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4 TRANSPORT AND LOGISTICS SERVICES AS A COMPONENT OF THE TRANSPORT COMPLEX AND THEIR QUALITY MANAGEMENT

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ABSTRACT

Section 1 of this monograph discussed the impact of the quality of education on the development of both the individual sector and the country as a whole. In this section we will talk about one very powerful component of the transport complex of each country – transport and logistics services. During the transition of Ukraine's economy to an innovative path of development, the processes of specialization, concentration and cooperation of industrial, agricultural and other industries should be strengthened, which leads to continuous growth of cargo transportation and requires further improvement of transport and logistics management methods, introduction of advanced logistics technologies. That is, the key to the development of logistics and the market of transport and logistics services is the effective management of their quality. The main problems of quality of Ukrainian logistics are considered in the work. Quality management of transport and logistics services is a permanent purposeful process for the formation and development of relations with consumers, associated with the provision of a range of logistics services. The basic principles of quality management have been substantiated: orientation on requirements, constant communication with consumers of logistic services; building mutually beneficial relationships with consumers and staff of an enterprise; flexibility of the system of transport and logistics customer service and others. Methodological support for quality management of transport and logistics services has been developed, which includes a certain procedure and a set of appropriate methods for implementing this activity based on the application of the scenario approach and algorithmization of procedures for obtaining possible states of operation of modern transport and logistics sector.

KEYWORDS

Quality, transport and logistics service, quality management, quality management process of transport and logistics services, quality of the logistics process, order terms, quality management strategies.

4.1 TASKS OF QUALITY MANAGEMENT IN TRANSPORT AND LOGISTICS SYSTEMS

Under modern conditions in connection with the expansion of economic ties, international trade, globalization of companies the market of transport and logistics services is actively developing [1]. There is a natural increase from 4 % to 10 % annually. The largest volumes of transport and logistics services are in the United States, the European Union and China, accounting for 23 %, 20 % and 17 % of the world, respectively. Among the EU countries, Germany has the largest share (4 %).

By 2024, the global logistics services market is projected to reach $ 236 billion. There will be an annual increase in CAGR from 7.5 % in monetary terms and 6 % in quantitative terms.

Ukraine's share in the world logistics market does not exceed one percent. The domestic market of logistics services is at the stage of formation and consolidation of the industry; significantly inferior to Western countries not only in volume but also in quality and complexity of services.

The transport sector of Ukraine's economy meets only the basic needs of enterprises and the population in transportation. At the same time, the level of safety, quality and efficiency indicators of passenger and cargo transportation, energy efficiency, technogenic load on the environment do not meet modern requirements: standards and requirements of the European Union.

It should be added, that the coronavirus pandemic has caused a forced reduction in traffic, intensified the struggle for the client. The transportation market has become more competitive. Priorities in the choice of logistics operator and transport service provider have changed significantly. When choosing a transport service provider, the main attention is paid to the reliability and guarantees of timely execution of orders, contrary to the fact that before the pandemic the main factor in choosing a transport company was the cost of transportation. In this regard, the key to winning markets and customers is the quality of the company's offer in the field of products and services. Its constant improvement becomes the main task of quality management in transport and logistics systems.

4.2 PROBLEMS AND PROSPECTS OF QUALITY MANAGEMENT OF TRANSPORT AND LOGISTICS SERVICES

Problems of quality of Ukrainian logistics and quality management of transport and logistics services are the attention of many domestic and foreign scientists.

Many studies with a practical focus are primarily related to the quantitative assessment of the logistics services market, logistics efficiency, the ranking of logistics companies in terms of gross turnover, consumer feedback, and so on.

The logistics market of Ukraine includes various types of freight: rail, road, air, water (sea and river). The most developed is the type of rail transport, which according to 2020 is 56.1 % of the market. The smallest share of this market is occupied by air transport (0.1 %). It should be noted, that the structure of freight traffic has changed over the last 5 years (**Fig. 4.1**).

There is a tendency to reduce the share of rail transport from 61.85 % in 2015 to 56.1 % in 2020, and, as a consequence, increase the share of road transport from 10.9 % to 20.8 %, respectively.

The World Bank publishes the Logistics Performance Index (LPI) in its research every two years. With the help of this indicator it is possible to make comparisons between the countries of the world and to define problems and opportunities in the field of logistics. The following are used as the main evaluation criteria: efficiency of customs and border clearance (customs);

quality of trade and transport infrastructure (infrastructure); simplicity of organization of international transportations at competitive prices (international shipments); quality and competence of logistics services (logistics quality and competence); tracking of cargoes (tracking & tracing); timeliness of cargo deliveries (timeliness) – **Table 4.1** and **Fig. 4.2**.

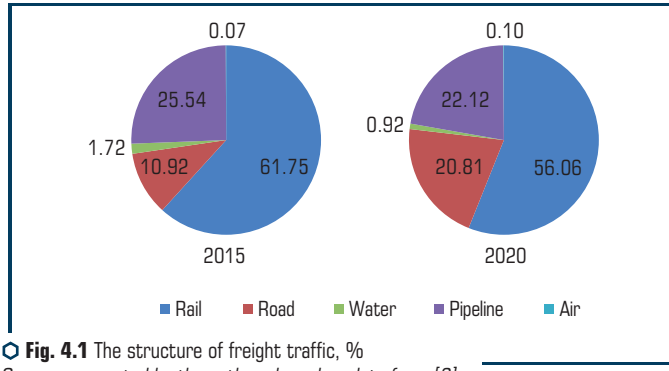

Fig. 4.1 The structure of freight traffic, %
Source: generated by the authors based on data from [2]

Despite the positive dynamics in relation to the rating of Ukraine on this indicator (from 102 place in 2010 it rose to 66 place in 2018), in 2018 the overall level of logistics services in Ukraine is estimated at 2.83 points out of 5 possible. In particular, the assessment of the level of quality and competence was 2.84 points.

In Ukraine, the most developed indicator is the timeliness of cargo deliveries (as of 2018 it is 3.42 points), and the least developed is the infrastructure indicator (2.22 points).

Table 4.1 The dynamics of the Logistics Performance Index (LPI) in Ukraine*

LPI components	Years				
	2010	2012	2014	2016	2018
LPI Rank	102	66	61	80	66
LPI Score	2.57	2.85	2.98	2.74	2.83
Customs	2.02	2.41	2.69	2.30	2.49
Infrastructure	2.44	2.69	2.65	2.49	2.22
International shipments	2.79	2.752	2.95	2.59	2.83
Logistics competence	2.59	2.85	2.84	2.55	2.84
Tracking & tracing	2.49	3.15	3.2	2.96	3.11
Timeliness	3.06	3.31	3.51	3.51	3.42

** Source: generated by the authors based on data from [3]*

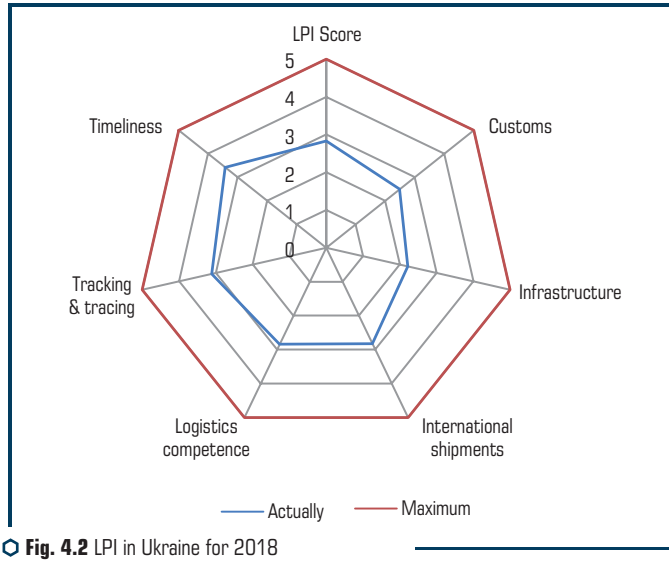

Fig. 4.2 LPI in Ukraine for 2018

The editorial board of one of the leading profile media magazines MINTRANS has prepared a list of the largest logistics companies, operating in Ukraine (**Table 4.2**).

Table 4.2 The general characteristics of the largest logistics companies in Ukraine

Company name	Country of origin	Staff number, pers.	Strengths	Gross turnover, 2019
1	**2**	**3**	**4**	**5**
Küehne + nagel (1992)	Switzerland	450	maritime and aviation logistics, automotive and contract logistics with a focus on integrated logistics solutions	1100
DSV logistics (2013)	Denmark	180	international road transport, sea container transportation, air transportation, design, warehousing logistics, distribution, customs brokerage services and cargo insurance	900
FM logistics Ukraine (1996)	France	900	distribution of consumer goods, cosmetics and beauty, industry and healthcare; manages operations on more than 57,000 m^2 of Class A warehouse platforms	800
Raben (2003)	Netherlands	500	warehousing logistics, international and domestic freight, customs and sea freight, Fresh Logistics (service of fresh products that require temperature from 0 °C to +6 °C)	600

● **Continuation of Table 4.2**

1	2	3	4	5
Ekol Ukraine (2012)	Turkey	680	Rainbow goods accounting system, which allows a customer to see the actual quantity of goods, the need to replenish stocks, allows you to track the history of goods at all stages of the logistics chain	550
Zammler (2007)	Ukraine	625	services in the field of road, sea, rail, air transportation, customs brokerage and a full range of warehousing services	550
Pakline logistics (2004)	Ukraine	882	logistics consulting services, fulfilment using conveyor lines, storage and warehousing logistics services, express courier delivery in Ukraine and the world, cold logistics for pharmaceuticals and FMCG, services for online stores	500

There is a rating of logistics companies in Ukraine, which is based on the analysis of reviews, left in Google maps, company websites, specialized forums, etc.

The leaders of the rating are Ubi-logistic and Wheltrans – **Table 4.3**.

● **Table 4.3** The rating of logistics companies in Ukraine*

Rating position	Company name	Work directions
1	Ubi-logistic	full cycle of logistics services; emphasis on speed, reliability and convenience
	Wheltrans	
2	YURIS GRUP	freight transportation by various modes of transport, warehousing logistics services
3	PROFI CARGO SERVICE	professional in the field of foreign economic activity, customs brokerage services; international sea freight – one of the priority services in the range
4	KOSMOS LTD (Dnipro)	road transport within Ukraine, import/export, sea container transportation under one-time and long-term contracts, as well as projects «Outsourcing of the transport problem», transportation of oversized cargo, consultations on any issues of delivery
5	GREIMAR, LTD (Odesa)	organization of international transportation by road in all directions; warehousing and forwarding services in the port of Chernomorsk

** Source: generated by the authors based on data from [4]*

Theoretical research on quality management of transport and logistics services is mainly limited to coverage of the evaluation and organization of logistics services; implementation of qua-

lity standards, studying the experience of implementing quality management systems in logistics companies, etc.

Most publications of domestic and foreign authors [5–9] deal with the application of various methods of assessing the quality of logistics services, establishing the reasons for non-compliance with the requirements, stated by consumers, and so on. For example, [5] presents the results of the study of how logistics services affect customer satisfaction. The following factors of quality of logistics services were measured: contact with the staff quality, order status, timeliness, processing of discrepancies in an order and exchange of operational information in logistics services. It has been proved, that there are significant links between timeliness, order conditions, quality of contacts with staff, prompt exchange of information and perception of customer satisfaction in logistics services.

In [6], a service model was developed in logistics services for the delivery of documents and packages by studying the relationship between the elements of service and customer perception (ie Kansei); in [7] the quality of ground staff service at Don Muang International Airport was evaluated by comparing the perception of ground staff quality by service (quality criteria reliability, kindness, confidence, empathy and perceptivity were used).

Works [8–12] are devoted to the development of general theoretical provisions of quality management of transport and logistics services.

In [10] the general theoretical provisions concerning quality management of services of transport and logistics companies are resulted. The concept of quality management as «the process of influencing the production of services by the top management of a transport and logistics company, middle and lower managers who perform management functions to ensure the required quality» is presented [10]. The debatable points of this definition are, first of all, the emphasis on the fact that the process is carried out only by the management of various links, all employees of an enterprise should be involved in quality management. Secondly, there is no purposefulness of such a process (ensuring the required quality does not fully reflect all the goals of modern management) and the specifics of the activities in the logistics sector.

The undoubted merit of the authors of this work is the development of an algorithm for managing the quality of services of transport and logistics companies in order to improve the clarity of processes and mechanisms that arise in the process. This algorithm allows you to assess the current and forecast levels of quality of logistics services and develop the necessary measures to improve quality. At the same time, it should be noted, that the implementation of activities according to this algorithm requires refinement of the principles and methods of quality management, establishing the concept of logistics management, etc.

The main provisions of the implementation of the integrated approach to quality management of transport services are contained in [11]. The quality management system is considered as an effective system that combines the activities of different divisions of a logistics provider with its business partners and customers, which ensures the maintenance of the required or achieved level of quality, as well as its improvement to ensure production and logistics services at the most economical level to meet customer requirements completely. This approach is implemented

through the Gap-model for estimating differences in the quality of customer service of the logistics provider.

In modern research, much attention is paid to the standardization of quality management activities, including logistics companies, given that for Ukraine, which aspires to join the EU, there is a requirement to implement at the national level at least 80 % of existing standards of the EU.

Thus, in [12] the role of standardization as a way to improve the quality of logistics services is highlighted, the main European standards of quality management in freight chains are considered: CEN/TR 14310:2002. Freight transport services. Declaration and reporting on environmental performance in freight chains; EN 12507:2005 Transport services; EN ISO 9001:2000 Transport services. Appropriate transport chains System for declaring the conditions of activity; EN 2798:2006 Transport quality management systems. Road, rail and inland water transport. Quality management system requirements in addition to EN ISO 9001 for the transport of dangerous goods in terms of safety; EN 3876: 2002 Transport. Logistics and services. Appropriate transport chains; EN 5696: 2007 Individual storage. Specification for individual storage services [13].

In order to establish the quality management systems, most effective and implemented in the activities of logistics companies, relevant studies are conducted, the results of which are presented in [14, 15]. The paper [14] presents the results of the implementation of quality management systems in 2016–2017 in Lithuania. At the same time, 66 logistics companies, operating in the field of freight transportation, warehousing, production and trade, were analyzed. The study showed that most companies have implemented ISO quality management systems. The second most popular quality management system is LEAN, with just over 3 percent of companies surveyed using Agilesystem.

In [15] a similar study was conducted on logistics companies in Bulgaria and proved that the introduction and certification of quality management systems is a necessity to ensure the competitiveness of products. It has been established, that 12.5 % of companies in the field of logistics are certified in accordance with ISO 14001: Standard Environmental Management 2015. For manufacturing companies, this percentage is 20.5 %, which is much higher.

Occupational safety and health management system BS OHSAS 18001:2007 is used by 17.9 % of manufacturing companies and only 5.9 % of companies in the field of logistics.

The analysis of practical experience and theoretical provisions on quality management of transport and logistics services indicates a low level of scientific and methodological support of this activity, which indicates the need to improve them, taking into account modern requirements.

4.3 METHODOLOGICAL ASPECTS OF QUALITY MANAGEMENT OF TRANSPORT AND LOGISTICS SERVICES

The theoretical position of this research is the conceptual approach to quality management of transport services, which is presented in [12]. It is based on the principles of logistics management, customer relationship management, harmonization of the enterprise management system

based on quality and the use of the principles of a synergistic system approach. It provides for the integration of the principles of TQM and logistics, the application of the variable approach to the choice of technologies to improve the processes of transport and logistics services; comparison of evaluation by consumers of motor transport services with evaluation of the quality of its formation processes.

The quality of transport and logistics services is primarily determined by the needs and demands of consumers. In this case, a provider of such services (logistics operator) is obliged to present to the client the maximum possible set. Transport and logistics service will be high-quality only when consumers have the opportunity to choose for themselves the operations they really need from the wide range of services offered.

The list of offered types of transport and logistics services includes logistics activities, related to the transportation of goods or passengers and the provision of additional services. For example, the complex of services for loading and unloading of goods includes: loading and unloading of vehicles, respectively, at stations (ports) of departure and destination, in the warehouses of consignors and consignees; formation and development of packages; repair of transport packaging; packing, binding, covering of cargoes; loading of cargoes into containers and unloading from them.

The list of warehousing services includes the following: storage and transshipment of goods; their sorting, marking; reception and delivery of goods, checking the number of seats, weight, appearance of the cargo, the condition of the container and packaging; acquisition of small consignments of goods or consolidation of cargo units; unbundling of shipments for delivery to consignees.

Based on the analysis of definitions of the concept of quality, highlighting their essential characteristics, we provide the following interpretation. The quality of transport and logistics services (service) is a set of properties and characteristics that arise as a result of consumer interaction with suppliers (other stakeholders), RTE (other transport and logistics companies), associated with the movement of goods and (or) passengers in space and in time with the use of vehicles, providing the necessary set of services, the degree (level) of which allows to meet various socio-economic needs that are constantly changing.

The set of such properties and characteristics (delivery time, delivery speed, service rhythm, cargo storage, route flexibility, etc.) is formed as a result of interconnected activities, resources and system. A chain of relationship between resources, system, processes and results is formed.

Quality management of transport and logistics services is a permanent purposeful process of formation and development of relations with consumers, related to the provision of a range of logistics services that meet the needs of consumers.

In the management of the quality of transport and logistics services, in our opinion, the main principles should be considered the following: focus on requirements, constant communication with consumers of logistics services; building mutually beneficial relationships with consumers and staff of an enterprise; the relationship of customer service logistics with marketing, financial management and quality management; flexibility of the system of transport and logistics customer service; basing decisions only on facts and not on the situation or experience of employees of an organization;

attention to processes, considering them as the optimal maximization of product value for a consumer and minimization of its cost, both for the consumer and a provider.

The implementation of these principles is combined with specific principles of logistics (**Table 4.4**).

Table 4.4 The principles of quality management of transport and logistics services

General principles of quality management	Specific principles of logistics
Focus on requirements, constant communication with consumers of logistics services	Determination of the end result as the purpose of a flow in accordance with the economic, technical and other requirements of the system
	Establishment of consumer value
	Research of customer behavior models
	Compliance with a set of environmental requirements
	Systematization and use of complaints in further work as a learning material for employee training
Setting of mutually beneficial relationships with consumers and staff	Coordination of actions of all participants, involved in the formation and management of a flow, including direct and indirect
	Data personalization
Relationship of logistics customer service with marketing, financial management	Formation of all types of provision and maintenance of a flow, ie its infrastructure
	Implementation of flow management and achievement of the goal with minimal cost
	Use of modern technical means of management – control and regulation of flow parameters
decisions based only on facts	Strengthening the calculation principle at all stages of flow management, including planning, regulation, accounting, control, analysis
	Flow scheduling – continuous tracking of movement and change of each object of a flow and adjustment of its parameters
Procedural approach	Formation of a flow as a control object
	Ensurance of flow reliability
	Regulation of the process of providing transport and logistics services

The algorithm of the process of quality management of transport and logistics services, based on the main directions of meeting the needs of the modern transport and logistics sector, is built in the form of a block diagram and is shown in **Fig. 4.3**.

Block 1 is designed to enter all the source information, needed to make optimal management decisions. Such information is a set of data on the quality of logistics services by their respective types in terms of three components: quality of the logistics process (service), duration of services (service time) and price compliance.

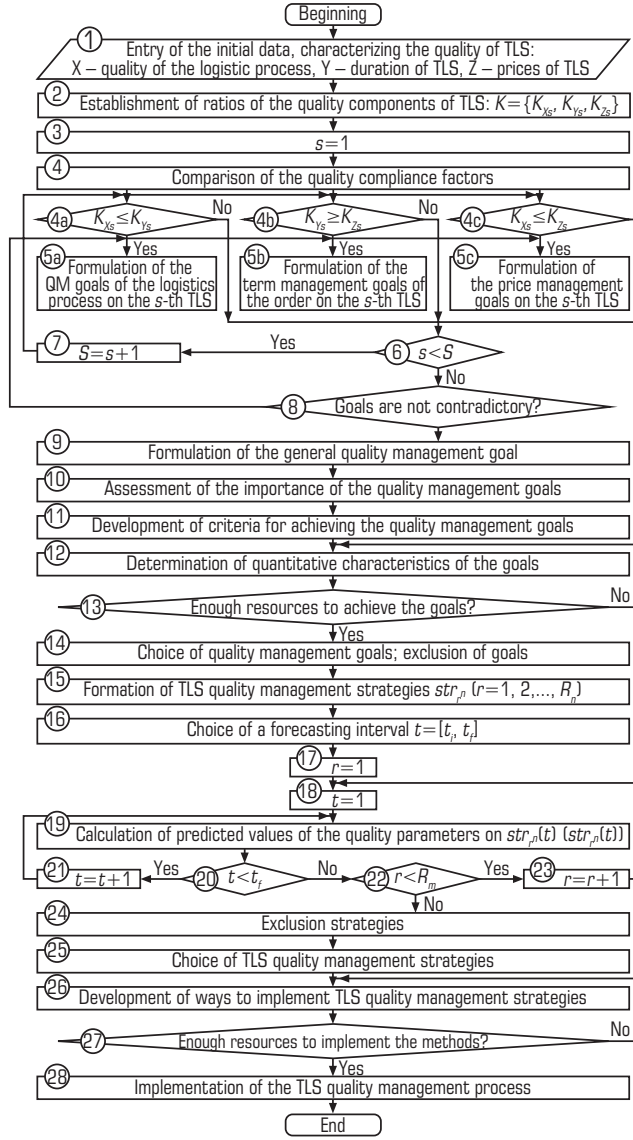

Fig. 4.3 The algorithm of the process of quality management of transport and logistics services

The quality of the logistics process (service) includes the implementation of various types of consumer requirements for the complex of declared services. The criteria for assessing the quality of the logistics process should include:

– availability of goods in stock (possibility of instant delivery from stocks that are in stock at a supplier);

– flexibility of supply (ability to adapt time (for example, time of day and night), size, range and method of supply to customer expectations: willingness to deliver at night, small batches of goods, environmentally hazardous goods, etc;

– frequency of deliveries (during the day, day, week, month);

– reliability of deliveries (competence and punctuality of expected deliveries, timeliness of deliveries with a small number of errors and losses);

– convenience of documentation and others.

The next criterion for assessing the quality of transport and logistics services is the duration (service time), ie the interval between the receipt of an order for the supply of products and the receipt of the ordered products by the consumer.

This indicator should also be considered from the consumer's point of view as the compliance of transport and logistics services over time (maximum delivery speed is not always required if it will lead to increased logistics costs and higher service costs). In this case, such compliance should be considered in terms of time of ordering, time of order processing, time of preparation of the order for shipment and time of delivery of the ordered goods.

The price of logistics services should be considered as a means of ensuring compliance with customer requirements (high quality at the best price); flexibility and adaptability of the service to market conditions and one of the ways to optimize the total logistics costs.

The initial data for modeling the process of quality management of transport and logistics services will be the appropriate sets:

$$X=\{x_{is}\};\ Y=\{y_{js}\};\ Z=\{z_{rs}\}, \tag{4.1}$$

where X – set of data on the quality of the logistics process when providing s-logistics service $i=\overline{1,n}$, n – number of quality indicators of the logistics process; Y – set of data on compliance with the deadlines for the provision of s-logistics service $j=\overline{1,m}$, m – number of indicators that assess the compliance with the deadlines; Z – set of data on the price of s-logistics service, $r=\overline{1,k}$, k – number of indicators that assess the compliance of the price of logistics services to the stated requirements; $s=\overline{1,S}$, S – number of transport and logistics services.

The level of satisfaction of the relevant requirements for the quality of the logistics process is set by surveying consumers to provide transport and logistics services on a five-point scale (1 point – the requirement is insignificant; 2 points – the requirement is below average; 3 points – the requirement at the average level; 4 points – the requirement above the average level; 5 points – the requirement is high) with the following assignment of appropriate relative values: 0.2; 0.4; 0.6; 0.8 and 1.0.

Conformity of performance over time is assessed by comparing with the average value in the market of transport and logistics services on the following scale:

– delivery time is less than the average by more than 10 %;

– delivery time is less than the average by less than 10 %;

– delivery time is equal to the average;

– delivery time exceeds the average by no more than 10 %;

– delivery time exceeds the average by more than 10 %.

It is also proposed to compare the price compliance indicator with the average industry level. The rating scale is similar to the previous scale.

As a result of work of this block of algorithm we will receive matrices of data on quality of transport and logistic services:

$$\text{A. } X\begin{pmatrix} x_{11} & x_{12} & \dots & x_{1i} & \dots & x_{1n} \\ x_{21} & x_{21} & \dots & x_{2i} & \dots & x_{2n} \\ \dots & \dots & \dots & \dots & \dots & \dots \\ x_{s1} & x_{s2} & \dots & x_{si} & \dots & x_{sn} \\ x_{S1} & x_{S2} & \dots & x_{Si} & \dots & x_{Sn} \end{pmatrix},$$

$$\text{B. } Y\begin{pmatrix} y_{11} & y_{12} & \dots & y_{1j} & \dots & y_{1m} \\ y_{21} & y_{21} & \dots & y_{2j} & \dots & y_{2m} \\ \dots & \dots & \dots & \dots & \dots & \dots \\ y_{s1} & y_{s2} & \dots & y_{sj} & \dots & y_{sm} \\ y_{S1} & y_{S2} & \dots & y_{Sj} & \dots & y_{Sm} \end{pmatrix},$$

$$\text{C. } Z\begin{pmatrix} z_{11} & z_{12} & \dots & z_{1r} & \dots & z_{1k} \\ z_{21} & z_{21} & \dots & z_{2r} & \dots & z_{2k} \\ \dots & \dots & \dots & \dots & \dots & \dots \\ z_{s1} & z_{s2} & \dots & z_{sr} & \dots & z_{sk} \\ z_{S1} & z_{S2} & \dots & z_{Sr} & \dots & z_{Sk} \end{pmatrix}. \quad (4.2)$$

Block 2 involves procedures for establishing indicators (coefficients) that characterize the ratio of quality components, namely the conformity of process quality to timing, the conformity of price processes and the ratio of timing and price:

$$K = \{K_{Xs}, K_{Ys}, K_{Zs}\}, \quad (4.3)$$

where K_{Xs}, K_{Ys}, K_{Zs} – coefficients that characterize the ratio of quality components, namely the compliance of process quality with deadlines, the compliance of price processes and the ratio of terms and prices when performing *s*-transport and logistics services.

Blocks 3–7 are cycles of comparison of coefficients of conformity for different transport and logistics services. Block 3 begins this cycle, ie the first ($s=1$) transport and logistics service, provided by a logistics company, is considered.

Blocks 4a–5a, 4b–5b and 4c–5c can be implemented in parallel.

Block 4a presents a comparison of the coefficients that characterize the ratio of quality indicators of the service process and the timing of the order on the s-th transport and logistics service. If this ratio does not exceed 1, ie there are shortcomings in meeting the quality requirements of the service process, it is necessary to decide on the goal of quality management (increase reliability, ensure flexibility of delivery, etc.) and define these goals (block 5a). At the same time, attention should be paid to the unambiguity of the goals, ie their content, size and timing; operability – their measurability.

Otherwise (if all comparisons are made for the s-th transport and logistics service) – go to the comparisons of indicators on the next ($s=s+1$) transport and logistics service (blocks 7a and 7b), provided that no comparison has been made for all types of transport and logistics services ($s<S$ – block 6).

Similarly, a comparison of the coefficients that characterize the ratio of time and price and the ratio of service quality and price on the s-th transport and logistics service is carried out.

We obtain the initial data for the analysis of the ratio of quality indicators of transport and logistics services $P_1'(\tau=[t_i,t_f])$, where t_i – initial, t_f – final moments of modeling (**Table 4.5**).

Table 4.5 The initial data for the analysis of the ratio of quality indicators of transport and logistics services

Actions	Comparison					
	X* and *Y		***Y* and *Z***		***X* and *Z***	
Comparison made	$K_{X_s} \le K_{Y_s}$	$K_{X_s} > K_{Y_s}$	$K_{Y_s} \ge K_{Z_s}$	$K_{Y_s} < K_{Z_s}$	$K_{X_s} \le K_{Z_s}$	$K_{X_s} > K_{Z_s}$
decision on the goals of quality management made	yes (decision on goal setting)	no	yes (decision on goal setting)	no	yes (decision on goal setting)	no

Block 8 implements the verification of the goals of quality management in terms of its various components for consistency. Consistency means compatibility, absence of contradiction – a logical criterion of correctness of the formulated goals of motivation. Thus, the comparison is carried out in pairs on the corresponding types of goals by assignment of signs «+» – at consistency of the goals and «–» – in the opposite case (**Table 4.6**).

If the goals of quality management of the logistics process and the goals of quality management at the time of an order do not contradict each other, we move on to the next block, otherwise – it is necessary to return to the formulation of relevant goals (blocks 5a and 5b) and either adjust them or exclude some.

Table 4.6 Checking the goals of quality management in terms of its various components for consistency

Quality management goals of the logistics process	Quality management goals for order time			
	G_{p1}	…	G_{pj}	G_{pm}
G_{p1}	+(–)	…	+(–)	+(–)
…	…	…	…	…
G_{pi}	+(–)	…	+(–)	+(–)
G_{pn}	+(–)	…	+(–)	+(–)

Block 9 formulates the overall goal of quality management of transport and logistics services (QMG) of an enterprise. The goal formation process is implemented «bottom up» (as opposed to the traditional sequential hierarchical distribution of the main goal in sub-goals – «top down»), ie goals of a lower hierarchical level – quality management goals of the logistics process and quality management goals at the time of an order form a higher level goal. Therefore, the overall goal of quality management of transport and logistics services consists of many goals of quality management of the logistics process, and quality management of the time of ordering, quality management of the price of services, which are included in the overall set of quality management goals (G):

$$GQM = <\{G_{pm}\}, \{G_{tm}\}, \{G_{prm}\}> \cup G. \quad (4.4)$$

Blocks 8 and 9 are logical operations, performed by specialists. The effectiveness of their implementation depends on many factors: the degree of knowledge of the problem, scientific foresight, personality traits and qualifications, behavior, intuition, and others. These operations are the mental conclusions of experts and are not subject to automation.

Block 10 provides an assessment of the importance of goals. The degree of importance of goals, the numerical characteristics of which are called priorities – the prerogative of a person who makes such decisions. Priorities, assigned by specialists, are called coefficients of relative importance of goals.

The procedure of pairwise comparison method can be a tool for assessing the importance of goals [16–18].

For p goals, a matrix of size $p \times p$ with elements:

$$F_{fq} = 1, \text{ if } G_{qmf} > G_{qmq}; \quad (4.5)$$

$$F_{fq} = 0, \text{ if } G_{qmf} < G_{qmq} \ (f, q = \overline{1,p}). \quad (4.6)$$

This means: if the goal of quality management of transport and logistics services G_{qmf} is not less than the goal G_{qmq}, ie $G_{qmf} > G_{qmq}$, then at the intersection of the f-row and q-th column is 1, if the goal of G_{Mq} is better than the goal G_{Mf}, then put zero.

Next, the procedure consists of calculating the sum of the elements F_{fq} for all columns, ie the number of quality management goals, in comparison with which the G_{qm} is more important:

$$Fq = \sum_{q=1}^{p} F_{f,q};\ (f,\ q = \overline{1,p}). \tag{4.7}$$

Summarize the values of F_{fq} on all lines and set the coefficient of relative importance of the goals of quality management of transport and logistics services:

$$k_{B_f} = \frac{F_f}{\sum_{f=1}^{p} F_f},\ (f,q =). \tag{4.8}$$

In block 11, criteria for achieving the goals of quality management of transport and logistics services are developed. In this case, the criteria must adequately reflect the degree of achievement of goals, be measurable. Such criteria are the criteria-requirements (U_g), in accordance with which decisions are made on the adoption and implementation of goals.

The criteria for achieving the goals of quality transport and logistics services can be the parameters of different types of resources: financial (costs, required to achieve the goals); time (time, for which the goals are expected to be realized); human (whether the necessary qualifications, experience and so on in the staff who will implement the goals), etc. These parameters are determined based on restrictions on the use of resources, ie the criteria for achieving quality goals are the maximum possible management costs:

$$\sum_{f=1}^{p} G_{M_f} \le \left\{U_g \subset R_1, R_2, R_3, R_4\right\}. \tag{4.9}$$

Block 12 involves the definition of quantitative characteristics (if possible) of the quality management goals of transport and logistics services. The characteristics of the quality management goals are the necessary means to achieve them. For example, for the goal of «developing a system of rewarding employees of an enterprise for quality» the parameters of the goals will be: the availability of information resources that characterize the achievement of quality by individual employees; availability of financial resources – bonus fund; availability of human resources – employees, engaged in bonuses; availability of material resources – technical means for calculations, stationery, etc.

In general, we obtain the following matrix of goals (**Fig. 4.4**).

Block 13 provides an assessment of the quantitative parameters of the goals according to the relevant criteria, ie it is checked whether there are enough resources of different types, needed to achieve the goals. With sufficient resources – goals are accepted (1), otherwise – rejected (0). In case of insufficient resources, it may be necessary to return to block 12 and adjust the quantitative parameters of the goals or to blocks 5a and 5b and specify or exclude certain types of goals.

Goals	Goals parameters by criteria			
	R_1	R_2	R_3	R_4
G_{qm1}	$P_{G_{M11}}$	$P_{G_{M12}}$	$P_{G_{M13}}$	$P_{G_{M14}}$
. . .	. . .	. . .	. . .	. . .
G_{qmf}	$P_{G_{Mf1}}$	$P_{G_{Mf2}}$	$P_{G_{Mf3}}$	$P_{G_{Mf4}}$
G_{qmp}	$P_{G_{Mp1}}$	$P_{G_{Mp2}}$	$P_{G_{Mp3}}$	$P_{G_{Mp4}}$

Fig. 4.4 The goals matrix

In block 14, the final selection of quality management goals for transport and logistics services is carried out. The following options are possible:

1) if at the previous stage a decision was made to adopt goals, and these goals are important, they are included in the list for further development;

2) if at the previous stage a decision was made to exclude the goals, and these goals are unimportant, they are not included in the list for further development;

3) if at the previous stage it was decided to exclude the goals, and these goals are important, they are included in the list for further development, but require the search or attraction of additional funds for their implementation.

Block 15 provides for the development of quality management strategies for transport and logistics services in accordance with consumers and employees of an organization as possible options for achieving the selected goals:

$$str_{r_n}\ (r = 1,2,\ldots,R_n);\ str_{r_m}\ (r = R_{n+1},R_{n+2},\ldots,R_m), \tag{4.10}$$

where R_n – number of possible quality management strategies for transport and logistics services, related to consumers; R_m – number of possible quality management strategies for transport and logistics services, aimed at employees of the logistics company.

Currently, in the modern literature, a list of typical strategies for quality management of transport and logistics services is not developed; in practice, logistics service strategies are used.

The most common approach to the selection of types of logistics service strategies is to use the classification of strategies of M. Porter. According to this approach, the following service strategies are distinguished:

1) low service costs (cost leadership);

2) selection of a client (for example, strategy of a highly profitable client or strategy of «elimination» for consideration of buyers undesirable from the point of view of difficult and expensive logistical needs;

3) logistics skills, ie the formation of the ability to generate original knowledge in the future (for example, skills in the field of logistics information management or unique performance of one or two service elements, etc.);

4) the most important element of service (replacement parts supply strategy);

5) trade-offs, ie the art of using the relationship between costs and benefits of service, the achievement of which involves the implementation of a strategy of low costs and high standards of service.

For the purpose of practical realization of strategies of quality of logistic service and maintenance of a choice of more effective administrative decisions, it is offered to allocate such strategies concerning an object, ie that, on which realization is directed first of all, and a subject (on which to direct supposed changes in logistic service) – **Table 4.7**.

At the next stage (block 16) it is necessary to choose a forecasting interval $t = [\tau_i, \tau_f]$, that reflects the implementation of this strategy of quality management of transport and logistics services.

Then the cycle of calculation of forecast values of quality parameters is realized under the condition of realization of each developed strategy str_r. Block 17 begins this cycle by considering the first type of strategy $r=1$. In block 18, the first time period from the prediction interval $t=1$ is taken for calculations. Block 19 provides for the calculation of forecast values of quality parameters according to the strategy option str_r, of the formation of the forecast $F_1(t+1)$.

To calculate the predicted values of quality parameters for each strategy option, we build a matrix of changes in quality indicators for processes S. In this case, if the achievement of the indicator in the process S_1 contributes to the achievement of quality indicators in other processes, the influence with a sign «+» is put, if on the contrary, interferes – a sign «–». The strength of the interaction will be estimated by linguistic formulations and expressed in quantitative terms from the interval [–1; +1] in accordance with the scales, presented in **Table 4.8**.

Matrices for changing the forecast values of quality parameters for each strategy (str_r) will look like this (**Table 4.9**).

The change in the values of quality parameters for each strategy (ΔK_{str_r}) is determined taking into account the ratio of the various components of quality by the formula:

$$\Delta K_{str_r} = \sum_{r=1}^{R} \sum_{s=1}^{S} K_{X_s} ORK_{Y_s} \cdot b_{sr}, \qquad (4.11)$$

where OR – operator, which means the use of the values of the quality indicators of the logistics process K_{Xs} or TLS deadlines K_{Ys} or TLS price K_{Zs} in the formula; b_{sr} – influence degree of the strategy str_r on the change of quality parameters for different types of transport and logistics services.

Blocks 20–21 are designed to calculate forecast values for the entire forecasting interval $t < \tau_f$, ie if there is the transition to the calculation of the forecast for the next forecasting period, otherwise – to block 22: calculation of forecast values for the next strategy of motivating the quality of consumers or employees of an enterprise.

● **Table 4.7** The types of strategies for ensuring the quality of transport and logistics services

Strategy type	Realization direction	
	TLS consumer	**Worker**
Improvement of the logistics process quality	Creation of a TLS quality management system	Introduction of a bonus system for the quality of transport and logistics services
	Certification of the company's quality management system in accordance with national and international standards and procedures (in particular, ISO 9000)	Delegation of responsibility, involvement in decision-making (creation of autonomous working groups, quality circles), use of «Job» – factors (increase of content, enrichment of work)
	Development and use of customer logistics standards	
	Benchmarking	Application of payment systems according to goals and results, taking into account the degree of effort
	Use of logistics technologies to support the product life cycle	Implementation of the system of internal communications
	Organization of client selection	Encouragement of employees to perform high-quality tasks on time
	Identificatiion and use of the most important element of service	
Optimization of TLS realization terms	Ensurance of a minimum delivery time	Implementation of programs, aimed at reducing working hours, its regulation by various methods, increasing the number of vacation days (depending on working conditions and years of service)
	Optimization of logistics infrastructure location	Adjustment of work schedules
	Selection of the optimal transportation option	Use of the system of working off (penalty working hours)
Price strategy for TLS	Application of a flexible pricing system	Improvement of the level of qualification of employees (according to their personal capabilities and production needs)
	Reduction of logistics costs	Use of the system of fines: for administrative violations (lateness, non-fulfillment of the plan, etc.); deprivation of the prize for unsatisfactory results

● **Table 4.8** The scales of interaction strength

Linguistic scale	Numerical scale – b_s
Absent interaction	0 (empty cell)
Very weak	0.1
Weak	0.3
Middle	0.5
Strong	0.7
Very strong	0.9
Absolute	1.0

Table 4.9 The matrix of change of the forecast values of quality parameters at str realization

S	*S*				Forecast of changes in quality parameters
	1	2	...	*S*	
	Coefficients of quality components ratios				
	$K_{X_{s1}}(K_{Y_{s1}})$	$K_{X_{s2}}(K_{Y_{s2}})$	$K_{X_{s3}}(I_{Y_{s3}})$	$K_{X_{s5}}(K_{Y_{s5}})$	
1	+1	b_{1_r}	...	b_{1_r}	$\Delta\sum_{s=1}^{S} K_{X_s} ORK_{Y_s} \cdot ORK_{Zr} \cdot b_{1r}$
2	b_{2_r}	+1	...	b_{2_r}	$\Delta\sum_{s=1}^{S} K_{X_s} ORK_{Y_s} \cdot ORK_{Z_s} \cdot b_{2r}$
...	...	...	...	...	...
S	b_{S_r}	b_{S_r}	...	+1	$\Delta\sum_{s=1}^{S} K_{X_s} ORK_{Y_s} \cdot ORK_{Z_s} \cdot b_{Sr}$
Totally					ΔK_{str_r}

Blocks 22–23 are implemented similarly, presenting a list of all options for quality management strategies for transport and logistics services.

In block 24, the exclusion of options for strategies that do not allow to achieve the maximum possible quality indicators is carried out. In block 25 – quality motivation strategies are selected. At the same time it is possible to choose several options of a strategy at the same time, taking into account the need to achieve quantitative parameters of the formulated goals.

According to the selected variants of the strategy, ways (methods) of quality motivation are developed (block 26), the decision on their application is made on the basis of the conclusion about the sufficiency of resources for their implementation (block 27).

The adopted methods of quality motivation are subject to implementation and realization (block 28).

Thus, the methodological bases of modeling the process of quality motivation in the organization of transport and logistics services, based on the creation of structural scenarios; the developed algorithm of their realization and the corresponding methodical maintenance of performance of the corresponding stages, have been developed.

The main limitation of this section and all previous ones (Sections 1–4) is the lack of emphasis on one of the fundamental components of each sector, each industry of all countries without exception – an enterprise. The level of «enterprise» is the lowest, but most important. It is the functioning of enterprises that ensures the activities of both the sector and the industry in particular, and the country as a whole.

Therefore, the following sections of this study will be devoted to the issues of quality management with elements of innovation.

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