PRIMJENA CONJOINT ANALIZE U PROUČAVANJU POTRAŽNJE ZA MP3 PLAYERIMA NA TRŽIŠTU BOSNE I HERCEGOVINE

APPLICATION OF CONJOINT ANALYSIS IN STUDYING DEMAND FOR MP3 PLAYERS ON THE B-H MARKET

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SAŽETAK

Svrha: U radu je prikazana primjena conjoint analize u proučavanju procesa vrednovanja i kriterija odabira pri kupnji MP3 playera kod segmenta mladih, kao najznačajnijeg segmenta za tu kategoriju proizvoda.

Metodologija: Provedeno je nekoliko istraživanja mladih potrošača u sarajevskoj regiji. Najprije su provedeni nestrukturirani intervjui pomoću fokus grupa u kombinaciji s nizom pitanja višestrukoga izbora i otvorenih pitanja, a sve radi identificiranja varijabli proizvoda i razine njihove važnosti za preferencije potrošača. Nakon što su

ABSTRACT

Purpose: The paper illustrates practical aspects of conjoint analysis in studying evaluation and preference criteria when buying hardware MP3 players among the youth, as the most significant segment of such product buyers.

Methodology: The methodology consisted of several surveys of young consumers in the Sarajevo region. In the first step, we used unstructured focus group interviews combined with a series of multiple-choice and open-ended questions for identifying product at-

izdvojene glavne varijable i određene razine njihove važnosti, one su kombinirane kako bi se dobili različiti profili hipotetskog proizvoda. Dobiveni rezultati analizirani su pomoću softvera za conjoint analizu.

Spoznaje: Rezultati pokazuju da bi proizvođači i prodavači MP3 playara svoje strategije trebali usmjeriti na marku kada ciljaju na segment mladih kao najznačajniji segment za takve proizvode. Istraživanje potražnje i osjetljivosti na cijene pokazalo je da su kupci ove kategorije proizvoda osjetljivi na cijene i zbog toga su spremni mijenjati marke.

Ograničenja: Iako istraživanje obuhvaća većinu čimbenika koji se odnose na MP3 playere, poželjno bi bilo uključiti dizajn kao dodatni čimbenik te više različitih marki. Isto tako, veličina uzorka mogla bi biti veća što bi omogućilo segmentaciju tržišta temeljem dobivenih part-worths.

tributes and attribute levels that are relevant to consumers' preferences. After the main attributes and the levels of attributes had been selected, they were combined to form different hypothetical product profiles. Obtained data were analyzed with the help of the conjoint analysis software.

Findings: The results show that MP3 player manufacturers and sellers should focus their marketing strategies on the brand when targeting young people, as the most significant market segment for such products. The findings of the demand and price sensitivity analysis imply that the buyers of this product category are generally price-sensitive and therefore willing to switch brands.

Limitations: While the study covered the most important attributes regarding MP3 players, it might be desirable to include design as an additional attribute as well as more brands. Also, a sample size could be increased to allow market segmentation based on the obtained part-worths.

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1. INTRODUCTION

A reduction of the audio file size by means of compression allowed the MP3 format to become very popular on the Internet in the late 1990s. The popularity of the MP3 format was further enhanced by the success of the companies involved in developing reproduction software (most notably, the Nullsoft company and its Winamp software player, introduced in 1997) and the software for the exchange of MP3 audio files (primarily Napster, introduced in 1999). These programs allowed an average user to simply reproduce, create, share and collect MP3 files. Consequently, MP3 became the most popular format for distribution, compression and listening to music on computers.

As a result of such trends in accepting the MP3 format and a large user base, it was only a matter of time for someone to come up with the idea of transforming the popularity of the MP3 format into a hardware form. Thus, as early as in late 1998, the market saw the launch of the first portable MP3 players with flash memory. Today, there are a huge number of devices of the sort available with various characteristics and the most numerous variant includes MP3 players which use flash memory for file storage.

In order to plan appropriate strategies for attracting new and keeping existing customers, companies involved in the MP3 player manufacturing have to identify the criteria determining potential users' decision when selecting a product. The evaluative criteria are the various features a consumer looks for in response to a particular type of problem[1]. Closely related to evaluative criteria are consumer preferences. Since in the decision-making process a customer considers the offers by several companies, it is particularly important to determine the preference structure. Before even starting to develop certain strategies that might influence consumers' decisions, a marketing manager has to know which evaluative criteria consumers use when taking decisions, how they evaluate various options related to each of the criteria as well as what the comparative value of each criterion and what consumer preferences are?

Responses to these questions, i.e. determining the comparative value of evaluative criteria and the preference structure can be obtained by direct or indirect methods. Due to the limitations of direct methods in measuring a relative significance of evaluative criteria, a number of researchers have adopted indirect methods, the most important being conjoint analysis. Hair et al. say that "conjoint analysis is a multivariate technique developed specifically to understand how respondents develop preferences for any type of object (products, services or ideas). It is based on the simple premise that consumers evaluate the value of a product or service (whether actual or hypothetical) by combining the separate amounts of value provided by each attribute".[2]

The use of conjoint analysis eliminates the need for expensive prototypes for conducting tests before introducing a new product to the market. As a result, conjoint analysis proved to be a particularly suitable method for obtaining responses for a broad range of marketing issues. Thus, Vriens claims that "in terms of conducting ways and the issue researched, conjoint studies can be classified into six groups: studies dealing with segmentation decisions, studies related to product decisions, competitive analysis studies, pricing decision studies and studies related to distribution channels and promotion decision".[3] Besides, conjoint analysis is frequently used for the brand equity analysis. Commercial use of conjoint analysis in the United States and Europe was discussed in detail by Cattin and Wittink,[4] Wittink and Cattin,[5] and Wittink et al.[6]

Although used for three decades in the West,[7] the technique has not been used in any research in Bosnia and Herzegovina (B-H) to date. This paper illustrated practical aspects of conjoint analysis on the example of a study dealing with evaluative criteria and preferences in purchasing hardware MP3 players among B-H youth, as the most significant segment of these products buyers.

The questions studied are following:

- Which attributes do consumers consider when buying an MP3 player?

- What is the significance of each attribute and its levels in the overall value of an offer for a buyer?
- What is the curve of the price elasticity of demand for this product category?
- How can the manufacturers and marketers of MP3 players use the obtained information to improve their marketing mix?

2. METHODOLOGY

The first task related to the conjoint study development pertained to the identification of attributes and levels considered by potential users in order to evaluate various offers within this product category. Out of a few techniques for identifying attributes and their levels for conjoint study purposes we opted for the review of computer magazines that presented and tested different models of these devices. The levels identified in this way were further refined by interviewing part of the target group (73 people altogether). The survey asked respondents to list any characteristics they would consider when buying such a device, and the manufacturers (i.e. brands) of MP3 players they had heard of. The results indicated that most respondents consider memory capacity (70% of all respondents), followed by price (44%), player size (36%), design (32%) and brand (22%) as relevant. With respect to brand, as many as 95% respondents mentioned the Sony brand among others, followed by Panasonic, Philips and Samsung (each listed by 21.4% respondents) and Siemens (11%) while other brands were recalled by a fairly small number of respondents (See Exhibit 1).

EXHIBIT 1

Please, specify which characteristics of MP 3 players you first take into account when buying this product.

Category label	Code	Count	Pct of responses	Pct of cases
Weight/dimensions	1	3	2.5	6.0
Memory capacity	5	35	28.7	70.0
Display	6	1	.8	2.0
Type of built-in battery	7	1	.8	2.0
Price	8	22	18.0	44.0
Warrant	10	1	.8	2.0
Design	11	16	13.1	32.0
Brand	12	11	9.0	22.0
Size	13	18	14.8	36.0
Color	14	4	3.3	8.0
Quality	15	8	6.6	16.0
Technical superiority	16	1	.8	2.0
Functionality	17	1	.8	2.0
	Total responses	122	100.0	244.0

Please, specify any MP3 player manufacturers that you have heard of.

Category label	Code	Count	Pct of responses	Pct of cases
Sony	1	40	45.5	95.2
Panasonic	2	9	10.2	21.4
LG	3	3	3.4	7.1
Neo	4	1	1.1	2.4
Roadstar	5	3	3.4	7.1
Philips	6	9	10.2	21.4
Samsung	7	9	10.2	21.4
Sanyo	8	1	1.1	2.4
Aiwa	9	3	3.4	7.1
Apple	10	2	2.3	4.8
Creative	12	1	1.1	2.4
Genius	13	1	1.1	2.4
Siemens	14	5	5.7	11.9
Schneider	16	1	1.1	2.4
	Total responses	88	100.0	209.5

Source: Research

Although the player design and size can be included in the conjoint study by means of pictorial representation or the prototypes given to respondents to see, we believed this would make the research, which is of basically explorative character, unnecessarily difficult. It was thus decided not to use these attributes, i.e. further course of the study assumed that all the options presented to respondents have the same design and size, and that they differ only with respect to the memory size, brand and price.

With the attributes defined, the next step included the choice of the appropriate conjoint methodological approach. The review of related literature revealed that the choice-based conjoint analysis (CBC) is the most suitable method for studies where price and brand play important roles.[8] In the choice-based approach, the respondent is presented with a few sets of products and asked to choose a product from each set (one he/she would buy if these were the only available options in the market).

With respect to attribute levels, two problems arose in relation to the brand. The first one, including a few brands, could result in the so-called number of level effects, since the brand as an attribute could have far more levels than other attributes. This effect is manifested in the fact that the attributes with a greater number of levels artificially gain more significance than other attributes in a study.[9] Therefore, in order to avoid this effect, it is necessary to ensure that all the attributes in the study have approximately the same number of levels. The second problem was the fact that a number of brands identified by the literature review were not available in B-H stores, or were little known brands and manufacturers.

In order to solve this problem, we decided to use only three levels for the 'brand' attribute, as follows: Sony, as a representative of a well-known brand (remember that as many as 95% respondents recalled this brand), then Panasonic, as a representative of medium-known brands (21.4% respondents), and Xiro as a representative of little-known brands (not mentioned by any respondent in the test group). Xiro is a relatively new manufacturer, focused exclusively on MP3 players. The quality of Xiro devices is proven by the results of a review in which Xiro emerged as the winner among a few models tested.[10]

In price studies it is sometimes very useful to vary the prices of products that are to be shown within a conjoint task depending on other attributes (such as e.g. the memory size in our example). If this is not the case, the experimental design can result in unrealistic tasks (scenarios) included in the questionnaire (e.g. that the model produced by the same manufacturer which has a smaller-size memory could have a higher price than the same model with the larger memory).

One of the ways for solving the unrealistic task problem without reducing the design efficiency is the use of the so-called conditional pricing. Conditional pricing allows the creation of a look-up table, which serves to set the prices to be shown for specific attribute combinations. The price essentially still has three levels but they are presented descriptively as a 'low', 'medium' and 'high' price (Table 1).

Table 1: Conditional pricing table for CBC MP3 study

	Low price	Medium price	High price
128 MB	79 BAM*	99 BAM	119 BAM
256 MB	119 BAM	149 BAM	179 BAM
512 MB	159 BAM	199 BAM	239 BAM

* 1 EUR = 1.956 BAM (BAM is the national currency in Bosnia and Herzegovina)

Source: Research

In developing the table, the research started with the average price for different memory sizes (middle column). In order to obtain the prices shown in the column entitled 'low price', average prices were reduced by 20% and rounded to an integer. 'High prices' were calculated by increasing the average prices by 20%. The final list of attributes and their levels is presented in Table 2.

Table 2: Final list of attributes and their levels.

Attribute	Levels
Price	Low (79 – 159 BAM)
	Middle (99 – 199 BAM)
	High (119 – 239 BAM)
Memory	128 MB
	256 MB
	512 MB
Brand	Sony
	Panasonic
	Xiro

Source: Research

With respect to the experimental design itself, we opted for a randomized design, which is not fully orthogonal but allows measuring all the interactions, including those believed to be non-existent before the experiment itself. Although statistically less efficient than the fixed design, the random design allows more flexibility to the researcher, and is easier to implement. The loss of statistical efficiency in case of the accidental compared to the fixed design is usually minimal in most experiments.[11]

Other issues in developing the CBC questionnaire pertained to the number of profiles to be used within a single task, the issue of how many tasks to include in the questionnaire and, finally, how many different versions of the questionnaire should be made. Increasing the number of alternatives results in the incremental information and increased statistical efficiency but also requires more respondent's time to understand the question and provide an answer. Pinnell and Englert claim that "a task with four alternatives takes 33% more time than a task with two alternatives, while a task with seven alternatives takes 70% more time".[12] In terms of the number of tasks, Johnson and Orme conclude that "respondents can be given up to twenty tasks without the loss of quality of the collected data".[13] They also recommend the use of a number of different versions of the questionnaire. It is theoretically possible to ensure that each respondent receives a unique ver-

sion of the questionnaire. For computer-administered questionnaires, about a hundred versions are recommended, while in the studies where the paper-based version is administered the number can be significantly smaller for practical reasons.

Having in mind the above-described issues and the study goal, ten different versions of the questionnaire were developed, each with ten tasks (scenarios), and with each task having five alternatives (for product profiles and the so-called 'none' option).

Having identified the attributes with corresponding levels and decided on the choice of appropriate methodological approaches, we started compiling data. The sample size for conjoint studies typically ranges from 150 to 1200 respondents, while 30-60 respondents suffice for explorative studies.[14]

This research was conducted in Sarajevo on the convenience sample of 171 School of Business students who are under 25 years old. We visited five randomly selected classes (at the first, second and third year of study) and asked students to participate voluntarily in the study. Since it deals with the evaluative criteria and preferences when deciding about an MP3 player purchase, we believe that these young people are a representative sample as they are the most significant consumer segment in case of this product category, and companies that want to attract this market segment must understand how individuals choose their product. Naturally, this can also be a limiting factor but since the research was of non-commercial and exploratory nature, we believe that the use of this population was justified in terms of reducing both financial costs and time costs of conducting the study.

3. RESULTS

The compiled respondents' choice data were analyzed by using the multinominal logit model (MNL), which belongs to the group of models for discrete choice analysis (choice between a finite set of alternatives). This type of analysis allowed the estimate of both main and interaction effects. Adding interactions in the logit model and their later use in simulations can considerably improve the possibility for choice forecasting. The test results are presented in Table 3.

Table 3: Interaction significance testing and choice of best model

Model	log likelihood	Improvement compared to additive model	Improve. x 2	df	Confidence interval
(1) Null model	-2752.13				
(2) Additive model (main effects only)	-2112.94				
(3) Additive + price x brand	-2103.29	9.65	19.3	4	99%
(4) Additive + price x memory	-2093.26	19.68	39.36	4	99%
(5) Additive + brand x memory	-2110.01	2.93	5.86	4	below 90%
(6) Additive + price x brand + price x memory	-2085.37	27.57	55.14	8	99%
(7) Additive + price x brand + brand x memory	-2099.67	13.27	26.54	8	99%
(8) Additive + price x memory + brand x memory	-2089.48	23.46	46.92	8	99%
(9) Additive + price x brand + price x memory + brand x memory (all interactions)	-2080.88	32.06	64.12	12	99%
Improvement of model #6 compared to model #4		7.89	15.78	4	99%
Improvement of model #8 compared to model #4		3.78	7.56	4	below 90%
Improvement of model #9 compared to model #4		12.38	24.76	8	99%
Improvement of model #9 compared to model #6		4.49	8.98	4	below 95%

Source: Research

Besides their main effects, models 3-5 include an interaction term. In the models involving a single interaction, the greatest improvement compared to the additive model is seen in model #4. Similarly, it can be claimed that the brand x memory interaction, although contributing to the improvement of the likelihood value, has the confidence interval below 90%, which means that it is not a statistically significant improvement.

The next step involved the estimate of improvement of the model which includes two interactions, compared to the single interaction model. It was shown that model #6 is a significant improvement compared to model #4. Finally, we compared the improvement made by using model #9, which includes major effects with all the possible interaction effects, compared to model #6. It turned out that $p>0.05$ in this case, and we therefore concluded that it is not a major improvement compared to model #6. The average attribute importance is presented in Table 4.

Table 4: Relative attribute importance

Relative importance	CBC logit main effect only	CBC logit model 6
Memory	30.47 (3)	26.03 (3)
Price	30.85 (2)	31.51 (2)
Brand	38.68 (1)	42.47 (1)

Source: Research

It can be observed that both models (additive and the model with interactions) reveal that brand has the greatest relative importance, followed by price and finally by memory.

We used the CBC study results to conduct the sensitivity analysis and determine the demand price elasticity and brand strength estimate. Sensitivity analysis involves conducting simulations: first, by defining the basic scenario including several products, and then by modifying each of the products defined in this way according to the given criterion and observing the effect of given modifications on the changes in the share in preferences. In our case, the basic scenario is presented in Table 5.

Table 5: Basic scenario for sensitivity analysis

Product	Memory	Brand	Price in BAM
1	256 MB	Sony	149
2	256 MB	Panasonic	149
3	256 MB	Xiro	149

Source: Research

The criterion for monitoring the change in the preference share is the price. In this way respondents' answers were used to calculate the percentage at which the respondents as a group would choose each brand at any given price. Results of the sensitivity analysis are given in table 6.

Table 6: Sensitivity analysis

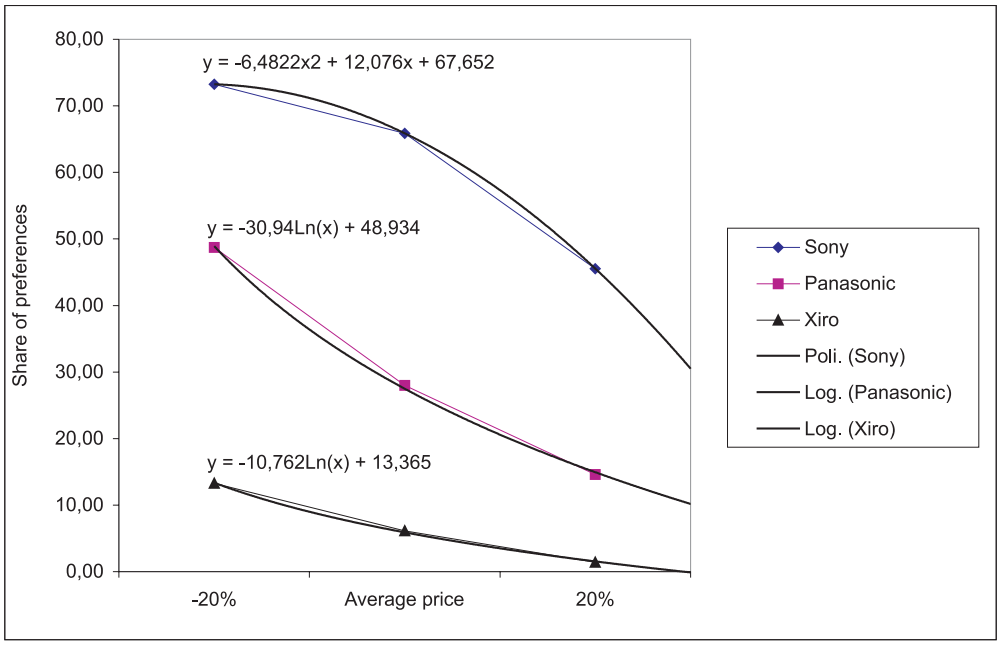
Product	Price		
	Low	Middle	High
1	73.25%	65.87%	45.54%
2	48.74%	28.01%	14.61%
3	13.29%	6.11%	1.41%

Source: Research

Data presented in Table 6, which sums up the sensitivity analysis results, were used to graphically present the relative demand for each individual brand (Pinnell and Olson, 1996). Figure 1 is an example of such a graph. Price sensitivity for each brand is presented with the slope of demand curve for the given brand.

The curves in the figure reveal that price variations affect the relative demand for a specific brand within this product category. For instance, at the average price (149 BAM) demand for Sony brand is approximately 66%. A 20% increase in the brand price (if other brand prices remain constant) changes the demand to 46%. In order to estimate what this means within the price elasticity of demand, we will take the 30% relative change in demand (20%/66%) and divide it by the 20% price increase. The resulting elasticity coefficient is 1.5.

Figure 1: Demand curves for individual brand



Source: Research

Using the same prices, it is possible to calculate the coefficient of the demand-price elasticity for the Panasonic brand. Its share amounts to 28% at the average price of 149 BAM, while falling to about 13% after the 20% price increase. The percentage of demand change is 46% (13%/28%), which results in the price elasticity coefficient of 2.3.

These demand estimates show that even though Panasonic lost 13%, which is less compared to the 20% for Sony, Panasonic lost 46% of its demand while Sony lost only 30%. If Sony raises its prices and Panasonic does not respond, both the share and revenue will decrease since Sony's price elasticity coefficient is 1.5, which in turn points to the elastic demand. On the other hand, if Panasonic were to follow Sony's price increase, both the share and sales revenue would increase, with revenue growing faster than its share.

Elasticity coefficients for the three brands are given in Table 7.

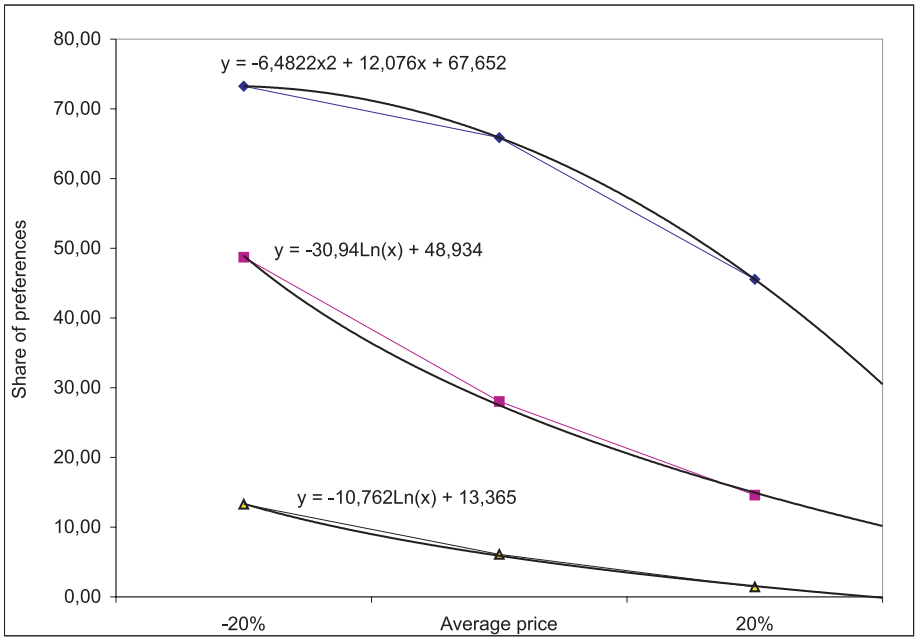
Table 7: Coefficients of the price elasticity of demand

	Coefficient of the price elasticity of demand	
	When increasing price by 20%	When decreasing price by 20%
Sony	1.5	0.5
Panasonic	2.3	3.7
Xiro	3.8	5.8

Source: Research

The coefficients of the price elasticity of demand suggest that if all the three manufacturers raised their prices, Panasonic and Xiro would lose acceptability in the market faster. The discussion so far makes it clear that Sony has the greatest brand equity. The strength of Sony brand can be graphically presented as shown in Figure 2.

Figure 2: Ratio of different MP3 player brands' strengths



Source: Research

The graph shows the premium we can charge for the brand name or the discount a brand must allow at a particular level of relative demand. For example, in order to achieve the 49% share, Panasonic must reduce its price by 20% from the current average price. On the other hand, in order to achieve the 49% market share, Sony can charge a 17% price premium. Taken together, this means that in order for the market to be indifferent between the two brands, Panasonic should set its price 32% lower than Sony (1-[Panasonic price divided by Sony price: (1-0.20)/(1+0.17)])

4. LIMITATIONS OF THE RESEARCH

The main limitation pertains to the attributes included in the study. While the study covered the most important attributes customers could consider when buying MP3 players, we believe that including design as an attribute would be very significant for an actual MP3 player manufacturer. In doing so, it would be the most useful to show to respondents the design with a few alternative sketches representing various levels, and see to what degree each of them affects the buying decision (pictorial representation). Besides, it would also be desirable to increase the number of brands by using the so-called evoked set conjoint designs in order to avoid the number of levels effect and an unrealistic increase in the significance of the attributes with a greater number of levels (brand, in this case).[15]

The second limitation and recommendation for future research would pertain to the increase in sample size, which would allow market segmentation based on the obtained part worths, and possible use of Hierarchical Bayes analysis for even more accurate calculations of model parameters and obtaining individual usefulness values in the CBC study.

5. CONCLUSIONS

Here are some major findings with respect to the actual conclusions of the MP3 player-related empirical study:

1. Results of the momentary spontaneous recall of MP3 player manufacturers showed that Sony is the best-known (mentioned by 95% of all respondents that participated in focus groups), followed by Panasonic, Philips and Samsung (each of which was mentioned by 21.4% of respondents) while only a small percentage of respondents recalled the remaining ten manufacturers, some of which do not make MP3 players at all (Exhibit 1).
2. The analysis established that there is an interaction effect between brand and price, and between price and memory size as attributes, which in turn allowed the construction of a still more accurate model for simulations.
3. The study results indicate that, when shopping for MP3 players, the young as potential buyers consider brand, price and memory size as the most important characteristics when making the purchasing decision.
4. Based on what has been described above, it can be concluded that, when targeting the young as the most important market segment of such product buyers, it is necessary for MP3 player manufacturers and marketers to focus their marketing strategies on the product brand. Branding should become the foundation of any strategy for this kind of products.
5. Results of the analysis of price sensitivity of demand imply that buyers of this product category are generally price-sensitive and consequently, willing to replace one brand with another. Still, price sensitivity is far lower for well-known brands and in some cases non-elastic (Sony). Consequently, manufacturers of different MP3 player brands should be cautious when contemplating changes in their product pricing since even a slight price change can result in a major change in demand, particularly in case of less well-known manufacturers.
6. The research results suggest that, in the long term, little-known manufacturers could increase their share only by building their brand name awareness. This can be achieved by increasing the perceived quality of their products through appropriate promotional efforts that would emphasize the benefits offered by their products (reliability, durability, functionality).

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