POSSIBILITIES TO USE STATISTICAL TOOLS IN ASSESSING THE DISTINCTIVE ATTRIBUTES OF THE CONCEPT OF NEW PRODUCT

MOGUĆNOSTI KORIŠTENJA STATISTIČKIH ALATA U PROCJENI KARAKTERISTIČNIH OSOBINA NOVIH PROIZVODA

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Abstract: *The paper aims to explore ways to assess the characteristics of a new product using statistical tools. In this respect, the paper will briefly present the new product concept and the statistical methods that can be applied. Research will apply to a general purpose product using data from a market research performed in city of Timisoara. The analysis consists in determining the product functions, defining characteristics that meet these functions, followed by a statistical survey of attributes' hierarchy depending on the consumer needs.*

Key words*: concept of new product, determinant attributes, analysis of variances*

Sažetak: *Rad nastoji istražiti načine vrednovanja karakteristika novog proizvoda koristeći statističke alate. Rad će predstaviti novi koncept proizvoda i statističke metode koje se mogu primijeniti. Istraživanje se odnosi na proizvode opće namjene i koristi podatke istraživanja tržišta u gradu Temišvaru. Analiza se sastoji od određivanja funkcija proizvoda, definiranja karakteristika koje odgovaraju tim funkcijama. Slijedi statističko istraživanje hijerarhijskih svojstava ovisno o potrebi kupca.*

Ključne riječi: *concept novog proizvoda, određene karakteristike, analiza varijanci.*

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1. Introduction

Creating a new product is a laborious process, which must cover a series of intermediate stages that are absolutely necessary to get the best possible result. For a proper understanding of the term "new product" is necessary to briefly clarify both concepts of product and novelty. For the product, the analysis can be conducted on two ways that are strongly interdependent and interconnected. Thus, from a technical standpoint, a product is a system consisting in a hierarchical combination of a number of elementary sub-systems [1]. In terms of marketing, these subsystems must meet consumer expectations. In this case, the product is viewed as a set of characteristics, being each separately and in interconnection capable to meet consumer's explicit or implicit needs. A product can be offered as a physical, material object or in an immaterial form as services or ideas. Consumers actually buy the advantages enjoyed by that product.

The concept of novelty is defined as any idea, practice or object perceived as new by the entity to which it is intended [2]. In this way, the new product is that whose characteristics (attributes) are viewed by the consumers as being made for the very first time. A new product must have the characteristics of quality designed and built to allow differentiation from similar ones by overcoming a certain threshold of novelty. Distinctive attributes of a new product are those that allow differentiating the offers between same classes of products.

To see whether some attributes are distinctive, it can be successfully applied the statistical technique known as "analysis of variances" or abbreviated, ANOVA [3]. Survey using this method requires determining the product functions, to define the attributes that meet these functions, followed by a statistical analysis of attributes hierarchy depending on the consumer needs. Attributes considered essential for choosing the new product is compared with other three brands considered representative for this category.

2. The selection of functions and attributes of the new product

The new product that is analysed in the present study is a general purpose good and consists in a new generation of video projectors. As it is defined [4], a video projector takes a video signal from a certain source and projects the corresponding image on a projection screen through a lens system. The main functions of a video projector are given by its many uses, such as: conference presentations, classroom training, business presentations, live events applications or home theatre. As well, the video projectors are widely used in schools or other training institutions, connected to diverse interactive devices for educational purposes.

Starting from these functions of the product, it must be defined the characteristics (attributes) that meet the functions. To select the relevant attributes for a product is necessary to accomplish at least three conditions for an attribute: to be pertinent, to be measurable and to be operational [5]. In these circumstances, the attributes considered significant in the analysis are:

- The *resolution* is the capability of a video projector to reproduce sharp, clear and distinguishable separate parts of an image projected. Resolution is directly related to the number and density of the dots of colour;
- The *brightness* means the light output, measured in lumens and is required for a larger screen or a room with a high amount of ambient light. Projected image size is connected with this characteristic because while the total amount of light does not change, when size increases, the brightness decreases;
- The *contrast* in visual perception is the difference in appearance of two or more parts of a field seen simultaneously or successively (brightness contrast, lightness contrast, colour contrast, simultaneous contrast, successive contrast);
- The *lamp life* generally means the value of lamp life expectancy based on laboratory tests of representative lamps, burning at rated volts, on an approved system, operating with a certain burning cycle. A longer lamp life leads to a longer time of using for the device;
- The *price* of the device is an important attribute that can influence the choice of the consumer. Regularly, the devices with a high quality features are more expensive, therefore the price is an element of balance between consumer needs and its financial possibilities;
- The *interface* (RGB, S-Video, USB, DVD, Blu-ray, etc.) is the point of interaction between the video projector and the source data devices. A larger number of possibilities to connect means a increased versatility of the product;
- The *noise and cooling* is a compound attribute that matters especially in the small spaces where the noise of device may affect the performance of presentation. Cooling capacity is important because it adjust the period of continuous operation of the device;
- The *size, weight and design* are relatively subjective attributes that may influence the purchase of equipment. A modern design and reduced size and weight can determine purchasing a product over another with similar technical characteristics;
- The *power consumption* may be a factor in purchase decision because a product with low power consumption may produce some long-term resource savings;
- The *warranty/post-warranty services* are collateral assurances or guarantees that the product seller assures for a specific remedy such as repair or replacement in the event the device fails to meet the warranty term. A longer term of warranty means an extended guarantee referring to the lifetime of the product;
- The *menu languages* offer the possibility that the product to be used by a larger number of consumers from different countries using diverse languages;
- The *usability* means the possibility to use very easy the device, without complicate menus or specifications. This attribute is relevant for users who are not familiarised with this type of equipment.

3. Assessing the distinctive attributes of the concept of new product

Identification of distinctive attributes of a new product means the selection of product features that are very visible, those is important to consumers and have the capacity to differentiate offers between them [6]. The attributes were assessed based on a point scale ranging from 1 (low interest) to 10 (very high interest).

Database used has resulted after a market research made in the five major stores that sell video projectors from city of Timisoara. The number of relevant respondents remains 212 from an initial database of 230 persons (18 persons did not complete properly the questionnaire). Data from these investigations were entered to the Microsoft Excel software, and data processing was carried out with the Eviews software.

The variance analysis technique (ANOVA) – consists in an analysis of attributes based on variance calculus and interpretation. The model distinct the influence factors in respect with variation sources in two categories:

- The "explicative" or "effect" (Between Groups) component that show the variation of attributes determined by important differences which exist between attributes;
- The "residual" (Within Groups) component that explains the variation of the attributes determined by random factors.

The results applied on database are presented in the Table 1:

Source of Variation	SS	df	MS	F	F critical
Between Groups	2476,0739	11	225,0976272	61,38627	1,792422211
Within Groups	9284,6038	2532	3,666905124		
Total	11760,678	2543			

Table 1. The results of ANOVA technique

On the column *SS* from the table 1 are calculated the components of total variation of the attributes. The variation of "Total" component is given by the relationship:

$$V_T = \sum_{i=1}^{n_S} \sum_{j=1}^{n_L} \sum_{k=1}^{n_{SL}} \left(r_{ijk} - \bar{r} \right)^2 \tag{1}$$

Where: r_{ijk} are the rankings of the attributes;
$\bar{r}$ is the total average of attributes' rankings;
n_S are the degrees of freedom on the rows of the samples;
n_L are the degrees of freedom on the columns of the samples;
n_{SL} are the degrees of freedom on the rows and the columns of the samples.

The variation of "Between Groups" component is calculated by relationship:

$$V_{TL} = n_S n_{SL} \sum_{j=1}^{n_L} \left(\bar{r}_j - \bar{r} \right)^2 \tag{2}$$

Where $\bar{r}_j$ is the average on the columns of the samples.
The variation of "Within Groups" (Residual) component:

$$V_\varepsilon = \sum_{i=1}^{n_S} \sum_{j=1}^{n_L} \sum_{k=1}^{n_{SL}} \left(r_{ijk} - \bar{r}_{ij} \right)^2 \tag{3}$$

On the *df* column of the Table 1 are the degrees of freedom for each component. On the *MS* column of the Table 1 are calculated the estimators of variances of the components.

The variance estimator of "Between Groups" component:

$$s_{TL}^2 = \frac{V_{TL}}{n_L - 1} \tag{4}$$

The variance estimator of "Within Groups" (Residual) component:

$$s_\varepsilon^2 = \frac{V_\varepsilon}{n_S + n_L + \left(n_{SL} - 1 \right)} \tag{5}$$

Next step is the testing of the hypothesis of the ANOVA technique, based on the Fisher–Snedecor repartition. The hypothesis assumes that all $\bar{r}_j$ averages are equal, as in the relationship:

$$H_0: \bar{r}_1 = \dots = \bar{r}_j = \dots = \bar{r}_{n_L} \tag{6}$$

The testing of this hypothesis consists in comparing the calculated *F* value of the Fisher statistic test with the critical value of the test *F critical*. As it can be observed from Table 1, the calculated *F* value of the Fisher statistic test for the first hypothesis is significantly larger then critical value of the test *F critical*. That means that the attributes of the video projector have a statistical significant variation. For the analysis performed, that shows that there exist distinctive attributes, which are significantly different by other attributes.
To separate the distinctive attributes of the video projector, will be analysed the second table with results of ANOVA technique:

No.	Groups	Sum	Average	Variance
1.	Resolution	1882	8,877358491	1,1223285
2.	Interface	1854	8,745283019	2,8637217
3.	Brightness	1797	8,476415094	1,0563132
4.	Contrast	1781	8,400943396	0,9048332
5.	Lamp life	1734	8,179245283	2,6122686
6.	Warranty/Post-warranty services	1728	8,150943396	4,4605204
7.	Price	1706	8,047169811	2,7465796
8.	Noise & Cooling	1581	7,45754717	4,1545873
9.	Usability	1544	7,283018868	5,6067245
10.	Size & Weight	1512	7,132075472	4,0677815
11.	Power consumption	1430	6,745283019	7,1101672
12.	Menu languages	1109	5,231132075	7,2970357

Table 2. The averages and variances of attributes' rankings

First step in analysing the Table 2 is to sort the attributes of video projector by average ranking. It can be observed from the Table 2 that the first seven attributes have an average ranking above 8 (the ranking scale is between 1 and 10 points). That means that only these attributes are significant for consumers. The last five attributes are not important in the consumers' choice and will be eliminated from the analysis. The average ranking under eight points shows that these last five attributes can be important for some customers, but are not statistically relevant for the consumers' choice as a whole. The second step is to sort the remaining attributes by variances, as is shown in the Table 3:

No.	Groups	Sum	Average	Variance
1.	Warranty/Post-warranty services	1728	8,150943396	4,460520433
2.	Interface	1854	8,745283019	2,86372172
3.	Price	1706	8,047169811	2,74657963
4.	Lamp life	1734	8,179245283	2,612268622
5.	Resolution	1882	8,877358491	1,122328534
6.	Brightness	1797	8,476415094	1,056313154
7.	Contrast	1781	8,400943396	0,904833229

Table 3. The most distinctive attributes

From the Table 3 results that the most distinctive attribute which accounts for the consumers are the Warranty/Post-warranty services, followed by the Interface and Price. The technical attributes as Lamp life, Resolution, Brightness and Contrast are important for the consumer but are less distinctive. That means that the video projectors from the market have relative similar technical attributes and cannot be significant differentiate by the consumers based on these attributes.

4. Conclusion

According to the results of statistical method applied, the attributes that can make the difference in the consumers' choice are the additional services as warranty or post-warranty and the possibilities to have a full connection with all type of media environments through the interface of the device. Also, a very distinctive attribute is the price of the video projector. At relative similar technical specifications, the customer always will choose the less expensive device.

Statistical assessing tools used to find the distinctive attributes of a product is certainly a more rigorous analysis than others, but can not be considered a comprehensive one. Statistical research should be correlated with qualitative methods and analytical assessment based on elements such as geographic and demographic distribution of consumers, the benefits expected by consumers or behavioural and attitudinal criteria.

Only a complex analysis that includes all these categories of assessments may eventually lead to the expected result. Due to the relatively high degree of difficulty and relativity of this research is recommended to be used a post-facto confirmation method that allows managers to ensure that made a choice in optimum conditions.

8. References

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Photo 169. Discussion / Diskusija