Simulation the Attractiveness of Transport Services as a Tool for Assessing Consumer Loyalty in the Digital Epoch

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Abstract

The digital initiatives used in the study as tools for assessing the loyalty of consumers of transport services made it possible to determine the feasibility of introducing additional services. The driving forces for adaptation of the latest information technologies and digital tools for competitive positioning of transport companies are identified. Study of consumer preferences based on simulation the attractiveness of transport services in the field of rail transport led to the conclusion that the development of digital technologies will remain a key factor influencing consumer's choice. A model of multidimensional analysis of transport service attractiveness based on analysis of structure of consumers and the degree of satisfaction with the quality of such service by certain consumer groups was developed. It was proven that development of digital technologies and services for passengers may improve the ability of the railway companies to address new challenges related to quarantine restrictions.

Keywords 1

Simulation, Consumer Satisfaction, Loyalty, Transport Services

1. Relevance

The rapid decline in passenger traffic in Ukraine since 2016 requires the development of effective tools to ensure the loyalty of potential consumers. Nowadays it is crucial to study consumer preferences on digitalization and numerous developments arising from it. The practical use of these methods creates a comprehensive information structure, which is important for any industry, and for the passenger rail transport in particular. A separate aspect of relevance is related to the decisive role of the railway industry, its ability to develop rapidly, which is supported by the following important management components: cost structure, safety and intensity of competition. In the age of large-scale digitalization, the IT sector of the railroads faces a number of challenges related to the combination of new sales channels, social networks, mobile applications, online shopping, Big data, cloud technologies etc. Special attention though should be paid to consumers of railway services and their needs. The introduction of digitalization in consumer service processes, the provision of new services, ease of use of rail transport are among the main factors determining the quality of rail transport and the degree of consumer commitment. Thus, further development of digitalization of railway services in the direction of focusing on consumer needs and requirements becomes necessary.

Quarantine restrictions have accelerated the need for such changes and forced companies to restructure and improve their operations in accordance with consumer requirements. There are new

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challenges due to the definition of the nature and degree of consumer loyalty in the process of preparation for the trip and its implementation.

The main business entity in the market of passenger rail transportation in Ukraine is JSC "Ukrzaliznytsia". According to official data [1], this type of transport provides almost 50% of passenger traffic and is the leading industry in the road transport sector of the country. According to the State Statistics Service of Ukraine [2], the volume of passengers transported by rail in 2001-2019 fell down (Fig. 1). The decrease in the number of transported consumers in 2019 compared to 2001 by 68.02% indicates a significant loss of competitive advantages of this mode of transport. This indicates the need to generate new ideas and implement modern practices to improve consumer service.

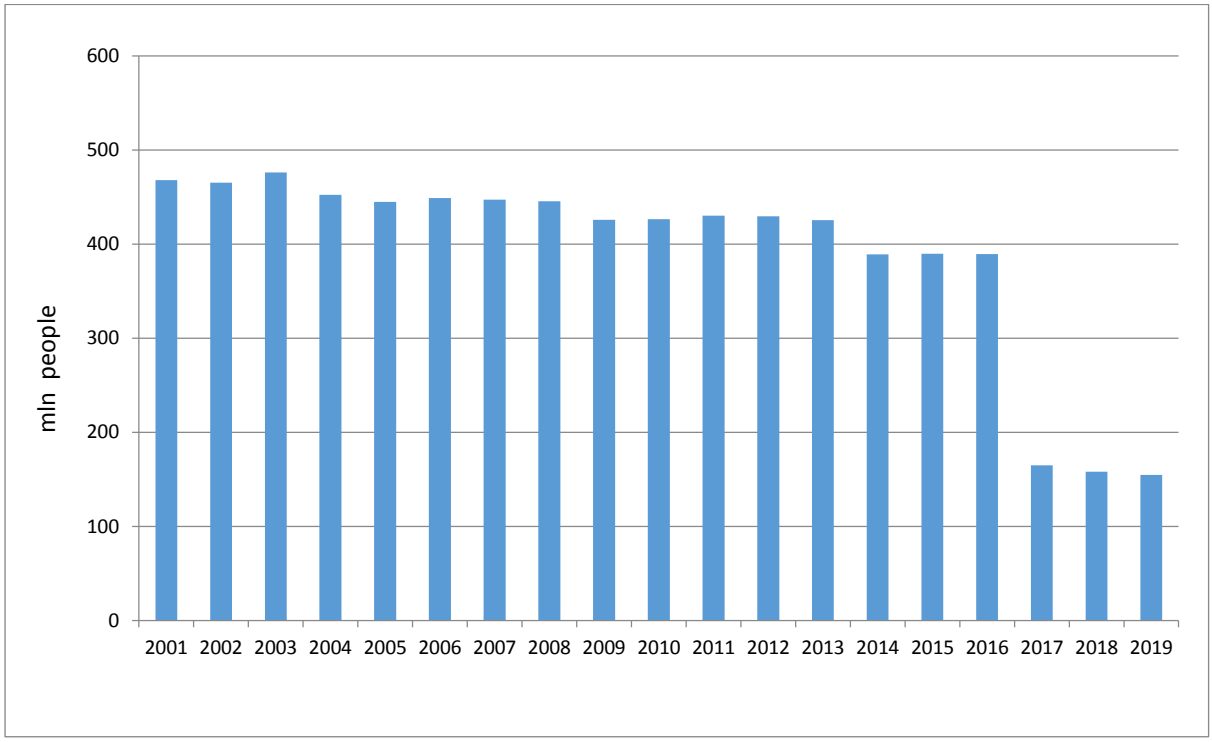

Figure 1: Volumes of passenger transportation by railways of JSC "Ukrzaliznytsia" in 2001-2019

2. Literature review

The most convenient way to model the level of consumer satisfaction is the Kano model (other name "Theory of attractive quality") (1984), which can be used to measure the emotions of consumers and the impact of quality of products or services on their perception. Such an instrument is based on Herzberg's "Motivation - Hygiene" two-factor theory [3]. With the help of the Kano model, it is possible to measure the degree of consumer's needs satisfaction in order to ensure the proper quality of goods or services, which affects the competitiveness of the company. The components of the model are various characteristics, properties, attributes of the product or service that determine its quality composition and meet the needs of consumers. As long as consumer requirements are taken into account, he/she feels the need for the existence of certain characteristics of the product/service or simply does not feel dissatisfied.

If consumer requirements are not taken into account, consumer dissatisfaction or lack of satisfaction arises. This is a model that considers the relationship between the quality of goods (services) and consumer satisfaction [3].

We have analyzed and systematized the works of scientists around the world on the application of the Kano model in both theoretical and practical aspects, including in various industries. The Kano model allows to divide all characteristics of the goods (services) into 3 types. In [4], the expectations of consumers in the jewelry sector were classified using the Kano model for new product

development. This made it possible to conclude that there is a correlation between the classification of expectations and the level of consumer satisfaction in this market segment. The Kano model was also used in the study of the tourism industry [5], where the nonlinearity of service quality features in the tourism sector was discovered.

In [6], the recommendations were proposed to meet consumer requirements and increase the level of satisfaction of consumers of the machine-building industry. R.Turisova [7] using the Kano model investigated the problem of including the product in a certain price category through the typology of its quality features.

The authors of [8] use the two-dimensional Kano model to assess the quality of services and consumer satisfaction in pharmaceutical logistics. The issue of improving e-commerce using Kano tools is the subject of the scientific work [9], which examines consumer satisfaction in terms of sustainable development.

In the paper [10] the hypothesis about the impact of digitalization on the activities of railway transport enterprises in the field of passenger transportation through using electronic sales channels, mobile applications was confirmed. Application of methods of multidimensional analysis is investigated in works [11, 12] in the context of sustainable development of railways in the conditions of European integration.

The application of the Kano model to improving the quality of health services was highlighted in [13]. The authors of [14] propose a quantitative technique based on the analysis of composite data of the Kano model. It is concluded that timely updating of data on consumer needs allows to assess the progress of meeting them over time. In the study [15] the Kano model is used to the quality management strategy in the aviation industry.

3. Research methodology

In order to identify the interests, commitment and needs of consumers of railway transport services in online booking, registration and payment of travel documents during 2020, a survey was conducted using the Google form. The study involved 55 respondents – users of rail passenger services. The form of the survey was an individual survey, the frequency of the survey was one-time, the type of expert assessment was an opinion poll. The questionnaire contained 9 questions, combined into three blocks. The questions were closed-ended. Methods of multidimensional statistical analysis were used to process the obtained results. The questions of the questionnaire were formulated so that they could be used in the future in simulation the attractiveness of transport services as a tool for assessing consumer loyalty.

Simulation the attractiveness of transport services involves a detailed analysis of the structure of respondents by a set of characteristics (age, place of residence, Internet access and social status) and their degree of satisfaction with such services.

The features (properties) of services that affect the level of consumer satisfaction are divided into 3 groups: basic (expected), main (desirable), and exciting (influential). The basic features of the passenger railway transport services are fundamental for such services, inherent in them by default. The presence of such properties is perceived by consumers as appropriate. This, in particular, is a guarantee that the trip will not be canceled or that everyone who purchased travel documents for a specific route will have a seat on the train, etc. It is clear that the implementation of such properties of railway services does not affect consumer satisfaction directly.

At the same time, if a basic property is absent, then neither the desirable nor the influential property will relieve the consumer dissatisfaction. Therefore, the lack of basic properties of passenger transportation services by the railways of Ukraine will have negative consequences, while the presence of such properties is not a competitive advantage.

As for the main (desirable) properties, these are the features of rail transport services, which level directly affects the level of consumer satisfaction. It is due to such properties (in terms of consumers' age, place of residence, Internet access and social status) that the railway company can create competitive advantages. Such desirable properties for consumers can be: the distance between seats, the number of transfers on the way etc. For example, the greater the distance between the seats in "Intercity" high-speed trains is, the greater is the passengers' satisfaction with the service in general.

The appropriate level of desirable features of a service enables ergonomic design and as a result competitive advantages.

The third group of properties – exciting – are always unexpected for the consumer, because they are characterized by additional or unusual characteristics of services. For rail passenger transport, it can be delicious and varied for different categories of consumers food in the train. The level of such properties, as well as of basic ones, does not directly affect the needs satisfaction of rail transport consumers. The lack of exciting properties cannot disappoint consumers, as they did not expect them. However, if they were discovered by consumers, then due to the surprise effect, they may be impressed and become additional channels for disseminating information about the company, which, in turn, contributes to a positive image. A positive image will synergistically increase the level of consumer loyalty.

An important aspect of applying the model of attractiveness of transport services is alteration of their properties over time, because consumers get used to them eventually. Therefore, the management of JSC "Ukrzaliznytsia" needs to offer continuous improvement of its services in the field of passenger transport. However, it should be noted that consumers react not to the availability of the service, but to its absence, so further improvements may be impractical, and therefore, that property will become basic.

An important aspect is to determine the target audience of consumers to understand what properties need to be offered or improved. As expectations rise, the exciting property may be perceived by passengers as the main one in a few days and as the basic one in a few months. Thus, the provision of necessary basic and some main properties increases the competitive advantages of railways.

The proposed simulation of the attractiveness of the transport service allows to identify and distribute all the needs of railway passengers by priorities. The model in its practical use requires the development of special methods of consumer surveys to assess perception. Such survey was conducted using the Google form, in which each question was presented in three forms: positive, negative and evaluative. The main advantage of using this method for rail passenger transport is the identification of the relationship between the properties of the proposed updated service, market dynamics and the level of consumer satisfaction. And thus, it will help to harmonize the activity of JSC "Ukrzaliznytsia" with the interests and needs of their consumers.

4. Research results

The results of the study are obtained through the use of multidimensional statistical analysis, which determines the quantitative side of mass phenomena and processes at a higher level, comprehensively classifies and groups multifaceted objects, recognizes new ones and allows to identify latent qualities of objects.

In our study, multidimensional statistical methods are applied through the solution of the following problems:

1. Selection of groups of objects with a similar combination of features (structure of consumers of transport services).
2. Selection of groups of features that best reflect the image of the hidden indicator (degree of consumer satisfaction).
3. Compression of an initial space of features without significant loss of information (attribution of corresponding attributive characteristics by Kano types).
4. Measuring the closeness of the relationship between groups of functional and dysfunctional responses of respondents.
5. Selection and use of a scale for assessing functional and dysfunctional responses, as well as a scale for assessment responses on consumer preferences.

The implementation of these tasks involved conducting a survey of users of services of JSC "Ukrzaliznytsia" on the level of satisfaction with the services. Respondents were grouped by the following characteristics: age, main occupation at present, Internet access, place of residence (Fig. 2-5).

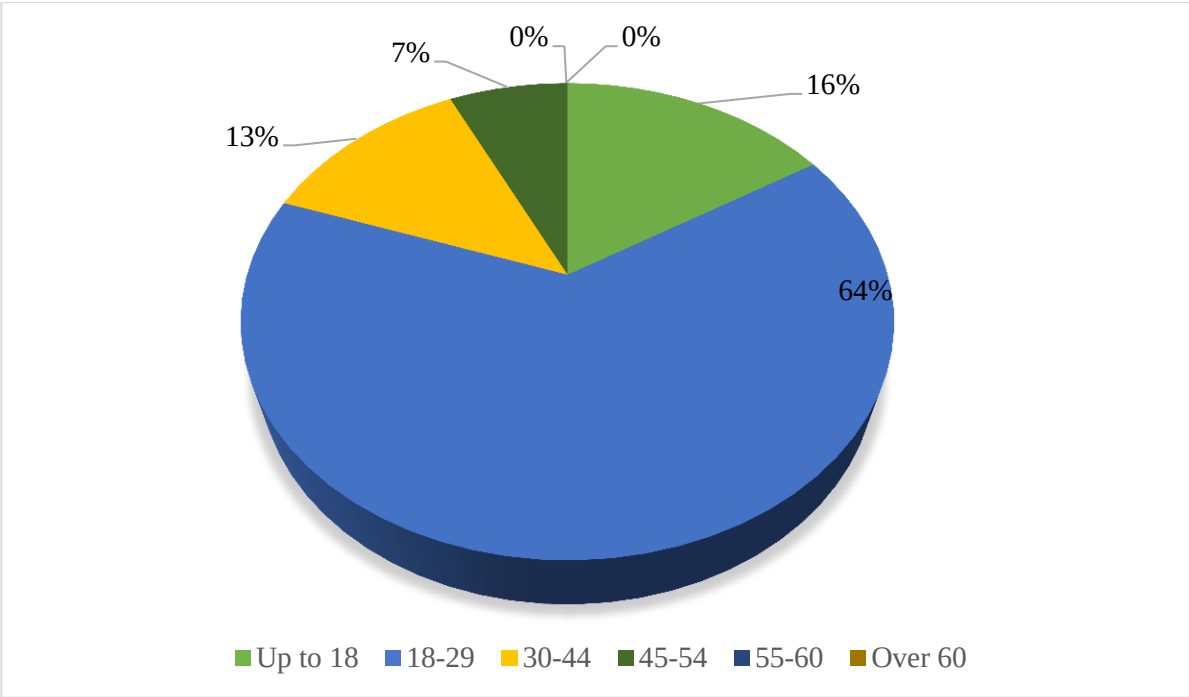

Figure 2: Grouping of respondents by age

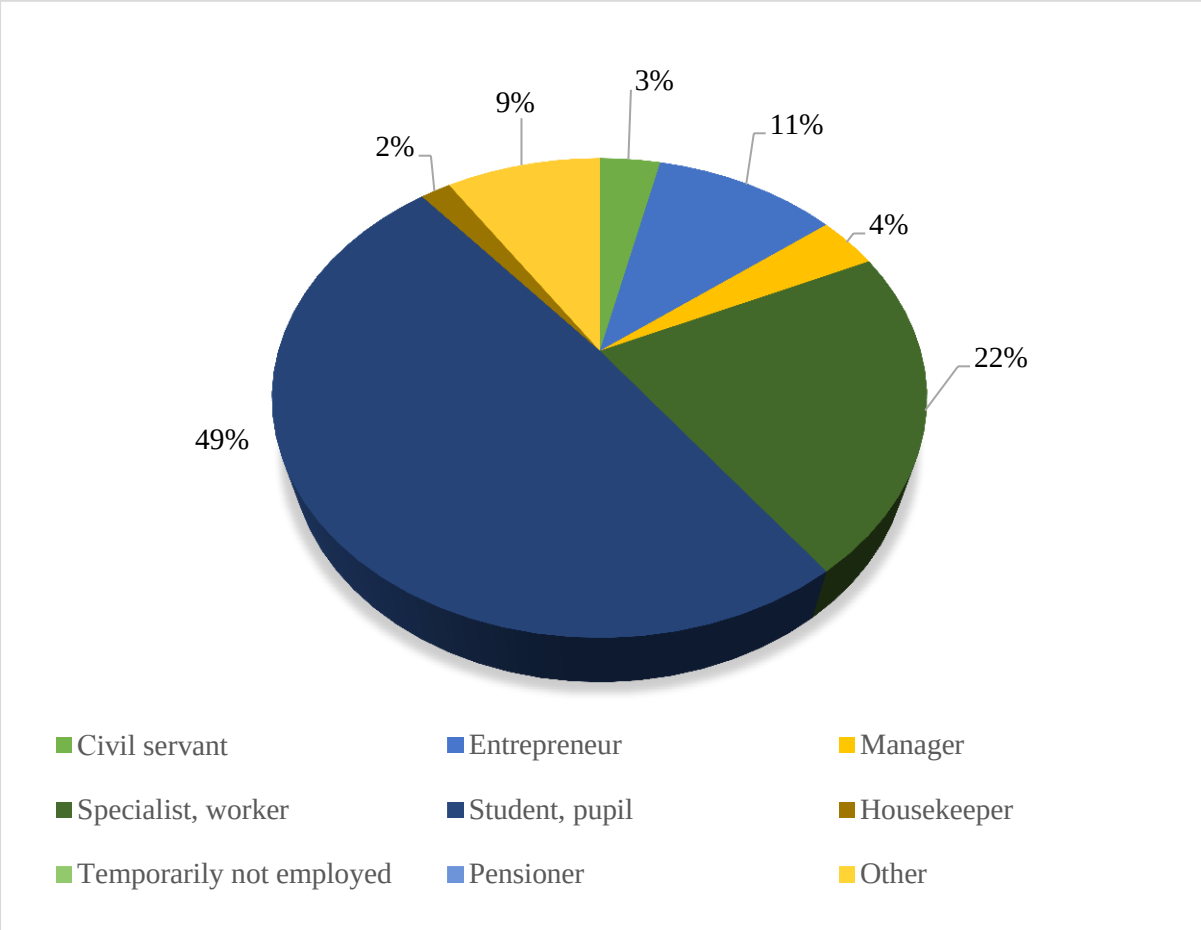

Figure 3: Grouping of respondents by main occupation

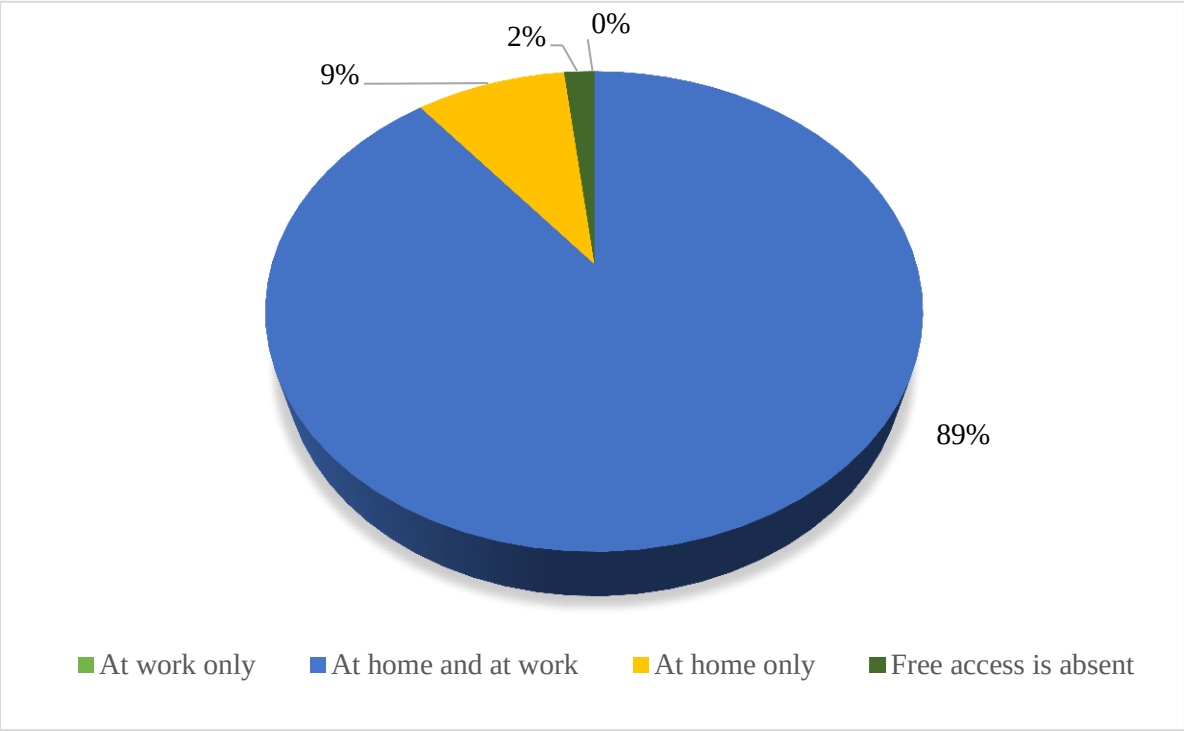

Figure 4: Grouping of respondents by Internet access

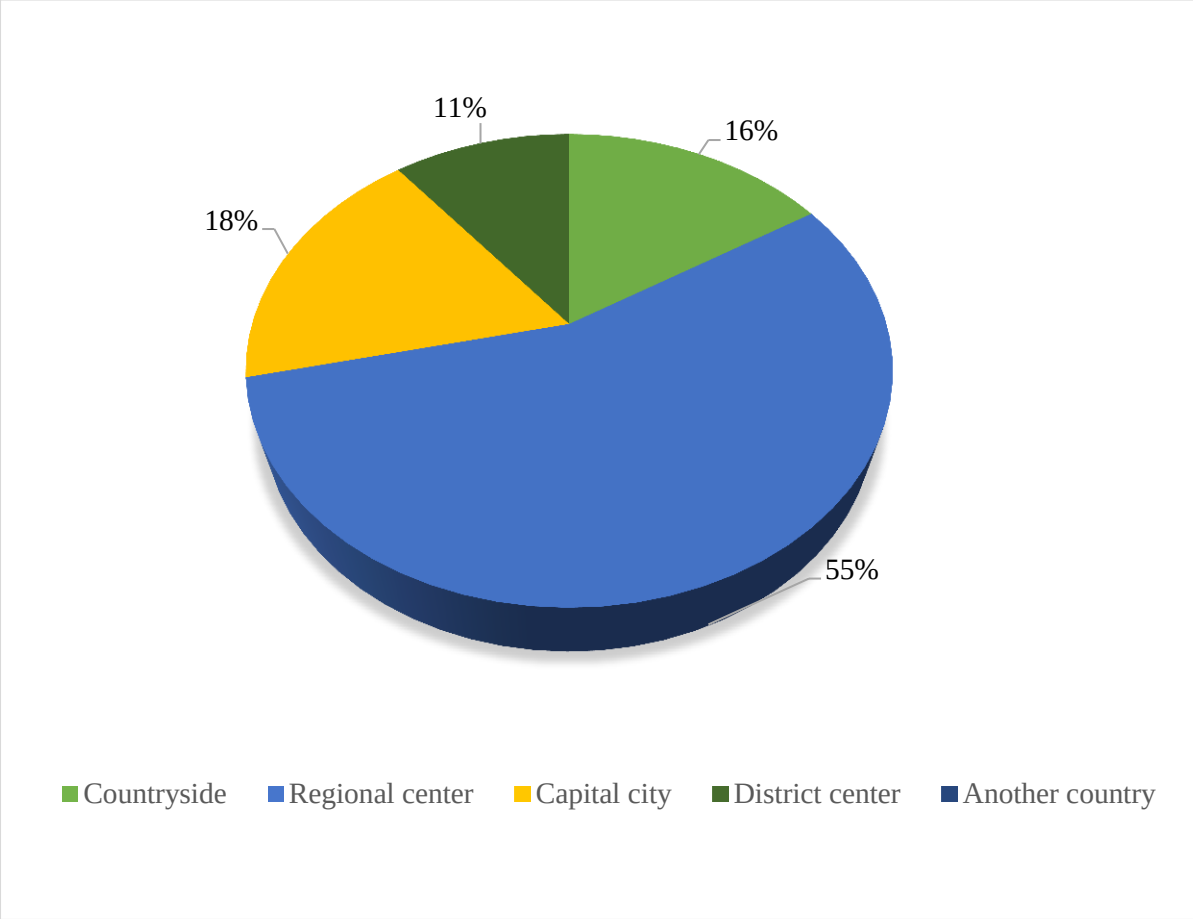

Figure 5: Grouping of respondents by place of residence

The results of the grouping show that young people aged 18-29 (64%) are the most active in using the railway services, and the largest share by occupation is accounted for by students (49%). This should be taken into account when studying the relationship between service quality and consumer satisfaction, as the incomes of young people, students and pupils are quite limited.

According to the results of grouping by the Internet access, only 1.8% of respondents do not have it, 9% use the Internet only at home, and almost 90% of respondents use it both at home and at work. This is a crucial feature when assessing the attractiveness of booking tickets through mobile applications. The sample consisted mainly of residents of regional centers and the capital (55% and 18%, respectively), who have traditionally been quite demanding on the quality of goods and services. The shares of those living in rural areas and district centers are 16% and 11%, respectively. A detailed analysis of the structure of respondents is an important step in conducting a multidimensional analysis of the attractiveness of transport services.

The next step is to study the quality of service provided and the degree of consumer satisfaction. This stage was implemented using the Kano model.

The Kano model defines the interaction between goods or services and consumer satisfaction and maintaining the quality of product functions (Fig. 6):

1. "Must-be" function is the main function, the absence of which leads to extreme consumer dissatisfaction. Such an attributive feature is perceived as given, appropriate, therefore, its implementation does not increase the level of consumer satisfaction. Implementation of this feature leads to absence of dissatisfaction with the product. Thus, this function is basic and located in the lower right corner of the graph.
2. "One-dimensional" function (or Performance) is a linear type of feature. With this function consumer satisfaction increases, but when the need is not met, the dissatisfaction increases. This feature is manifested in the expectations of consumers from the product or service. These are the performance requirements for product features. In the graph, this is a red line that runs through the center and usually reflects non-functional characteristics. As the graph shows, the level of satisfaction with the linear one-dimensional attribute is directly dependent on the level of functionality of this attribute.
3. "Attractive" function can cause excitement or a wow effect. The absence of such a feature will not cause consumers dissatisfaction with the product, but its presence will lead to the maximum level of satisfaction (i.e. to more than proportional satisfaction if such a function is satisfied). Often these features are special and have the greatest impact on consumer satisfaction. The graph shows this feature at the top right and displays a product that has significant competitive advantages.
4. "Indifferent" functions are manifested in the absence of requirements for benefits. This means that the consumer is indifferent to this feature. Such functional features are located in the left corner of the graph.
5. "Reserve" function is manifested through the feedback of the consumer when his expectations are not met. They often cause negative emotions and irritation in the consumer, even if the manufacturer likes them very much. These functions occupy the lower left corner of the Kano chart.
6. "Questionable" function indicates possible incorrect answers in the questionnaire.

The Kano model includes a survey tool that overcomes the bias that arises from traditional survey approaches to identifying consumer needs for a product. To implement the Kano model, a two-dimensional questionnaire is prepared for each product / service attribute. The first question is functional (positive question), and the second - dysfunctional (negative question). The first question is to find out how consumers feel if the proposed feature is present, and the second question is to find out how their perception if the feature is missing. Possible answers to each of the questions (functional or dysfunctional) are: 1. "I like it", 2. "I expect it", 3. "I am neutral", 4. "I can tolerate it", 5. "I don't like it".

After the survey, results are summarized and averaged to assess consumers' preferences, and are classified according to the characteristics listed above on M - "Must-be", P - "Performance", A - "Attractive", I - "Indifferent", R - "Reverse" and Q - "Questionable" categories.

Since several attributes of a product can be explored while analyzing consumer satisfaction, each quality attribute can be assigned to different quadrants of the coordinate axis corresponding to different Kano types.

The Kano method was used to study the rail transportation services of Ukrzaliznytsia as their largest provider in Ukraine.

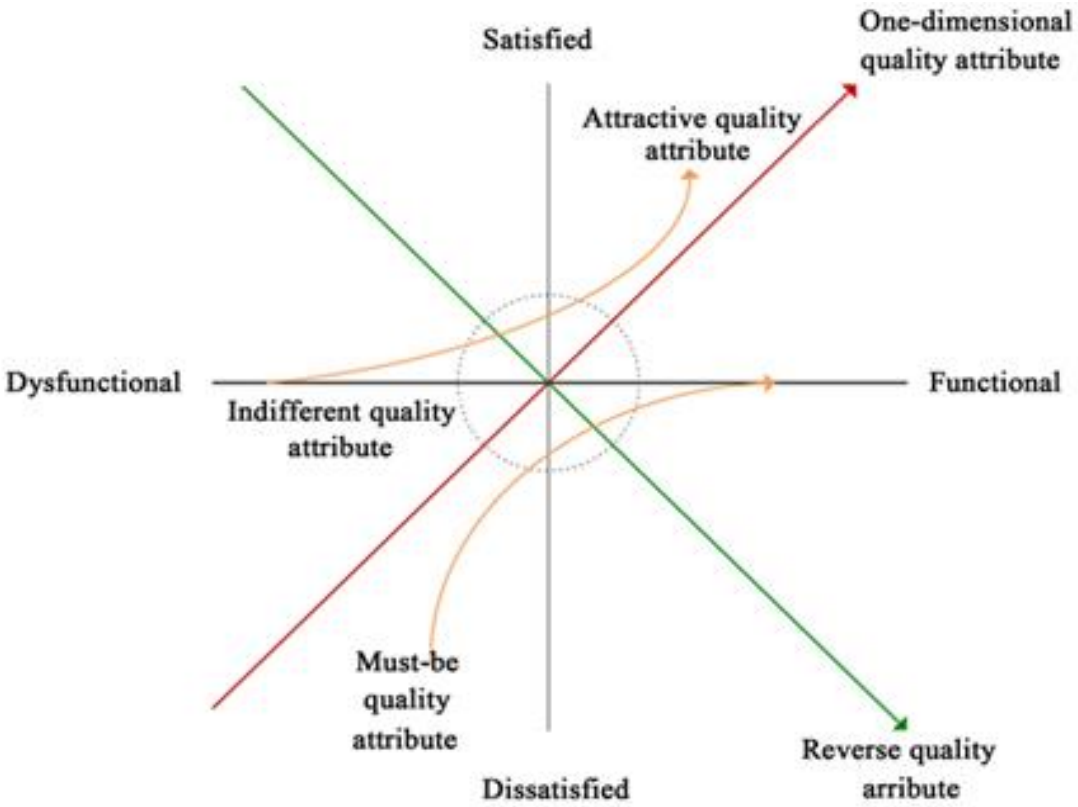

Figure 6: The Kano model [16]

All possible combinations of respondents' answers and the corresponding type of a product attribute are summarized in Table 1.

Table 1

Combinations of respondents' answers according to the Kano model

Functional (Y)		Dysfunctional (X)				
		I like it	I expect it	I am neutral	I can tolerate it	I dislike it
		-2	-1	0	2	4
I like it	4	Q	A	A	A	P
I expect it	2	R	Q	I	I	M
I am neutral	0	R	I	I	I	M
I can tolerate it	-1	R	I	I	Q	M
I dislike it	-2	R	R	R	R	Q

Three groups of questions were prepared that would help improve the quality of services provided, increase the attractiveness of rail transport and, as a result, raise the company's competitive advantages. They covered the possibilities of online reservation, of purchasing food during the travel and of using mobile applications for booking, registration and payment.

According to Kano's methodology, these questions described three functional characteristics of railway services: positive, negative and evaluative, reflecting the degree of satisfaction with the attribute. 55 respondents of different ages, social groups, place of residence and Internet access were interviewed.

The next step is counting the number of times when an attribute has been assigned to a category (Table 2).

Table 2
Respondents' answers according to the Kano model

Description	Discrete Analysis, %						
	M	P	A	I	R	Q	Total
Feature 1	26.83	65.85	2.44	4.88	0.00	0.00	100.00
Feature 2	27.27	13.64	0.00	59.09	0.00	0.00	100.00
Feature 3	32.35	55.88	5.88	0.00	0.00	5.88	100.00

The results of the calculations allowed the distribution of these characteristics between the types of Kano. The analysis was continued by determining the importance of each functional characteristic for consumers of railway transportation services (Table 3).

Table 3
Distribution of respondents' preferences by Kano types, points

#	Description	Continuous Analysis			
		Dysfunctional (X)	Functional (Y)	Importance (Z)	Category
F1	Feature 1	3.70	3.15	5.95	Performance
F2	Feature 2	1.57	2.00	3.98	Indifferent
F3	Feature 3	3.76	3.14	5.34	Performance

This made it possible to visualize the distribution of respondents' preferences (Fig. 7).

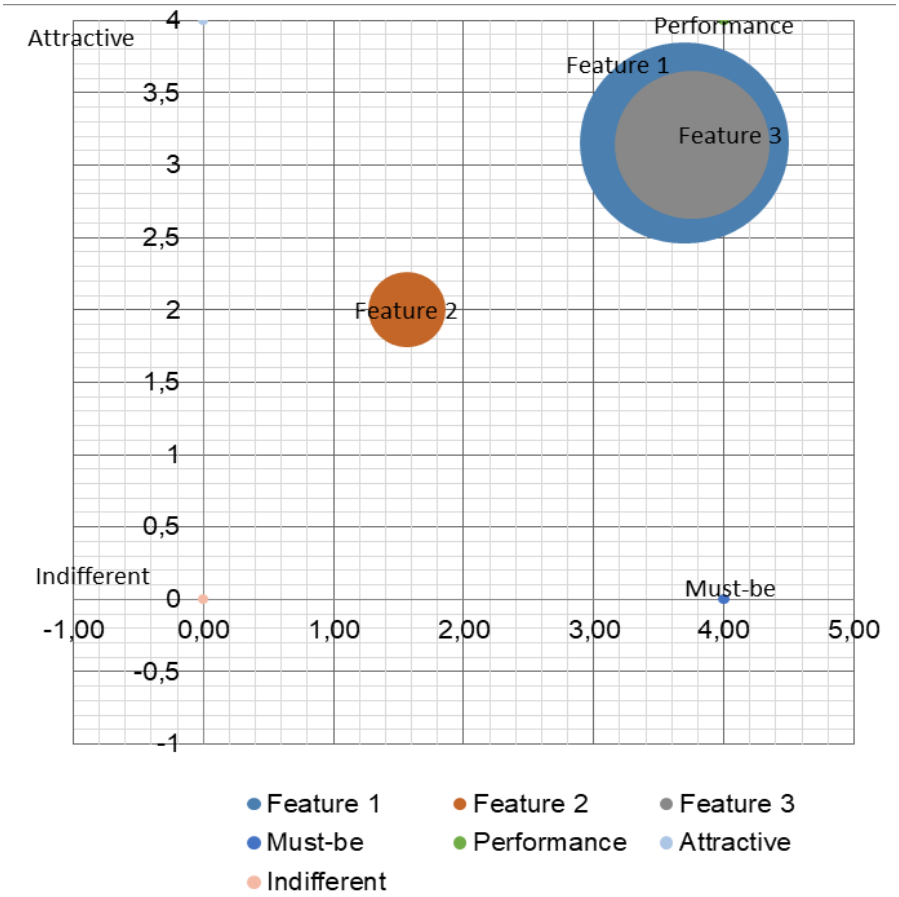

Figure 7: Visualization of consumer choice survey results

As a result of Kano's analysis of three attributive functions, which were proposed for implementation at Ukrzaliznytsia, it was determined that such a service as possibility to purchase food while traveling by rail is not important for respondents. Consumers treat this service as unimportant, which is also explained by the structure of surveyed consumers. In contrast, online booking of services and use of mobile applications for booking were rated by consumers as equally important (which is why the graphs of these attributes almost match) as one-dimensional functions. As a result of increasing the functionality of such attributes, consumer satisfaction with their use increases.

5. Conclusions and further research

The study showed that for online booking services and the ability to use mobile applications to book and pay for train travel, there is a need for their constant use and improvement as one-dimensional functions to maximize the quality of service. It is the development of such functions that the company needs to pay attention to within the policy of product improvement and increasing the competitive advantages of passenger transportation by rail. When using multidimensional methods in research, the following methodological issues can be addressed: development of conceptual formulation of tasks and directions of research; formulation and substantiation of the system of indicators that characterize the object of study; implementation of the algorithm of the corresponding multidimensional method with the use of practical data (usually through special computer programs – STATISTICA, SPSS, SYSTAT. In this study Google Sheet with Kano calculator was used); interpretation of the obtained research results; development of a set of recommendations for the problem solving. Tastes and preferences of consumers are dynamic characteristics, which requires their constant monitoring. Thereby the proposed model of attractiveness of transport services is not universal, but is quite flexible and can be adapted to specific conditions and objectives of studies.

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