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SIMULATION OF INTELLIGENT AND ACTIVE PACKAGING PERCEPTIONS IN SLOVAKIA

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Abstract: The importance of packaging functions is still growing and consequently, the interest of the company is to access to the packaging more innovative. The primary functions of packaging were always practical – to protect a product, to keep the product together, to contain it and to identify it. Today packaging is also a container for promoting the product and making it easier and safer to use. The paper deals with the innovative forms of packaging - active and intelligent packaging. Using KANO model, we monitored the perception of the active packaging functions in comparison to intelligent packaging function among different age categories of respondents in Slovakia.

1 Introduction

Nowdays as well as over the last decades the importance of the packaging system and its various functions is increasing. Whereas the packaging is traditionally intended as a mean of protection, preservation, handling, transport and storage of products, also the other functions such as promotion, getting the attention of customers and brand communication are becoming more recognizable. As a result of global change and progress in recent decades, access to packaging materials and packaging techniques also changes. Packaging functions are improved to increase product durability, track product and increase consumer awareness. Therefore the current interest of the company is to offer a customer such a packaging that will meet the marketing requirements and the needs of handling and transport at the same time. In the case of innovation it is important to target it to the specific customer segment and therewith it is in the company's interest to properly identify the target groups of the packaging innovation [1]. According to this the aim of the paper is to identify the perception of the active packaging functions in comparison to intelligent packaging function among different age categories of respondents in Slovakia and to illustrate that perception by a 3D simulation method.

The packaging size, shape, design, selected color and font significantly influence the consumer decision-making process and thereby affect the marketability of the product itself [2].

When creating product innovations it is necessary to think about the product at different levels [3] whereas each level increases its value to the customer. Regarding the packaging innovation companies should monitor changes in consumers' preferences and also focus on an attention to the new technology of packaging when selecting and introducing the packaging to the market.

In the past, there was a change in design about every 15 years, but now due to the changes in the market environment and the impact of environmental pressure the companies should apply more innovative and creative approach to packaging.

Traditional perception of packaging classifies the main functions of packaging into four basic categories[4]:

- Protection – the package protects the product against the deteriorative effects of the external environment,
- Communication – the package is a marketing tool that communicates with the consumer,
- Convenience – the package provides the consumer with greater ease of use and time-saving convenience,
- Containment – the package can contain products of various sizes and shapes.

The basic functions of the packaging are classified differently, for example, Zeman [5] and Kačenák [6] referred to 6 key function classification: protection, guarantee, rationalization, economic, communication and ecological. Dzurová [7] refers to the classification according to Schulte, who lists five functions, namely: protection, storage, transport, handling and information. According to Kollar [8] essential functions are the protection, handling, information and publicity, environmental and economic.

Innovative packaging is the result of creative, unconventional thinking [4], resulting to the creation of packaging with interactive features – intelligent and active packaging. They focus to improve packaging functions to

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meet current consumer demands, increased regulatory requirements, as well as increased interest in security.

Active packaging represent shift in the protection function from passive to active. The packaging is not only a passive barrier between the product and its environment, but the aim of protective function is to actively protect the product [4] and actively changes the condition of the package to extend shelf life or improve food safety, while maintaining the quality of the food [6]. According to the way in which they affect the characteristics of the product the active packaging can be classified as follows [9]:

- absorbers – active packaging systems based on absorption,
- emitters – active packaging systems based on the release of substances.

Intelligent packaging is associated with the performance of smart features and intelligent functions (such as detecting, sensing, recording, tracing, communicating, and applying scientific logic) to: facilitate decision making to extend shelf life, enhance safety, improve quality, provide information, and warn about possible problems [4]. According to Kačeňák [6] intelligent packaging is the term for systems that monitor conditions around the product and thus provide information about the quality of food during transport and storage. The time-temperature indicators, indicators of oxygen and carbon dioxide, the color temperature indicators, pathogen indicators and breakage indicators are distinguished [9].

The importance of active and intelligent packaging means mainly significant expansion of two packaging functions: protective function – especially in active packaging shift from passive to active protection and information functions – especially as intelligent packaging providing information monitoring the packing conditions. According [10] the requirements of customers to the innovation of packaging functions are as follows: the majority of respondents expect the packaging to be ecological and to fulfill principally information and protection function. These results confirm the actuality of intelligent and active packaging in terms of required packaging functions and therefore innovative packaging thus respond to the current market requirements.

Potential customers are more and more demanding information of product composition, quality, date mark and durability, thereby the companies should respond by that kind of innovation to meet these requirements. Regarding that research [10] the target group for packaging innovation represents the age category from 41 to 50 years according to their highest innovation status. This age category recognizes its own requirements in purchasing and selecting products and it considers protection and information function as the main important and ecological function as attractive [1].

2 Methodology

The research deals with the perception of active and intelligent packaging function and the Kano model was applied. Kano model aims to capture customers' opinion according to the requirements of an observed object [11]. Kano model is based on a survey using a Kano questionnaire. This questionnaire is constructed through pairs of customer requirement questions. Each question consequently has two parts: how do you feel if that feature is present in the product (functional form of the question), and how do you feel if that feature is not present in the product (dysfunctional form of the question). These pairs of positively and negatively conceived statements regarding the performance of monitored parameters, in this case packaging functions – protection, communication, convenience and containment. According to the methodological approach respondents had an opportunity to respond every question (statement) on a scale from 1 to 5 representing strong agreement to strong disagreement with that question (statement).

The sample of respondents was set at 120 respondents in Slovakia, keeping the same proportion of respondents for each given age category. The survey was conducted through electronic forms and personal questioning.

The responses were evaluated according to the cross rule [11], making it possible to categorize functions of packaging in the following categories according to how respondents perceived new packaging functions [10,11, 12, 13]:

- M (must be requirements) – are obligatory requirements that customers consider as normal and are automatically expected and their fulfillment is reflected in customers' satisfaction.
- O (one-dimensional requirements) – are those product attributes that lead to fulfillment and satisfaction in the event of non-compliance to customers dissatisfaction, but compared to the obligatory requirements customers automatically do not expect them.
- A (attractive requirements) – that have a clear impact on customers satisfaction because it is a requirement that customers did not expect, but it is attractive.
- R (reverse requirements) – are contradictory, they bother customers, as they require some additional action from them.
- I (indifferent, irrelevant requirements) – are requirements which do not affect customers satisfaction or dissatisfaction.
- S – are skeptical, questionable requirements

The results of Kano model allows to divide the monitored packaging functions into categories of mandatory, attractive, indifferent and reverse functions. Subsequently, the comparison analysis, which aims to identify and measure comparable data, was used. It was used to identify the differences between customers' perceptions of intelligent packaging functions and customers' perceptions of active packaging functions.

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According to packaging functions definition by Yam et al. [4] we considered expansion of protection and containment function as a nature of active packaging and the expansion of communication and convenience function as a nature of intelligent packaging.

The comparison analysis was based on the customer requirements identification by Kano model. In the next step the weight were assigned to these requirements. Every identified requirement represents value 1, which was multiplied by weight according to identified category as follows: must be = 3, attractive = 2, one-dimensional = 1, indifferent = 0, reverse = -1 [13, 14]. Based on the sum of values, we can compare customers' perceptions of active and intelligent packaging functions and we identify the target age group for active and intelligent packaging [1].

Thereafter, a 3D simulation was used to figure the perception of intelligent and active packaging functions by respondents in Slovakia.

3 Simulation of perceptions of intelligent and active packaging functions by respondents in Slovakia

KANO model identified requirements of the packaging functions among the monitored age categories.

The customer's value (Table 1) was calculated as the sum of the points that have been assigned to the individual categories of the questionnaire. The results indicate different attitudes to intelligent and active packaging according to the age.

Both functions, active and also intelligent packaging functions, report the most significant value for customers in the age of 41 to 50 years (as shown by the total customer value 3) followed by age categories 51 to 60 (as shown by the total customer value 2).

Active packaging functions are most valuable for the customers in the age of 41 and older, for whom the active packaging represents attractive and one-dimensional requirement. It represents those active packaging attributes that lead to fulfillment and satisfaction and in the event of non-compliance to customers' dissatisfaction. The higher the degree of compliance with these requirements is, the customers are more satisfied and in addition the attractive requirements have a clear impact on customers satisfaction increase.

Table 1 The comparison analysis of perceptions of intelligent and active packaging functions in Slovakia

		Packaging functions				
		Containment	Protection	Communication	Convenience	Total
18-30	Requirement	I	I	I	O	-
	AP function	0	0	-	-	0
	IP function	-	-	0	1	1
31-40	Requirement	R	O	I	O	-
	AP function	-1	1	-	-	0
	IP function	-	-	0	1	1
41-50	Requirement	A	O	O	A	-
	AP function	2	1	-	-	3
	IP function	-	-	1	2	3
51-60	Requirement	O	O	O	O	-
	AP function	1	1	-	-	2
	IP function	-	-	1	1	2
61+	Requirement	A	I	I	I	-
	AP function	2	0	-	-	2
	IP function	-	-	0	0	0
Total		4	3	2	5	

Notes: AP – Active packaging, IP – Intelligent packaging
Source: authors' computation

On the other hand, the younger ones in the age less than 40 years are are more interested in intelligent packaging functions, they are not affected by active packaging and their functions. The functions are indifferent to them, it involves the attributes that are not critical for customers and their pass or fail does not affect their satisfaction or dissatisfaction, Figure 1.

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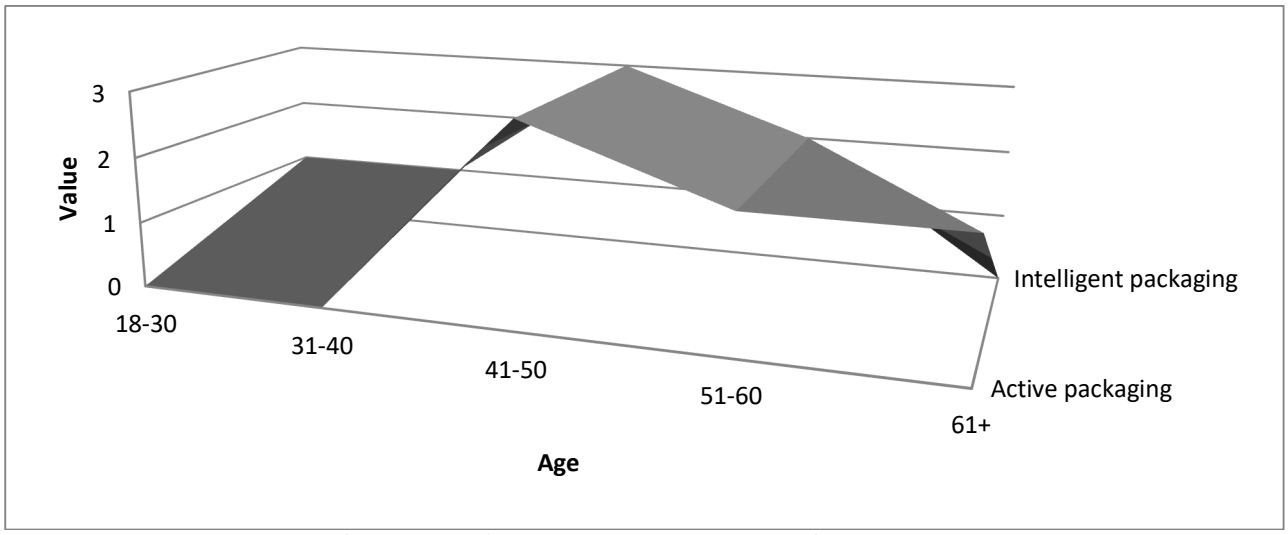

Figure 1 Simulation of perceptions of intelligent and active packaging functions by respondents in Slovakia

The comparison of the value of active and intelligent packaging functions for the customers indicates the differences in target groups of customer affected by these functions. To sum it up, the respondents in younger age are more oriented to the intelligent packaging. The generation of middle-aged is interested in intelligent and also in active packaging equally. And finally, the older age categories rather prefer only active packaging.

From the point of view of the individual functions influence, the most influential are two packaging functions – convenience and containment. The least influential for the respondents is the communication function, Figure 2.

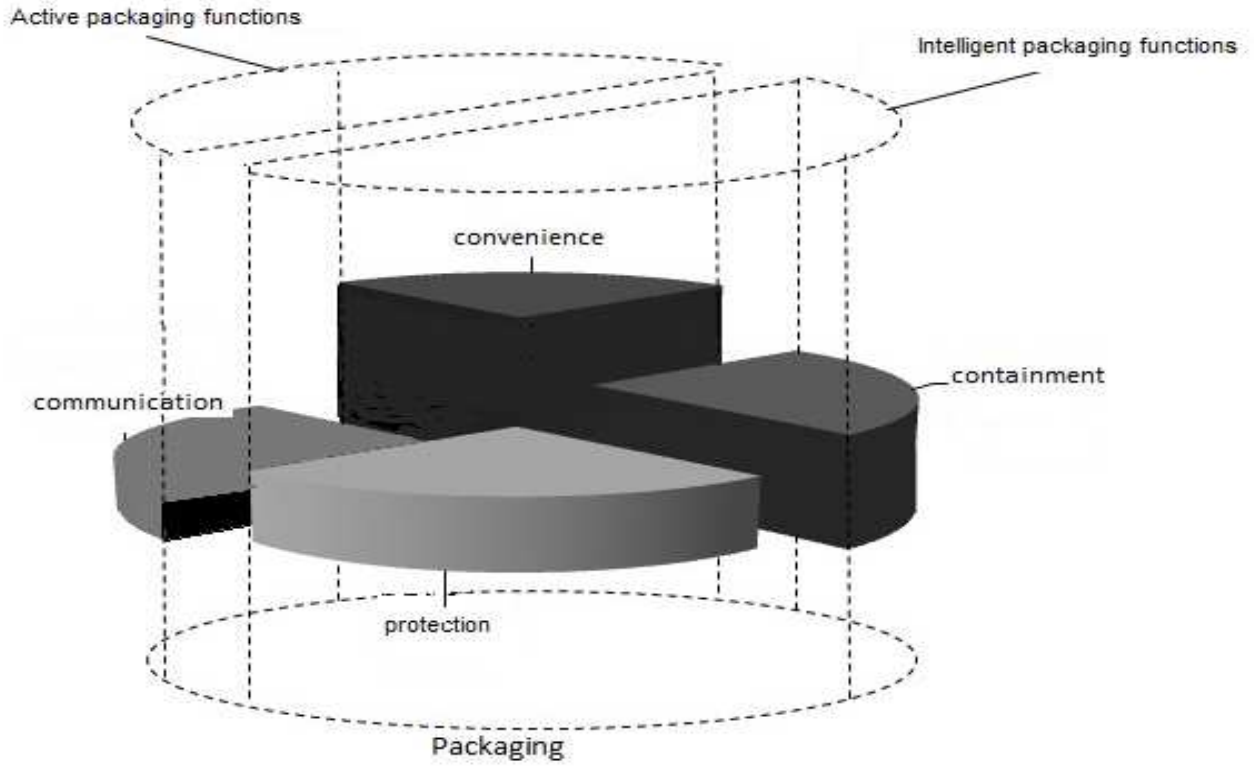

Figure 2 3D Simulation of perceptions of intelligent and active packaging functions by respondents in Slovakia

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4 Conclusion

The sheer importance of packaging functions is still growing and consequently, the interest of the company is to access to the packaging more innovative and creative. Active and intelligent packaging influence customer decisions mainly as one-dimensional requirement, i.e. those active packaging attributes that lead to fulfillment and satisfaction and in the event of non-compliance to customers dissatisfaction – the higher the degree of compliance with these requirements, the customers are more satisfied. According to the innovative approaches to the packaging can be concluded that younger respondents are more focused on the intelligent functions of the packaging, as they appreciate the packaging in the role of intelligent communicator. With increasing age of the customers, they are more oriented on active packaging functions, that provides convenience in the carriage, stocking and consuming.

The results and information about the perceptions and preferences of the packaging functions by the customers different age can be subsequently used during communication and innovation of packaging.

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