1 IMPROVEMENT OF THE QUALITY MANAGEMENT METHODS OF CARGO TRANSPORTATION BY ROAD TRANSPORT

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ABSTRACT

Quality occupies a key position in the economic and social strategy of developed countries, and its level is a reliable indicator of the general state of the economy. Quality provides an innovative vector of development and is an integral component of the development of all industries. The level of development of the transport sector, as a component of the road and transport complex, is one of the most important characteristics of the development of modern society – its social orientation. In the transport enterprises of Ukraine, the underestimation of the importance of the comprehensive development of the quality management system has led to an increase in defects in the infrastructure of railways, road, water and air transport, which significantly increases the risk of traffic safety violations. Improvement of quality management systems is one of the most important areas of transport development. The main task of transport is timely, high-quality and complete satisfaction of the needs of the economy and the population in transportation, increasing the economic efficiency of its work. The solution to the problem of effective distribution of goods and improvement of the quality of service to consumers of transport services in market conditions is closely related to the problem of service quality. Only a high level of service quality can ensure a reliable sales market for the services of transport enterprises. A high level of service quality and efficiency should be supported by an appropriate level of material and technical support, including the development of a system of warehouse and container terminals, modern loading and unloading equipment, computerized IT and management tools. Therefore, in the modern conditions of the transformation of Ukrainian society and changes in economic interaction, quality problems caused by the presence of a competitive environment require careful research. Special attention is paid to processing and data processing, the order, cycle and context of each stage of practical application of functional analysis and cost analysis for quality management in the transport industry.

KEYWORDS

Transportation quality, transport service, functional-cost analysis, innovative activity, internal reserves, international quality standards.

1.1 THEORETICAL FOUNDATIONS OF THE CONCEPT OF QUALITY

Quality belongs to the most capacious, complex and universal categories that have many aspects, features, and, therefore, theoretical approaches to defining the essence.

According to the ISO 9001 International Standard, quality is understood as "the ability of a set of characteristics, implemented and inherent in a product, system or process, to fulfill requirements". The explanations for the term "requirement" indicate that defining words can be used to indicate a specific type of requirement: for example, product requirements, process requirements, consumer requirements, etc. [1].

Conducting an analysis of the existing definitions of the concept of quality, Eduard Minko and Mihail Krichevskiy come to the following definition: "product quality is a set of essential properties, quantified by a system of technical and economic indicators, which distinguish products from other similar purposes, which determine the degree satisfaction of some needs and demand for products in market conditions of creation and use of products at socially necessary costs and prices for these products formed by the market" [2].

According to DST 15467-79, "quality is a set of product properties that determine its suitability to meet certain needs in accordance with its purpose" [3, 4].

It is proposed to understand the quality of service as a set of properties and characteristics of products (services), the level of which is formed by the relationships of all interested parties and allows satisfying different levels of constantly changing needs. Transport services belong to the services that complete and (or) precede the material production process.

The process of transporting cargo and passengers is a product of transport and is measured in ton-kilometers and passenger-kilometers, respectively. In today's conditions, this concept, in our opinion, can only be used as a quantitative indicator for calculating operational costs (fuel, depreciation costs for vehicles, wages, etc.). Transportation of cargo and passengers should be considered the main type of transport services [5].

Transport service is the result of the activity of the transport service provider to satisfy the needs of the passenger, consignor and consignee in transportation in accordance with the established norms and requirements (DST R 51005-96) [3].

The quality of transport services is a set of characteristics of the transport service that determine its ability to satisfy the needs of consumers through the proper and efficient performance of transport services, as well as to meet the established standards and regulations, the terms of the contract or the requirements usually imposed on the transport service.

Quality of service criteria are used to assess the quality of transport services for cargo transportation.

In real life, in the absence of appropriate control over the quality of the provision of transport services in the process of cargo transportation, violations of the cargo transportation process often occur and the following problems arise:

— disruptions in the delivery of goods in time;

— non-fulfillment of the cargo transportation plan;

— cases of cargo loss or theft;

— facts of cargo damage;

— non-compliance with the terms of cargo delivery.

The competitiveness of transport organizations, the rational use of modes of transport and modern cargo delivery schemes, the expansion of foreign trade, etc., directly depend on the quality of transport services. And although, in addition to quality, competitiveness includes price, delivery time, performance, guarantees, service and a number of other components, according to the results of surveys, quality occupies 70 % of the "weight" of all indicators of competitiveness. Thus, in the market economy, much attention is paid to quality problems caused by the existence of a competitive environment. In this regard, the management of the quality of transport services is an urgent need of the hour, since this knowledge is vitally necessary in the conditions of a market economy and fierce competition in the market of transport services.

When considering issues of the quality of transport services and transport services, the following features must be taken into account:

1. The selection of a set of services requires consideration of all possible variants of transport service levels.

2. The client may have several needs, which entails the conformity of the properties and characteristics of the services to several often conflicting requirements at the same time.

3. When concluding a contract, requests and needs of customers are clearly discussed and recorded.

4. In many cases, the client's needs change over time, which necessitates periodic marketing research. Each type of transport service requires serious study and analysis.

5. Customer needs and requests are usually expressed in certain properties with quantitative characteristics of these properties and include such aspects as safety, functional suitability, operational readiness, reliability, economic factors, environmental friendliness, etc.

6. The term "quality" is not used for a quantitative assessment and is not used in an expression that exceeds the degree in a comparative assessment. In such cases, qualitative adjectives are used: "relative quality", "level of quality", "measure of quality".

The ISO 9004:2000 standard "Quality management systems. Guidelines for improving indicators" indicates that the assessment of the effectiveness of the quality system from a financial point of view is important. However, the method of its calculation is still unclear. And this is due, first of all, to the novelty and multifacetedness of the problem, the variety of factors affecting the effectiveness of quality assurance activities.

The result of the creation and implementation of the transport services quality management system is an increase in the efficiency of meeting transport needs, due to the desire to receive high-quality transport services at a minimum price.

Users of transport services now prefer such indicators as compliance with time schedules for the delivery of goods and passengers, responsibility for meeting stipulated needs, reliability of delivery. The fulfillment of these requirements is connected with a sufficiently accurate temporal assessment of the links of the delivery of goods and passengers, that is, with knowledge of the regularities of changes in all their elements and the establishment of specific values. Identifying patterns of links and elements of delivery is the basis for the systematic construction of all possible types of organization of transportation of goods and passengers.

1.2 ENSURING THE QUALITY OF TRANSPORTATION SERVICES AS A MODERN CHALLENGE

The theoretical aspect is that in the special scientific industry literature, this issue of assessment and management of the quality of cargo transportation was not given the necessary attention. There are a sufficient number of developments on the quality assessment of passenger transportation on different routes, in different modes, but there are no corresponding methods for cargo transportation, there are only separate developments of different indicators.

Thus, at the present time, there is a need to develop a methodology for assessing and managing the quality of cargo transportation by rolling stock of a motor vehicle enterprise.

The peculiarities of the assessment of the quality of transport services are as follows:

– quality should be assessed in terms of consumer satisfaction (quality indicators should be primarily subordinated to the requirements of the clientele and take their interests into account as much as possible);

– quality should be assessed separately for different groups of consumers (for different groups of consumers, the degree of importance of individual characteristics of the service can vary greatly, so summing up the set of quality indicators into one quantitative value leads to the formation of insufficiently informative quality models);

– when assessing the quality of transport services, it is necessary to determine the degree of satisfaction of consumer requirements, that is, to calculate the level of quality (it is necessary to assess the degree of compliance of services with consumer requirements, which will allow monitoring the approximation of the quality level of transport services to the standard set by consumers);

– assessment of the quality of transport services should be carried out regularly (consumers' needs and expectations may change, which leads to the need for regular reassessment of quality in order to maintain its level);

– when assessing the quality of transport services, it is not necessary to include the cost of services in the list of indicators (the cost of the service does not always reflect its quality, the price is an important indicator of the competitiveness of the service, not its quality);

– when assessing the level of quality of transport services, it is necessary to establish a generalized comprehensive quality indicator (required for an objective generalized assessment of the organization's competitive capabilities, as well as for assessing the effectiveness of measures to improve quality by comparing the received comprehensive quality indicator) [6, 7].

In the work of Nadiia Popova [8], customer requirements for service distribution channels and criteria for assessing their work are defined.

Services are a type of activity aimed at satisfying the corresponding part of the clientele's needs, characterized by the presence of the necessary technological, economic, information and resource support.

Since services are activities, their production and consumption are inseparable from each other. Unlike a product, a service cannot be provided to the consumer until the moment of sale, and it

cannot be produced in stock. Service can be provided only when a service order is received. Therefore, services cannot be stored as goods.

In market conditions, the development of new competitive types of transport services and their improvement is a crucial condition for the activity of every enterprise.

That is why, as a rule, the advantage over competitors is gained by those motor transport companies that, when developing new offers, effectively use the concept of marketing and focus, above all, on the interests of customers.

Customer requirements for service distribution channels:

1. A wide list of services. For example, when choosing a brand of rolling stock, the client should have the maximum possible choice, which allows it to choose a rolling stock for a specific type of cargo.

2. Scope of services. The client must receive the service in the amount it needs.

3. Service performance time. The execution time of the request for service or transportation must satisfy the client.

4. Convenient location. It is important for the client not to waste time looking for the possibility of ordering services. The place of order should be conveniently located in relation to the client.

5. Service. Additional services provided directly by the channel itself play an important role in attracting customers, therefore, the more services, the higher the efficiency of the channel.

Control over the work of service distribution channels is based on the assessment of their activity indicators. Certain criteria must be developed to assess the performance of service distribution channels.

The following characteristics can serve as criteria:

– increase in sales volumes of services;

– customer reviews;

– speed of transfer of the application;

– increase in the number of new engaged clientele;

– increase in the number of regular customers;

– increase in the company's profit;

– increase in informing potential customers about the enterprise.

The results of the checks show whether there is a need to continue cooperation with the intermediary or whether it is necessary to terminate the contract. Comparative characteristics make it possible to identify the best channels, the best channel employees.

Properties of services that can be taken into account when assessing the quality of service:

– the consumer of services quite often participates in the process of providing services;

– the consumer of services does not become their owner;

– the service provision process cannot be tested before payment;

– the service is not tangible, it cannot be viewed or held.

Directions for improving the quality of transport services:

– increasing the technical and technological level of the transportation process;

– increasing the motivation of the company's personnel;

– professional development of personnel of transport and other enterprises;

– introduction and control of compliance with quality standards at the enterprise (end-to-end or selective).

Passenger transportation has its own comprehensive method of managing the quality of passenger transportation by road.

The main indicators of the quality of passenger transportation include:

– comfort of the trip (accumulation of buses and regularity of their movement on the routes);

– time spent by passengers on movement;

– transportation safety [9].

Modern analytical methods must be used to determine reserves for improving the quality of transport services. One of these methods is the functional cost analysis (FCA), with the help of which reserves for increasing the efficiency of the MTE work and the quality of the provision of transport services for each of the transport customers are determined at the same time. Let's consider the stages and order of practical application of this modern method of reserve research.

1.3 THE PROCEDURE AND STAGES OF USING FUNCTIONAL-COST ANALYSIS IN THE CONTEXT OF DETERMINING INTERNAL RESERVES

Functional-cost analysis is an effective tool for identifying unused intra-production reserves at enterprises of various branches of production and spheres of activity. The ultimate goal of FCA is to find the most economical options for the organization of production from the point of view of the producer and the consumer.

The algorithm of practical use of FCA consists of the following main stages [10]:

Stage 1. Identification of the main groups of transport customers and their ranking.

The content of the work of this stage is the selection of the main groups of clients according to the level of the volume of transport works (services) in terms of MTE. Various graphic methods are widely used for this:

– "NQ" type diagram (**Fig. 1.1**);

– Lorenz graph (curve of cumulative accumulation of values);

– graphic interpretation of the ABC method and etc.

The initial data necessary for the performance of work at this stage of the analysis should be collected economic information that reflects the activities of MTE for individual clients served.

The "NQ" type diagram is a graph, on the horizontal axis of which are the numbers (names) of all N-customers of vehicles served by the rolling stock, and on the vertical axis – the volume of transported cargo for each customer (shipper) in natural terms (Q – volume of cargo transportation) or in value terms (D is the amount of revenue from cargo transportation). All clientele served should be placed from left to right according to the degree of decrease in the volume of transported goods.
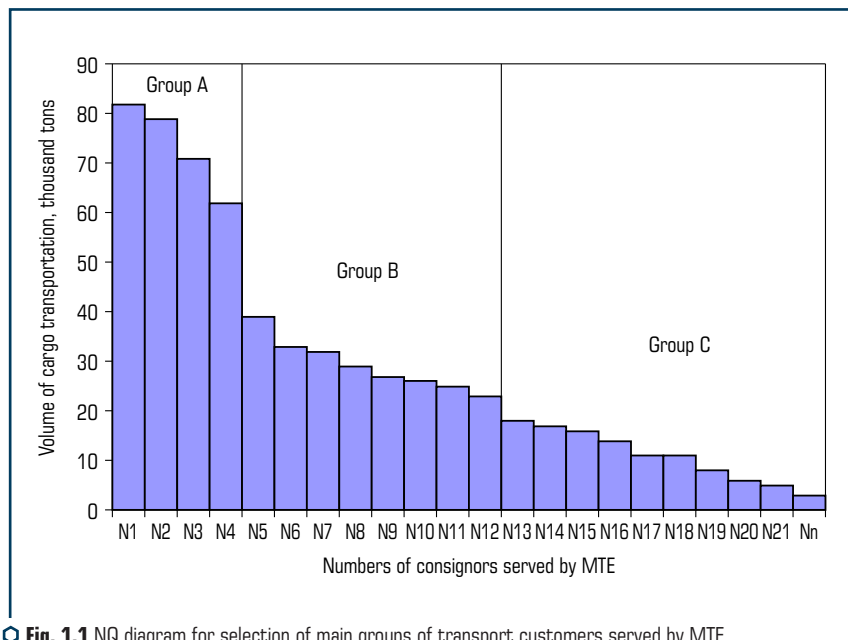
Fig. 1.1 NQ diagram for selection of main groups of transport customers served by MTE
Source: author's development

The data analysis allows to identify three main groups of transport customers served by MTE rolling stock:

— group A is the most important clientele with the largest volume of cargo transportation. Their number is small (15–20 % of the total number of customers), but they occupy the main positions in the production program of the operation of rolling stock of MTE (45–50 % of the volume of cargo transportation);

— group B is an average group in terms of importance, including 25–30 % of the total number of shippers. In the structure of the volume of transportation, their share is about 30–35 %;

— group C is a clientele that is not of great importance. It makes up 45–50 % of the positions of the production program, and it accounts for 20–25 % of the volume of transportation.

According to the principle of selection of the leading link, the objects selected in groups A and B as the most important should be the objects of further study. Let's consider them as the main clientele served.

Stage 2. Analysis of production costs and the efficiency of MTE work in servicing each customer.

Costs are identified and indicators of the efficiency of the use of rolling stock in the transport service of each of the main customers are calculated. The purpose of such an analysis is to obtain reliable information about the level of profitability of services provided by MTE.

The indicator of the profitability of transportation is used as an assessment criterion:

$$R_{tr_i} = \frac{P_{tr_i}}{D_{tr_i}} 100 \%, \qquad (1.1)$$

where P_{tr} – profit received by MTE from transportation of goods to *the i*-th transport customer, thousand UAH; D_{tr} – revenues of MTE from transportation of goods to the *i*-th customer, thousand UAH.

After the calculations are completed, a bar chart is built, on which the main contractual clientele is placed horizontally, and the level of profitability of transportation is placed vertically. In this diagram, all motor vehicle customers belonging to groups A and B are ranked from left to right in order of decreasing profitability.

The obtained results characterize only one side of the efficiency of motor vehicle production – from the point of view of MTE itself. Therefore, this analysis should be supplemented with other studies that will allow assessing the production activity of motor carriers from the perspective of the clientele served.

Stage 3. Analysis of the functionality of the performance of transport services (works).

One of the most important tasks (functions) of MTE is timely, complete and high-quality transport service to the clientele. Therefore, the purpose of this stage of the FCA is to determine the level of functionality (quality) of the performance of works and services for each of the transport customers that formed groups A and B.

The level of functionality of transport service can be expressed in different ways. In this case, it is suggested to use the functionality coefficient calculated for each and every consignor:

$$K_{f_i} = 1 - \frac{F_{fines_i} + L_{A_i} + S_{G_i}}{D_{tr_i}}, \qquad (1.2)$$

where F_{fines_i} – the amount of fines issued by the MTE clientele for untimely cargo transportation, thousand UAH; L_{A_i} – losses of consignors in connection with traffic accidents caused by the fault of MTE drivers, thousand UAH; S_{G_i} – the amount of shortages, losses and theft of goods during their transportation, thousand UAH.

Graphically obtained results should be presented in the form of a bar chart. The level of transport service functionality is marked on its vertical axis K_{f_i}, and the serial numbers of transport customers are indicated on the horizontal axis, and, as in the previous cases, the clientele is placed on the graph from left to right as the functionality coefficient decreases.

Stage 4. Selection of objects of innovative activity.

To determine the objects of innovative activity, a correlation table is built (**Fig. 1.2**).

In it, the number of rows and the number of columns is equal to the number of main consignors in groups A and B. The numbers of customers are recorded horizontally in the correlation table as the level of profitability of cargo transportation decreases, and the numbers of customers are indicated vertically as the functionality coefficient decreases.
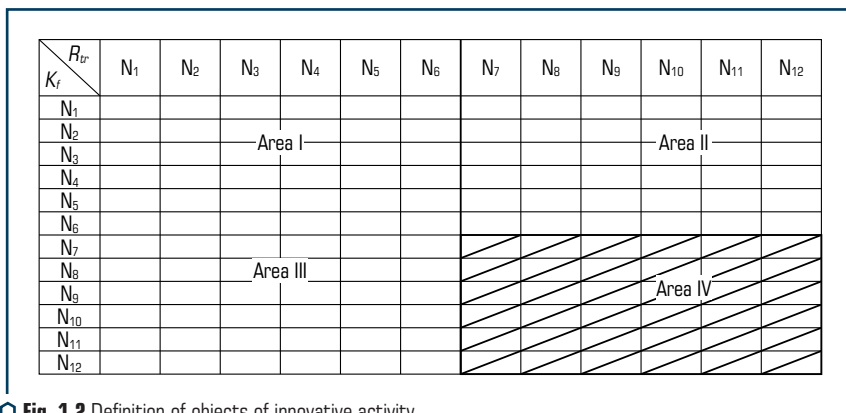
R_{tr} / K_f	N_1	N_2	N_3	N_4	N_5	N_6	N_7	N_8	N_9	N_{10}	N_{11}	N_{12}
N_1												
N_2				Area I						Area II		
N_3												
N_4												
N_5												
N_6												
N_7												
N_8				Area III						Area IV		
N_9												
N_{10}												
N_{11}												
N_{12}												

Fig. 1.2 Definition of objects of innovative activity
Source: author's development

With the help of a correlation table, the entire main contract clientele of MTE is divided into four areas:

– area I – it includes customers with the highest level of both transportation profitability and functionality;

– area II – motor vehicle customers who have achieved a high level of functionality (quality) of transport service, but there is a low level of efficiency in the use of rolling stock, i.e. profitability;

– area III – customers with a high level of profitability of cargo transportation and a low level of functionality of transport services;

– area IV – those customers of motor transport, in which the lowest level of both the efficiency of the transport process and the functionality of the transport service is observed during the reporting period;

– the last group of enterprises are motor vehicle customers and are objects of innovative activity; for each of the enterprises, it is necessary to propose measures to increase the efficiency of the use of rolling stock and increase the quality of transport service.

1.4 EXPERIMENTAL RESEARCH AND DEFINITION OF OBJECTS OF INNOVATIVE ACTIVITY

The use of functional-cost analysis makes it possible to form three groups of customers: group A includes 4 customers with a total volume of transportation of 293.5 thousand tons, group B – 8 customers with a volume of transportation of 233.5 thousand tons, and group C – 9 customers for 94.1 thousand tons. In accordance with the principle of selection of the leading link, the objects selected in groups A and B as the most important should be the objects of further study. Let's consider them as the main clientele served.

The initial data of the study are presented in **Table 1.1**.
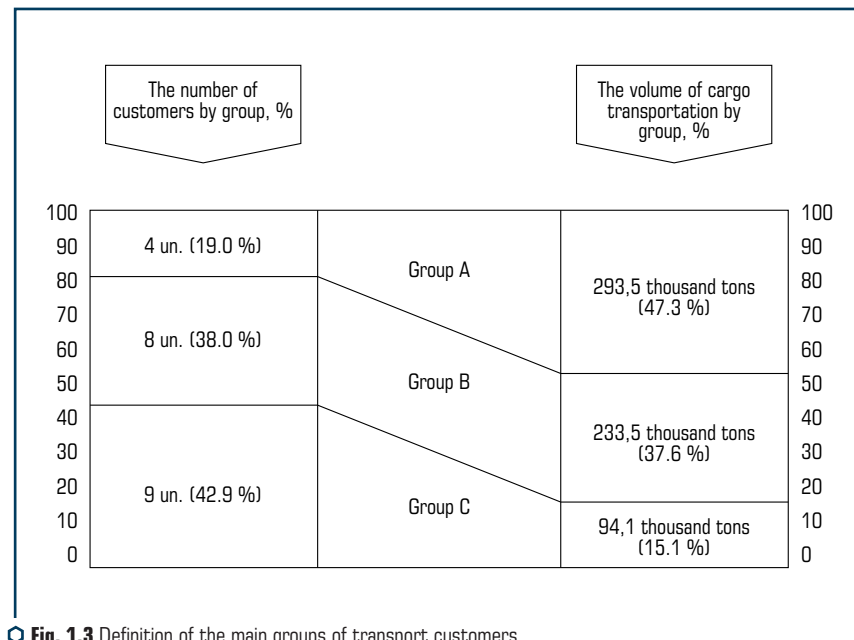
● **Table 1.1** Initial data on MTE operation

No.	Name of the customer	Volume of cargo transportation, thousand tons	Transportation profitability indicator, R_{tr}, %	Coefficient of functionality, K_f
1	"Fozzy" hypermarket (Fozzy)	70	35	0.98
2	SAN InBev Ukraine	79	33	0.95
3	Lactalis Ukraine	62	31	0.88
4	Philip Morris Ukraine	82.5	30	0.97
5	Danone	38.5	28.5	0.9
6	ATB market	33	26.5	0.95
7	PJSC Pivdenspetsbud	26	24.7	0.89
8	Synergy LLC	28	22.3	0.81
9	LLC Balakliya slate plant	27	19.4	0.86
10	Elektrovazhmash, plant	29	18.3	0.78
11	Vykont Ltd	24.5	16.8	0.78
12	LLC Metinvest SMC	32	15	0.85
13	LLC Comex	18.3	15	0.68
14	AB Metal	18	10.3	0.7
15	Art factory "Mechanics"	16	9.8	0.72
16	Kharkiv ZhBI plant	15	7.5	0.69
17	ZhBK "Promstroy"	10	6.9	0.73
18	Plant ZhBK-15	12	5.2	0.71
19	SE "Malyshev Plant"	8,9	4.8	0.65
20	Vladar	7.6	5.3	0.66
21	Red October	6.8	6.8	0.67

A graphic interpretation of the results of the first stage of the FCA is shown in **Fig. 1.3**.

The graphic interpretation of the results of the work of the second and third stages is shown in **Fig. 1.4**, **1.5**.

The correlation matrix, which is built at the fourth stage of practical application of FCA based on the results of our research, has the following form (**Fig. 1.6**).

Transport service customers entered the I area, 1 customer in the II area, 1 customer in the III area, and 5 customers in the IV area.

The number of customers by group, %

The volume of cargo transportation by group, %

4 un. (19.0 %)	Group A	293,5 thousand tons (47.3 %)
8 un. (38.0 %)	Group B	233,5 thousand tons (37.6 %)
9 un. (42.9 %)	Group C	94,1 thousand tons (15.1 %)

Fig. 1.3 Definition of the main groups of transport customers
Source: author's development
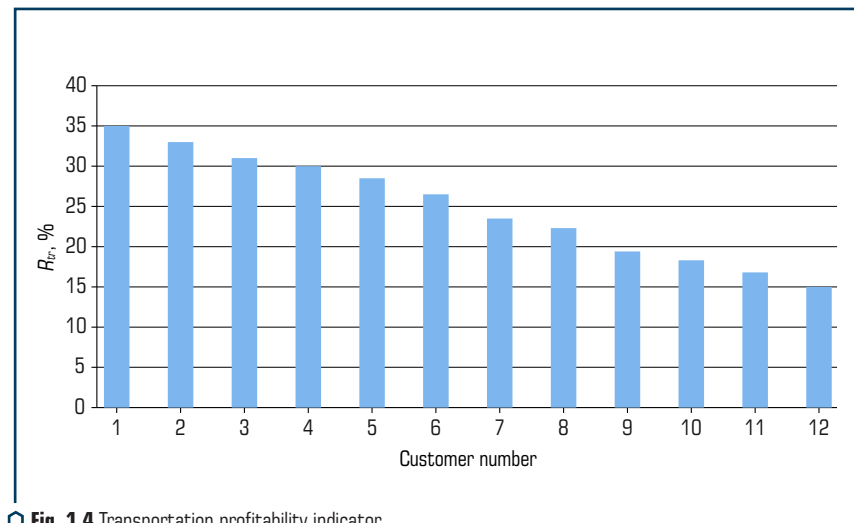
Fig. 1.4 Transportation profitability indicator
Source: author's development
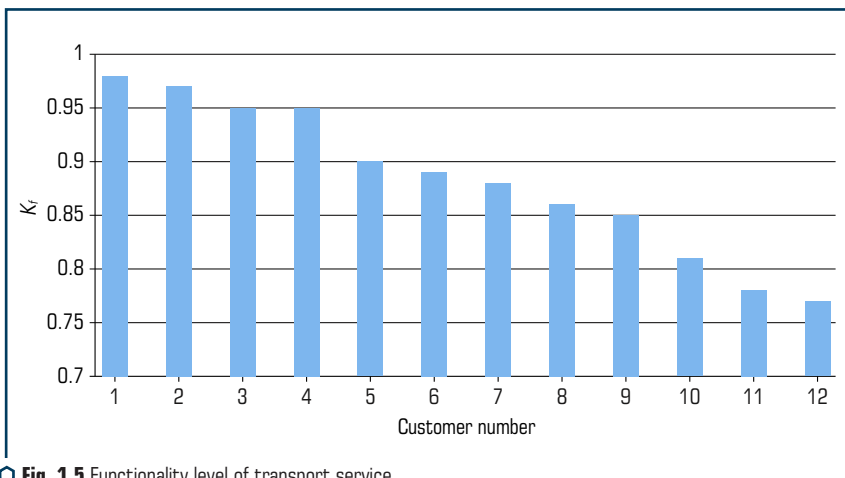
Fig. 1.5 Functionality level of transport service
Source: author's development
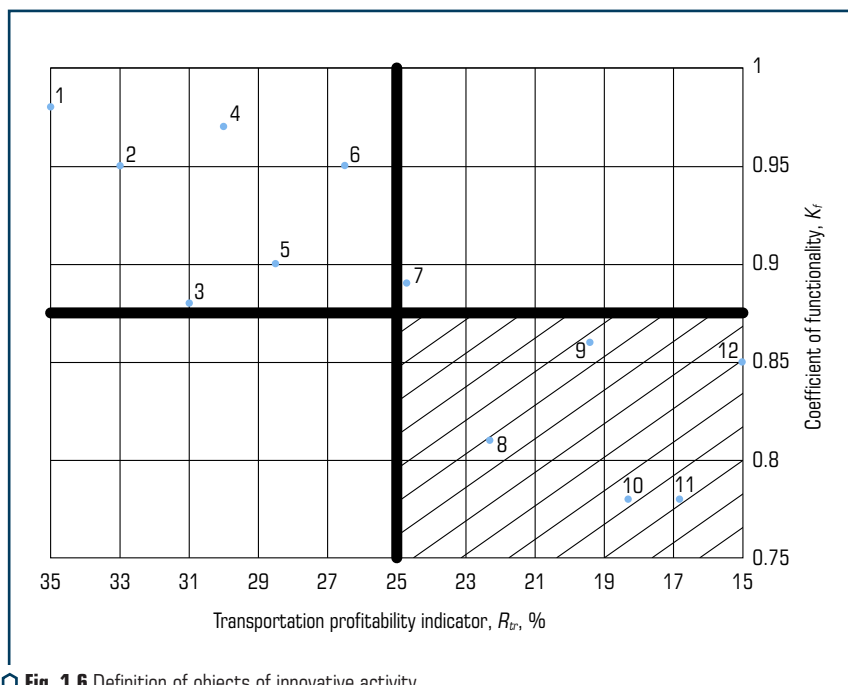
Fig. 1.6 Definition of objects of innovative activity
Source: author's development

Special attention is given to those customers of transport services with the lowest profitability index and the level of functionality of transport service, that is, they have the lowest level of both the efficiency of the transport process and the functionality of transport service. Therefore, the motor transport company should pay attention to the customers who got to the IV area, namely, according to this experimental study, three customers under number 8–12, which MTE can lose.

1.5 DISCUSSION OF THE RESULTS OF IMPROVING METHODS OF MANAGING THE QUALITY OF GOODS TRANSPORTATION BY MOTOR VEHICLES

The problem of solving the quality of transport services for the population, organizations and enterprises of Ukraine is very urgent. Indicators of the quality of passenger and cargo transportation are the most important, which characterize the competitiveness of modern motor transport enterprises and firms, but in modern conditions, the managers of most MTEs do not pay due attention to these indicators, there are no practical recommendations and methodological developments for assessing and managing the quality of cargo transportation for MTEs that work in market conditions. Improving the quality of transport services is the most promising way to ensure the competitiveness of enterprises.

The analysis of literary sources on the topic of the study shows the fact that until now there is no unified approach among scientists to the development of a comprehensive system of assessment and management of the quality of the provision of transport services by means of road transport, there is no unified approach to the system of indicators for assessing the quality of cargo transportation.

One of the newest methods of managing the work reserves of modern MTEs operating in market conditions is the functional-cost analysis. The advantage of this method is that as a result of its practical application in the course of conducting research, it is possible to simultaneously assess the effectiveness of the provision of transport services for each of the customers, as well as to assess the level of quality of cargo transportation for each of them.

The practical application of FCA in the course of experimental studies made it possible to develop recommendations that enable the management of MTE to identify objects of innovative activity, which include specific shippers, where a low level of both the efficiency of the transport process and the quality of the provision of transport services is observed, and to develop specific measures.

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