8	16,8	12,6	23,5	25,2	10,1
26	9,8	16	7,8	15,3	26,1	25,1
17	26,1	6,3	9,2	9,9	23,2	25,4
12	11,4	12,1	14,1	16,1	24,2	22,2
3	4,2	14,2	5,8	15,8	45	15
32	13,4	21,3	15	15	35,4	0
20	24,4	4,1	14,6	42,3	4,9	9,8
27	23,4	6,7	5,9	47,7	7,5	8,8
4	30,8	0	5	49,2	11,3	3,8
2	25,7	8,8	5,2	44,9	6,6	8,8
23	51,2	17,8	8,5	10,9	7	4,7
14	20,5	12,9	5,3	46,4	9,1	5,7
30	46,9	4,7	19,5	17,2	4,7	7,
8	41,7	2,6	13,6	25,2	6,2	10,7
25	41,3	10,8	0	29,7	6,1	12,1
34	49,2	12,9	8,3	15,9	6,8	6,8
9	24,2	1,3	22,3	19,8	18,2	14,3
15	22,7	4,7	30	26,7	7	9
29	17,8	10,9	24	38	4,7	4,7
19	17,7	13,5	33,8	8,4	17,7	8,9
11	21,7	10,9	29	12,7	4,1	21,7
6	37,6	19,9	34,5	4,6	2,3	1,2