

# 13

## THE USE OF KANO MODEL FOR THE CLASSIFICATION OF THE ELEMENTS OF PRODUCT QUALITY

### 13.1 INTRODUCTION

The most efficient production system and the best organization does not guarantee success when produced product or service provided does not meet the requirements of the customer or worse, it has the characteristics discouraging the customer to purchase. The problem becomes even more complicated if we add to this change of customer requirements in time and copying features of our product or service by competing companies. We can assume that the adjustment of the product features to changing customer requirements in time is a very important element of the company's strategy as important as the process of continuous improvement of the production system. Producing a good quality product at an attractive price is no longer a guarantee of success. We are increasingly dealing with the conscious customer who is willing to pay a little more for the product but provided meeting his requirements. For this purpose, businesses also of food industry use the Kano model to define the characteristics of the perfect product from the perspective of a potential customer. Customer satisfaction is a top priority for any organization and the aim is to achieve the highest level of satisfaction which directly translates into the economic effect of the organization. The desired satisfaction needs involvement and feedback from the customers through which improvement is achieved. There are many approaches to satisfy the customers but Kano model is the most effective method currently used by most of the practitioners and researchers in different aspects of customer satisfaction. Satisfaction ratings are being used as an indicator of the performance of services and products and help to formulate strategies of the companies. Hanan and Karp [7] have stated that "Customer satisfaction is the ultimate objective of every business: not to supply, not to sell, not to service, but to satisfy the needs that drive customers to do business." Market success of a product is also important from the environment point of view, since a product which is not sold, becomes the most useless product from both economical and environmental point of view. It has environmental impacts without having any value for the customer [4, 6].

## 13.2 KANO MODEL

In the 80s Noriaki Kano, a professor at Tokyo University, theorist of quality management, developed a model of customer satisfaction so called Kano model. Principles of this model are mainly to draw attention to the fact that not all the quality attributes in the same way satisfy customers. Furthermore, there are attributes that the customer considers necessary, as well as such features which are not expected. Kano model proved to be extremely useful, as it allows you to better understand the concept of quality of service or product. It also helps to find the source of customer satisfaction from product/service. Developed by a Japanese researcher model is perfect for the food industry to develop new products and packaging. Kano model answers the question how much influence on the satisfaction of final users (customers) will have making changes in the product (in the food industry suitable composition of ingredients and spices, and the type and capacity of the packaging). It also shows how customers evaluate the product and indicates the most important attributes to improve in qualitative terms. It was assumed that [1, 3, 8]:

- together with the progress of implementation grows the level of commitment of financial resources to improve the quality of the food product;
- user satisfaction is proportional to the implementation stage of functionality (in case of food products it refers to a more functional packaging);
- however, there is such a group of requirements for which user satisfaction is not proportional to the stage of implementation. Meeting the basic requirements does not increase satisfaction, and their failure gives a sharp drop in satisfaction;
- meeting the requirements of the threshold of excitement causes a rapid increase in satisfaction, and their failure will have no consequences.

Kano model is based on the division of functionality into groups, characterized by a certain level of user satisfaction:

- basic functionalities,
- functionalities desired,
- functionalities causing excitement.

Basic functionalities - without those functionalities the product does not meet the needs of the user. This means that the user will not feel disappointed when using the product, but also they would not affect the satisfaction from using the system.

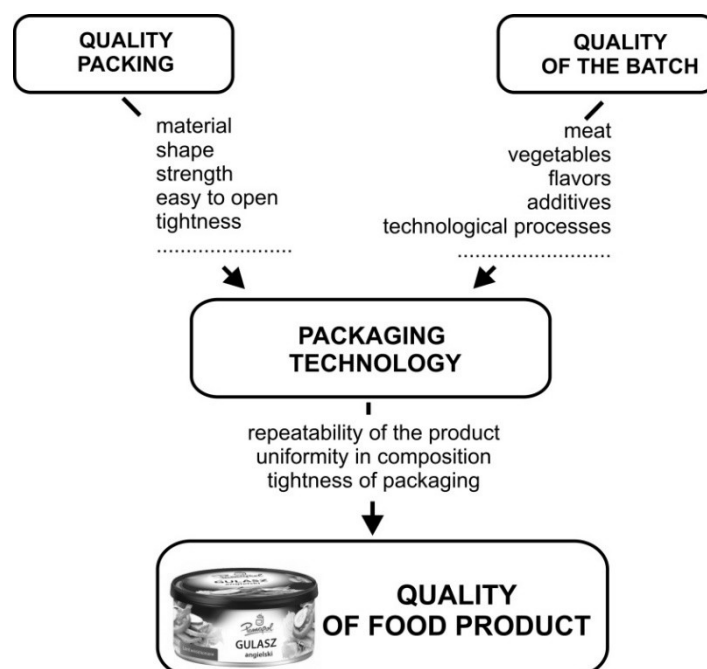
Functionalities desired - in other words, these are the features of the desired product (a set of characteristics and conditions, which are expected by customer/user using the product in question) and the perceived product (a set of impressions, feelings and associations which connects the user with a given product). Customer satisfaction in this case is related to the expenditures incurred for product development.

Functionalities causing excitement - these are innovative features of the project which distinguish us from the competition and (a necessary condition) cause an increase of customer satisfaction. They are not expected functionalities - they are designed to surpass the expectations of users. It should however be continually improved this group

of functionalities, because with the passage of time, they will become obsolete - become solution commonly used in competition, and therefore a basic or desired requirement.

### 13.3 METHODOLOGY OF RESEARCH

The quality of the food product is affected by many factors related to the quality of used raw materials for production, unique recipe as well as the quality of the package itself. Customer requirements relative to the product as well as to the package itself are subject to change. The study was conducted in the form of questionnaire survey based on Kano questionnaire. In the studies were used two questionnaires; one concerning the product and the other related to packaging. The Management Board of the company has accepted such an approach because sales analysis indicated a significant impact of the kind of package on sales of a particular type of the product mix. It was assumed that the quality of the final product is the result of product quality (including palatability so called batch) and the quality of packaging (aesthetic qualities and functionality).



**Fig. 13.1** Factors influencing the quality of the food product

Source: own elaboration

In the research was used Löfgren M. approach [13]. He used Kano model for the assessment of the perceived quality by the customer during normal using the package.

According to the theory of attractive quality, the relationship between the degree of sufficiency and customer satisfaction with a quality attribute can be classified into five categories of perceived quality [13]:

- attractive quality attributes (A),
- one-dimensional quality attributes (O),
- must-be quality attributes (M),
- indifferent quality attributes (I),
- reverse quality attributes (R).

Attractive quality attributes (A) provide satisfaction when fulfilled and no dissatisfaction when not fulfilled. These attributes are often referred to as surprise and delight attributes.

One-dimensional quality attributes (O) provide satisfaction when fulfilled and dissatisfaction when not fulfilled.

Must-be quality attributes (M) are taken for granted when fulfilled but result in dissatisfaction when not fulfilled.

Indifferent quality attributes (I) are perceived as neither good nor bad and therefore do not result in customer satisfaction or dissatisfaction, i.e., these are quality attributes that customers do not care about.

Reverse quality attributes (R) result in dissatisfaction when fulfilled and satisfaction when not fulfilled. For example, when you want a basic model of a product you will be increasingly dissatisfied the more functions it has.

Determination of quality characteristics for defined attributes requires to carry out meticulous survey. One form of such research is use of so-called quality game to determine the nature of individual characteristics [13]. Diagram of quality game is shown in Fig. 13.2. Kano uses appropriate questionnaire that helps with use of researches carried out on clients to include particular feature to one of three main groups. In this method are examined customer's responses to researched feature. Client has two possible options [8]:

- when given feature is present in product and functions normally,
- when given feature is not present in product, or does not operate in satisfactory manner.

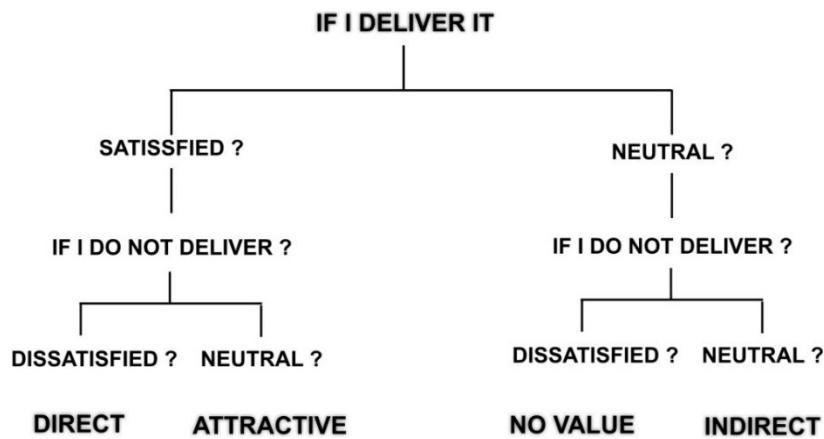


Fig. 13.2 Quality game

Source: [9]

These questions are usually as follows: If a given feature occurs, how do you feel?

1. Suits me.
2. It has to be like this.
3. I do not care.
4. I can live with that.
5. It does not suit me.

If a given feature does not occur, (or is not working properly), how do you feel?

1. Suits me.
2. It has to be like that.
3. I do not care.
4. I can live with that.
5. It does not suit me.

One variant treats feature in a positive way, and the other in negative. For each feature we receive combination of two answers. Each answer can take five values, in total we can receive twenty-five variants of combinations. Combinations are presented in Tab. 13.1.

**Tab. 13.1 Determination of the type of feature in the Kano method**

		Negative				
		Suits me	It has to be	I do not care	I can live with that	It does not suit me
Positive	Suits me	Q	A	A	A	O
	It has to be	R	I	I	I	M
	I do not care	R	I	I	I	M
	I can live with that	R	I	I	I	M
	It does not suit me	R	R	R	R	Q

Source: [2]

### 13.4 THE TEST RESULTS

The research was conducted on a population of 300 customers of grocery stores in urban areas, suburban areas and rural areas. Most attributes was classified as one-dimensional, part of attributes is associated with ergonomics. Tab. 13.2 shows comparison of the results of surveys. There was used scale from 1 to 10 where 10 defines the most important attribute. Obtained results correlate with those results obtained by Löfgren [13]. In a survey regarding the determination of quality attributes of food product packaging there was added an open question related to preferences regarding packaging for processed meat and processed meat-vegetable. In assumptions it was to establish preferences in choosing package between glasses, metal or aluminum packaging, without suggesting a choice and after determining by the customer attributes in the survey (Tab. 13.2).

For the contents of the packages that is the right product, based on the experiences of the company, there was used a generalized Kano questionnaire. The questionnaire deals with the quality of the product so called batch without taking into account external factors that is, in our case the factors resulting from the attributes of the packaging. The results of the importance of quality attributes of a food product on the level of customer satisfaction are presented in Tab. 13.3.

Analysis of the results of the Kano questionnaire demonstrated that the characteristics of the ideal product in case of processed meat products are the result of quality attributes of packaging and batch. At the same time you can see the relation associated with a place of carrying out questionnaire survey and the age of respondents. In rural areas glass packaging is preferred. In suburban areas glass and metal packaging are pre-

ferred. In the cities with academic centers the participation of the respondents choosing aluminum packaging is larger than in cities without large academic centers.

**Tab. 13.2 The importance of quality attributes of packaging of a food product according to customers**

No	Quality attribute	Classification	Stated importance
1	Leakage	M	9,5
2	Open-dating	M	9,2
3	Protection	M	9,6
4	Declaration of contents	M	9,4
5	Easy to open	O+M	9,4
6	Easy to close	O+M	8,6
7	User-friendly	O	8,1
8	Hygienic	O	6,0
9	Instructions	M	5,0
10	Easy to empty	O	7,8
11	Easy to grip	O	8,1
12	Symbols	O	6,2
13	Appearance	M	7,0
14	Easy to throw in the household waste	O	5,5
15	Easy to dose	O	5,5
16	Facilitates the sorting out of household waste	A	3,9
17	Recyclable material	O	7,6
18	Communicates a certain brand	M	7,0
19	Resealability	A	6,8
20	Communicates product family category	M	5,5
21	Fits in storage spaces	A+O	7,3
22	Contains just the right quantity	A	6,0
23	Aesthetically appealing	I+A	6,1
24	Attractive and nice-looking print	I	5,9
25	Additional functions	I+A	2,9

Source: own elaboration

However, in both cases, respondents prefer best glass packaging and secondly metal cans. In case of metal cans, respondents indicate a serious problem with protection (re-closure) of once open cans. An important attribute is the factor 7 (tab. 13.3) shelf-life of value of 6.5 which corresponds to attribute No. 3 (tab. 13.2) with a value of 9.6. Under the attribute 3 customers defined two areas, the safety of the product from external factors as well as the safety of the product from the elements coming from the packaging. For instance, glass is resistant to chemical, does not affect the organoleptic of the product, does not transmit to it any substances from the environment, and does not react with the product and the environment. Glass, however, has drawbacks - in spite of the

absorption of substantial part of UV radiation, the glass does not protect labile food ingredients (e.g. Vitamin C) before decomposition. Metal packaging are made mostly from tinned steel sheet, and acid-resistant steel sheet and metal sheets and aluminum foil. Metal packaging besides mechanical strength and heat strength, thanks to hermetical seal constitute a barrier for light, oxygen and microorganisms. The disadvantage of these packages is susceptibility to internal and external corrosion and chemical reactions resulting from contact with food package. The result of this is a transition of metal ions to food product which affects the taste of the product. That was also reported in the questionnaire (Tab. 13.3) item 13 of the repeatability of taste.

**Tab. 13.3 The importance of quality attributes of content (of meat) according to customers**

No	Quality attribute	Classification	Stated importance
1	Homogeneous batch consistency	M	9,8
2	Inviting colour of the batch	O	8,2
3	Pleasant scent of the batch	O	8,0
4	A large percentage of meat in a batch	O	9,0
5	Low content of thickeners	O+M	6,0
6	Content of antioxidants	O	7,8
7	Long shelf life	O	6,5
8	No flavour enhancers	M	5,0
9	High caloric content	O	7,8
10	Soft consistency of batch	O	5,3
11	Ecological dish	O	5,0
12	Ease of lubrication	M	7,9
13	Repeatability of taste	M	8,2

Source: own elaboration

Comparing obtained results with the results from previous years you must pay attention to change in the perception by the customer. More and more frequently we are dealing with a conscious and educated customer, who is knowledgeable about the food products, their composition and the manner of their storage. To glass packaging proved to be the most attached respondents over the age of 45 years. The largest percentage of metal packaging was observed in respondents under 30 years of age. Analysis of the obtained results showed that in case of packaging the most important for the customer is protection 9.6, and the tightness 9.5 on a scale of 1 to 10. An important element is information on content (percentage of components, thickeners, stabilizers and others) 9.4 point. Ease of opening is also an important factor in the perception of the product. This factor reached the value of 9.2. Ease of closing also proved to be an important factor 8.6 point, this factor in previous studies was not indicated by the customers as important. Respondents draw attention to a significant problem in case of the reclosing metal cans. In case of batch the greatest importance determining the level of satisfaction for the customer has homogeneous consistency of batch of 9.8. Secondly, it is important

for customers which meat content is in the offered product. An important determinant of quality is also the colour of batch 8.2 points and 8.2 pleasant smell. Ease of spread ability (portioning) of content of offered product also significantly affects the level of customer satisfaction 7.9 point.

## CONCLUSIONS

The quality of food products is very important for consumers because it affects their health and also determines the taste properties. There are developed many methods to assess the quality of such products, however, often lack of knowledge which quality characteristics and attributes are most important to the customer. In the literature you can find a lot of opinions and definitions of quality food products. One of the first was the definition of C. Szczucki, who perceives quality of food products as the degree of health, sensory attractiveness and availability in certain circumstances of the technological process [12]. The quality of food in comprehensive terms presented the classic of quality management A.V. Feigenbaum [11]. In this definition, he took into account of the quality of design, of execution and required by the customer. In contrast, T. Sikora offered concept of food with guaranteed quality, which can be obtained by the use of quality assurance systems in the entire manufacturing process. The quality of the food product [5, 10] is important for both the consumer and the manufacturer. Conducted research indicates that an important element in the concept of product development is quality assurance at the appropriate level. It should be considered in this area of the significance of the quality factors perceived by customer, which may be different from the perceived by the manufacturer. The quality of analyzed food product should be considered in terms of the logistics chain, life cycle or process - expanding frames of the process with suppliers and customers. As performed studies shown such an approach is justified because of the nature of the product. Packaging fulfils many functions, quality of which can be considered separately. Using as an indicator customer satisfaction, we are able to assess the quality of a number of attributes. Using the Kano model (measuring the level of customer satisfaction) there were evaluated the attributes that affect the quality of packaging. The obtained data served to changes in packaging technology in order to better adapt to customer requirements. One of the examples might be the use in canned meat of a special overlay which allows closing. This significantly improved the perception by customers of the product packed in metal can. This guarantees preservation of the product freshness, despite the opening of canned food. The obtained results also were used by the sales department to change the distribution assortment for different regions. Changing customer requirements over time generate the need for continuous monitoring of the level of satisfaction and identify the attributes of a perfect product not only in the food industry. As shown by performed studies questionnaire survey using Kano model are a good instrument.



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## REFERENCES

- 1 A. Bakhitar, A. Hannan, A. Basit, J. Ahmad. „Prioritization of value based services of software by using Ahp and fuzzy KANO model.” *International Conference on Computational and Social Sciences*, August 25- 27, 2015.
- 2 C. Basfirinci, A. Mitra. „A cross cultural investigation of airlines service quality through integration of Servqual and the Kano model.” *Journal of Air Transport Management*, Vol. 42, January 2015, p. 239-248.
- 3 C. Berger. „Kano’s method for understanding customer defined quality.” *Center for Quality of Management Journal*, Vol. 2, No. 5, 1993.
- 4 A. Chaudha, R. Jain, A.R. Singh, P.K. Mishra. „Integration Of Kano’s Model Into Quality Function Deployment (QFD).” *Journal Advice Manufacture Technology*, No. 53, 2011, p. 689–698.
- 5 S.T. Dziuba, B. Śron. „FAM-FMC system as an alternative element of the software used in a grain and flour milling enterprise.” *Production Engineering Archives*, Vol. 4, No. 3, 2014, pp 29-31.
- 6 M. Ernzer, K. Kopp. „Application of KANO method to life cycle design.” *IEEE Proceedings of EcoDesign: Third International Symposium on Environmentally Conscious Design and Inverse Manufacturing*, Tokyo Japan, December 8-11, 2003, p. 383-389.
- 7 M. Hanan, P. Karp. *Customer satisfaction, how to maximise, measure and market your company’s ultimate product*. New York, 1989.
- 8 N. Kano, N. Seraku, F. Takahashi, S. Tsjui. „Attractive Quality And Must-Be Quality.” *Hinshitsu* 14, 1984, p. 147-156.
- 9 D. Lock. *Podręcznik zarządzania jakością*. Warszawa: PWN, 2003.
- 10 D. Miarka, J. Żukowska, A. Siwek, J. Nowacka, D. Nowak. „Microbial hazards reduction during creamy cream cheese production.” *Production Engineering Archives*, Vol. 6, No 1, 2015, p. 39-44.
- 11 E. Skrzypek. *Jakość i efektywność*, Lublin: UMCS, 2000.
- 12 C. Szczucki. „Zakresy znaczeniowe podstawowych pojęć w kontroli produktów mięsnych.” *Gospodarka Mięsna*, No 1, 1970.
- 13 H. Williams, F. Wikström, M. Löfgren. „A life cycle perspective on environmental effects of customer focused packaging development.” *Journal of Cleaner Production*, No 16 (7), 2008, p. 853-859.

## THE USE OF KANO MODEL FOR THE CLASSIFICATION OF THE ELEMENTS OF PRODUCT QUALITY

**Abstract:** *The article presents a case study of the use of the Noriaki Kano model, which allows the identification of the characteristics of the perfect product from the perspective of a potential customer. One of the basic assumptions of the Kano model is the variability of customer requirements, which with the passage of time and copying attributes of a product by competing companies, so-called "stunning" factors become common and become expected attributes, then the desired factors, and in the final phase the discouraging factors. The studies of features, of the perfect product were carried out in the company of processing meat and vegetable. There were identified four groups of features: attracting, standard, one-dimensional and neutral. Based on obtained data there were modified packaging and changed areas of allocating given type of assortment on the market.*

**Key words:** *Kano theory, quality, food product*

## WYKORZYSTANIE MODELU KANO DO KLASYFIKACJI ELEMENTÓW JAKOŚCI PRODUKTU

**Streszczenie:** *W artykule przedstawiono studium przypadku wykorzystania modelu Noriaki Kano, który pozwala na wyodrębnienie cech idealnego produktu z perspektywy potencjalnego klienta. Jednym z podstawowych założeń modelu Kano jest zmienność wymagań klienta, które wraz z upływem czasu i kopiowaniem atrybutów produktu przez konkurencyjne firmy, tzw. czynniki „zachwycające” powszednieją i stają się atrybutami oczekiwanymi, następnie zaś czynnikami pożądanymi, a w końcowej fazie czynnikami zniechęcającymi. Badania cech idealnego produktu przeprowadzono w przedsiębiorstwie przetwórstwa mięsno-warzywnego. Wyodrębniono cztery grupy cech: wabiące, standardowe, jednowymiarowe i obojętne. W oparciu o uzyskane dane zmodyfikowano opakowania oraz zmieniono obszary alokowania danego typu asortymentu na rynku.*

**Słowa kluczowe:** *teoria KANO, jakość, wyrób spożywczy*

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