

Analysis of Transaction Costs in Logistics and the Methodologies for Their Information Reflection for Automotive Companies



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Abstract. Transaction costs emerge in different types of logistics activities and influence the material flow and the accompanying financial and information flows; due to this fact, the information support and assessment are important tasks for the enterprise. The paper analyzes transaction costs in logistics for automotive manufacturers; according to the analysis, the level of these costs in any functional area of “logistics supply” ranges from 1.5 to 20%. These are only the official figures of transaction costs of enterprises that do not take into consideration implicit costs. Despite the growing interest in transaction costs in logistics in the latest fifteen years, this topic is covered rather poorly in Russian literature; the definition of “transaction costs” is unclear, there is no technique of their information reflection and assessment. We have developed the methods for information reflection of transaction costs that can be used by automotive enterprises. Each enterprise will have an opportunity to choose the most suitable technique for information

reflection of transaction costs or to compare the level of transaction costs when using different techniques. Application of techniques for information reflection of transaction costs allows the enterprises to increase profits by optimizing and reducing costs and using their assets more effectively, to identify possible ways to improve cost parameters of their performance, to improve their efficiency and productivity; to cut out unnecessary or duplicate activities, to optimize the number of staff involved in a particular activity.

Key words: transaction costs, supply logistics, information reflection of costs, logistics costs.

Analysis, information disclosure and evaluation of costs are especially important tools for managing the enterprise in today's economy.

According to the European Logistics Association (ELA), logistics services account for 10 to 20% in the structure of the global gross domestic product, and logistics costs, depending on the industry, account for 10–40% in the cost structure of production enterprises. Moreover, this proportion continues to increase along with the rising cost of raw materials, components, and increased competition in the upstream market. The analysis of the structure of logistics costs in different industries in economically developed countries shows that the largest share in it is the cost of stocks management (20–40%), transport costs (15–35%), the costs of administrative and managerial functions (9–14%), one of the components of which are transaction costs (TC).

With the rapid growth of logistics costs, a tendency toward the increase in TC is becoming more and more pronounced, and therefore it seems relevant to analyze the level of TC at Russian enterprises, to determine their place and role in logistics, and to develop techniques for their information disclosure.

Formation of the TC theory as a coherent scientific concept is associated primarily with the works of R. Coase, J. Wallis, D. North,

A. Alchian, H. Demsetz, O. Williamson, S. Chang, Y. Barzel, M. Jensen, and others.

R. Coase based his thoughts on the concept of transaction and introduced the concept of “transaction costs” (1937) for estimating the cost of transaction operations [14].

As he noted, “without the concept of transaction costs, which for the most part is missing in modern economic theory, it is impossible to understand how the economic system works, to analyze a number of its issues and to develop the basis for the elaboration of policy recommendations” [8].

The analysis of the works of J. Wallis and D. North [22] shows that there exist different sources of increase in the transaction sector, which is typical for logistics as well.

When determining transaction costs, P. Milgrom, J. Roberts [20], E.A. Brendeleev [2], Y. Barzel, [13] do not separate them from the manufacturing process. As for the study from the standpoint of logistics, it reveals new types of transaction costs that will not always depend on the production process.

O. Williamson [23], C. Dahlman [15], M. Jensen and W. Meckling [18] give the definition of TC using the instrumental category, such as the contract, without taking into account the principles of logistics.

Most researchers understand transaction costs as the costs of functioning of the system. However, there is no generally accepted

classification of these costs, every researcher draws attention to the most interesting elements. J. Stigler identified “information costs” [21], O. Williamson — “the costs of opportunistic behavior” [23] M. Jensen and W. Meckling — “the costs for monitoring agent behavior and the costs of its self-limitation” [18], Y. Barzel, — “the costs measurement” [13] P. Milgrom and J. Roberts — “influence costs” [19], H. Hansmann — “the costs of collective decision-making” [7]; C. Dahlman included in their composition “the costs of collecting and processing information, the costs of negotiation and decision-making, the costs of control and legal protection of execution of the contract” [7].

The estimate of TC in the total cost of the firm in the assessments of various researchers are presented in *Table 1*.

The role of TC in modern society is very significant. As follows from the table, the transaction sector of the economy is 50 to 70%, and it gradually growing. At the same time, the share of transaction costs in the total costs of the firm ranges from 1.5 to 15%, but in transition economies they can be significantly higher.

The following researchers studied TC in logistics: V.V. Borisova, E.A. Bondarenko,

E.V. Loginova, S.V. Noskov, N.K. Moiseeva, M.Yu. Vinogradov, A.V. Parfenov, B.K., Plotkin, S.A. Cherkasov, N.I. Khrameshkin.

All these scientists contributed to the development of this research direction, but though the popularity of research on transaction and TC has increased, mostly these studies are fragmented and non-systematic. To date, the logistics experts are faced with the problem of insufficient knowledge of TC in logistics, this fact prevents from obtaining an objective disclosure of the situation at the level of subjects of the logistic system. Objective assessment of TC in logistics should be the main concern of managers, since obtaining such information that is required for making management decisions and monitoring their implementation is one of the main objectives of the company.

Transaction costs are important for explaining many phenomena in logistics. In an uncertain economic situation, senior managers are interested in proper management of the internal costs of the company and its transaction costs in the supply chain.

In modern conditions of development of logistics there is a change in the level of TC. This is reflected in the increase in their share in the cost structure of the firm. For example,

Table 1. Estimation of the amount of transaction costs, %

Information source	Extent of the transaction sector of the economy	Share of transaction costs in the total costs of the firm
J.J. Wallis, D.C. North [22]	54.7	
E.G. Furuboth, R Richter [16]	50–60	
J.K. Lafta [9]	tp to 70	
M.Yu. Vinogradova [3]		from 1.5 to 15
L.V. Gusarova, I. Mirgaleeva [4]		6.7
S. Osmolovets [10]		11.57

the costs of marketing activities, the costs of maintenance of executive personnel, the costs of the services of logistics specialists, marketers and lawyers in today's market conditions can exceed the cost of creating the product itself. This stimulates the emergence of firms and, in the scale of economic systems, industries specializing in the production of means of transaction –management, logistics, marketing and auditing. In this respect, the growing TC in logistics can be seen as an indicator of economic progress of the society and its transition to a higher level of development.

The analysis of TC in the structure of logistics costs helps present more specifically the situation at the enterprises of the Russian Federation that concerns logistics costs and TC included in them.

All organizations in varying degrees depend on raw materials and services provided by other organizations. The implementation of supply is one of the main functions in each organization, and the costs of supply, as a rule, take the highest values, and therefore, the analysis of TC is carried out with the help of a functional area such as purchasing logistics.

The object of the study is transaction costs in supply logistics, studied on the example of the automotive industry of the Republic of Tatarstan (RT).

The object of analysis was selected on the basis of the following provisions. The Republic of Tatarstan is part of the Volga Federal District of the Russian Federation. According to the Federal State Statistics Service of the Russian Federation, the main indicators of socio-economic development in the Volga Federal

District are at a high level in comparison with other federal districts. Having analyzed the main socio-economic indicators of the republics constituting the Volga Federal District, we can conclude that of the Republic of Tatarstan is the most interesting region for analyzing TC in supply logistics at industrial enterprises.

In terms of the volume of industrial production, the Republic is among the top five regions of the Volga Federal District and among the top five leading regions of the Russian Federation as a whole.

We chose machine building, and namely its sub-sector – the automotive industry – in order to analyze logistics costs and TC included in them.

The automotive cluster created on the basis of leading enterprises “KAMAZ” and “Sollers” is one of the “engines” of economic growth of Tatarstan's industry. “KAMAZ” group of companies is the largest automotive corporation in the Russian Federation.

The share of KAMAZ, which is the key town-forming enterprise of the city of Naberezhnye Chelny, accounts for almost three quarters of the volume of industrial products produced in this city. Based on these indicators, we can conclude that Naberezhnye Chelny is a single-industry town. The volume of industrial production of its enterprises is about 20% of the total volume of products manufactured in Tatarstan.

The companies belonging to “Sollers” group of companies produce “Ford” cars, “Isuzu” trucks, and “SsangYong” SUVs.

In order to improve the reliability of the study, we formed a representative sample of the Republic's largest automotive enterprises

(50 companies, including “KamAZ” and “Sollers”), on the example of which we carried out the analysis of TC in supply logistics for

2008–2014 (Fig. 1–2). The figures show the level of TC calculated as a percentage of the total number of respondents.

Figure 1. Distribution of enterprises according to the share of TC in overall logistics costs in 2008–2014

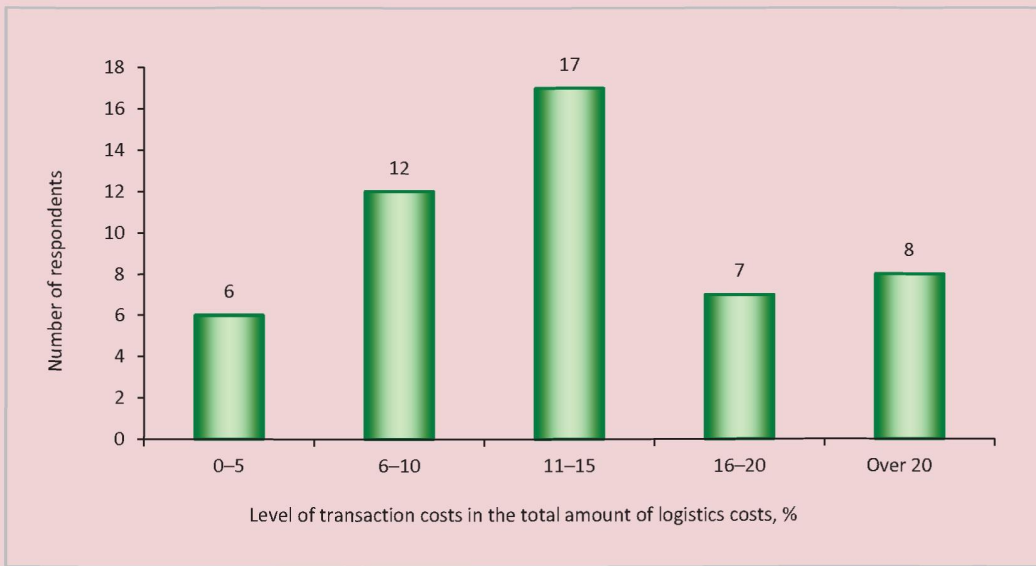
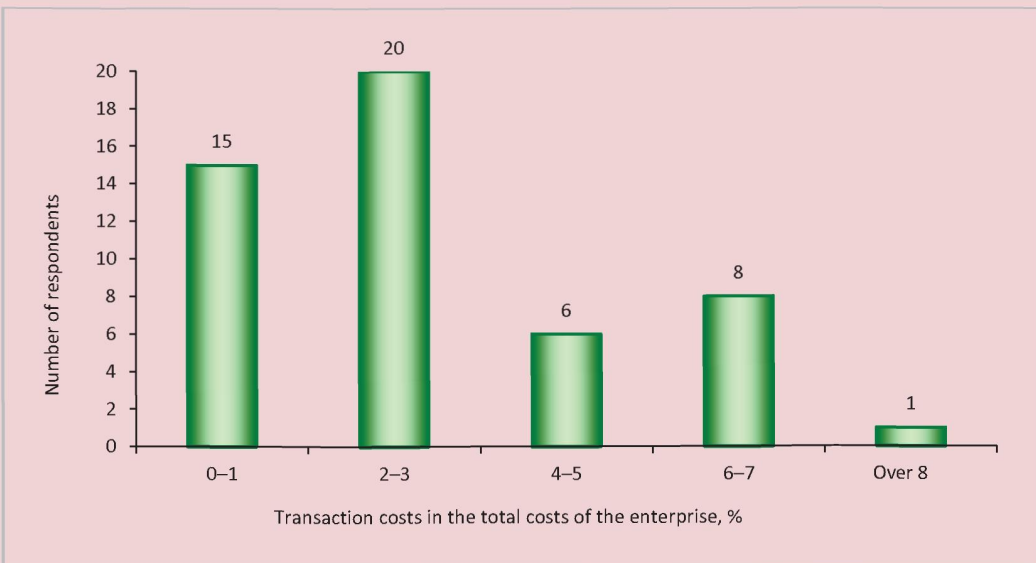


Figure 2. Distribution of enterprises according to the share of TC in the total costs of the enterprise for 2008–2014



As we can see, TC in supply logistics include:

1. The cost of finding information (communication services, including telephone calls, Internet, telex, fax and other means of communication, wages of employees engaged in search of the counterparties).

2. The costs of negotiating and concluding contracts (communication: telephone calls, Internet services, telexes, faxes, etc.; travel and hospitality expenses; the costs of requests and participation in auctions; the direct costs of legal registration of contracts; wage of employees who are engaged in negotiating and contracting).

3. The costs of conducting measurements (in the form of the costs of resources needed for the acquisition of measuring equipment in supply and the execution of measurement in assessing the quality of supplies; wages of inspectors engaged in the quality assessment).

Figures 1 and 2 illustrate a fairly high level of TC in supply logistics, it reaches more than 20% in eight automotive companies of the Republic, which confirms the relevance of the chosen research topic.

The similarly high level of TC in supply logistics is observed in the leading enterprises of the automotive industry abroad (*tab. 2*).

Transaction costs of automotive companies in this table are calculated as the cost of the goods purchased by one employee of the

supply service who performs transaction functions at that.

Over the past decade, many Western companies experienced a noticeable growth of logistics costs in logistical functions such as transportation, order processing, information and computer support, and logistical administration.

The integrated approach in logistics revealed a lack of information on costs. The planning and accounting systems that are traditionally used do not help allocate transaction costs from the total amount of costs. The analysis of TC in supply logistics with regard to their significant value for logistics systems predetermines the conclusion about the urgent need to develop methods of information disclosure of TC in supply logistics.

The techniques of information disclosure of TC in supply logistics are based on the principles of the ABC method [5, 6].

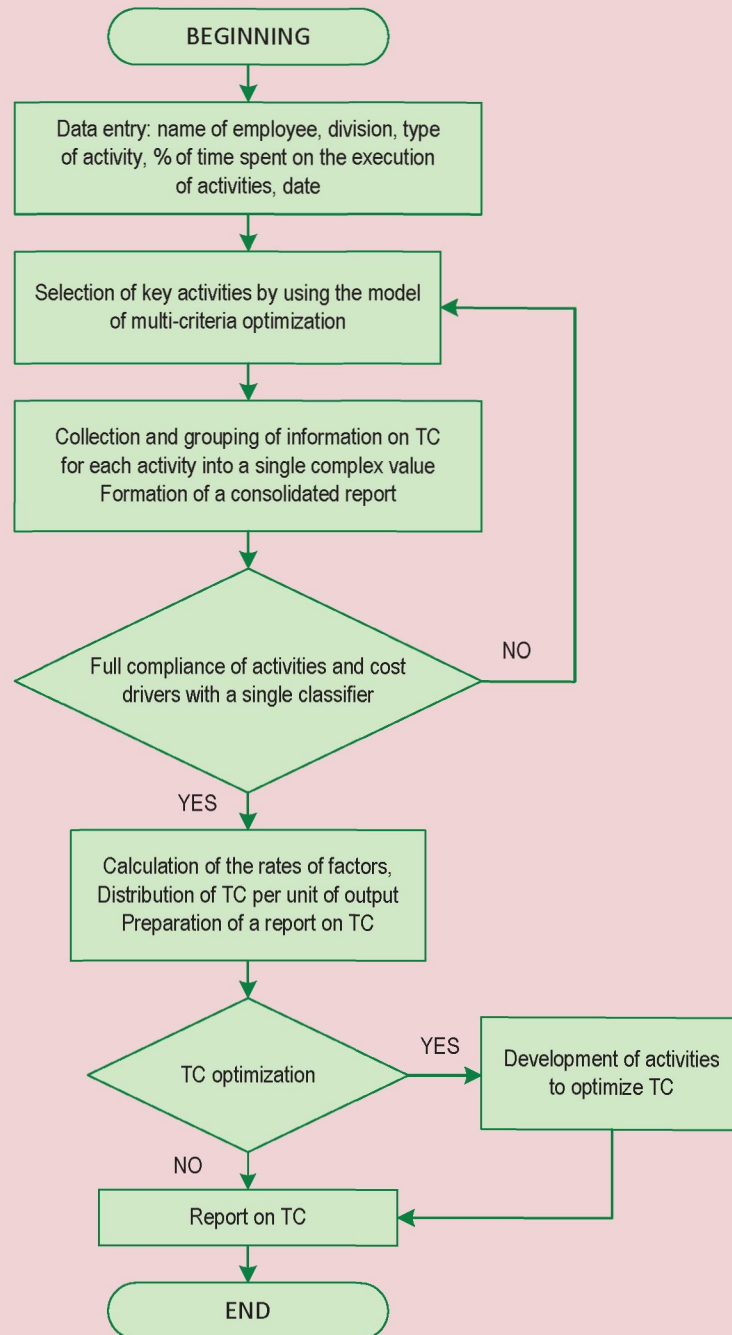
Figure 3 presents the algorithm for the technique of informational disclosure of TC in supply logistics. It includes the following steps:

1. Formation of a unified classifier of actions using a method of interviewing. Heads of departments that are the centers of TC are interviewed for the purpose of finding out what functions (actions) they perform and how much time it takes to perform these functions.

Table 2. Transaction costs in supply logistics at the leading enterprises of the automotive industry abroad [17]

Name	Chrysler	Ford	GM	Nissan	Toyota
TC of automotive companies, million US dollars	5.7	5.3	1.6	9.6	12.6

Figure 3. Algorithm for the technique of informational disclosure of TC in supply logistics



2. Types of activities are selected, because they will consume resources and incur costs. It is important to select only those actions which end in the obtaining of any result, because only then can they be attributed to a specific activity.

In order to reflect the costs of a particular activity, it is necessary to fill in the primary documents in accordance with the following requirements (*tab. 3*).

3. Based on the generated classifier of actions, the personnel that performs functions connected with supply logistics fill the form of the primary documentation, in which, according to their job description, they indicate the types of work performed, and the percentage of time spent on their execution.

4. The cost factors for each type of activity are selected and approved. On their basis, all the TC for this type of activity are distributed. The cost factor acts as a carrier of costs associated with certain activities, it is used as a base for the distribution of costs in this group.

The problem of choosing the types of activities, which emerges at this stage, is solved using the model for selecting and ranking the priority activities developed by the author [11].

5. Information on TC for each type of activity is grouped into a single value complex. The rates of factors (cost objects) are calculated.

When determining the costs in terms of type of action, it is necessary to use the factors to distribute among them the resources of overhead costs and TC. The costs associated with the actions performed by people will be distributed in proportion to the wage of the employee who performs the functions connected with supply logistics. The proportion of TC is defined as the product of the value of the cost factor R_i of the activity and its quantitative variable K_i , correlated with the specific object of calculation:

$$TC = R_i \cdot K_i. \quad (1)$$

Next, we allocate the costs by the type of activity by product (object). At this stage, TC are distributed by objects of calculation in the framework of the functionality of supply logistics. This stage allows us to identify the functions in the performance of which and the functionality in the framework of which the transaction costs reach the highest values, and which specific types of activities have the highest level of TC.

Table 3. Requirements to the registration of primary documentation on TC in supply logistics on the basis of the ABC method

No.	Economic operations	Primary document	Basis for establishing the code	Responsible service
1.	Payroll	Register of distribution of working time, job orders for contractor work	Types of works performed	Services, groups, departments
2.	Deductions from wages	Payslip	Type of payroll	Accounts department at the enterprise, finance department
3.	Overhead costs related to transactional activity in supply logistics	Registers of overhead costs	Types of overhead costs	Accounts department at the enterprise, finance department

The technique for information disclosure of TC in supply logistics includes a large volume of calculations; due to this fact, we propose the software that could be introduced at the automotive enterprises. It is possible to develop the information system on the basis of SAP. To facilitate the work of employees at this stage the proposed system coding transaction costs to work in SAP. This method of information disclosure is presented in more detail in [12].

According to many researchers who study the specific nature of TC, they consist of the costs of time and resources to conduct the transactions. Despite the wide distribution of this theoretical direction, currently there is no model for assessing TC in supply logistics. It is proposed to solve this problem with the help of an alternative technique for information disclosure of TC in supply logistics, which will make it possible to obtain one of the components of TC, and also with the help of models for assessing TC in supply logistics that we have developed.

As an example of a model for evaluating TC in supply logistics, the paper presents a model for estimating the costs of information search, the costs of negotiations and concluding contracts and the costs of measurement and control.

1. The costs of information search in supply logistics:

1.1. The costs of the search of information on suppliers of supply products and prices of supplies (C_{si}):

$$C_{si1} = WS + n \cdot C_{communication} \quad (2)$$

where WS is the wage of employees who are engaged in the search for information on suppliers

of supply products and prices of supplies (calculated according to the methodology of accounting TC in supply logistics), rubles;

$C_{communication}$ is the costs of communication, including, phone negotiations, Internet services, telex, fax and other means of communication, rubles;

n is the standard for the costs of communication.

1.2. The costs of the search for information on alternative suppliers (due to the incompleteness and inaccuracy of information):

$$C_{si2} = C_{si1} - (n \cdot C_{communication} + WS), \quad (3)$$

where WS is the wage of employees who are engaged in the search for information on alternative providers of supply products (calculated according to the methodology of accounting TC in supply logistics), rubles;

$C_{communication}$ is the costs of communication, including, phone negotiations, Internet services, telex, fax and other means of communication, rubles;

n is the standard for the costs of communication.

2. The costs of negotiation and contracting in supply logistics (C_{NaC}):

2.1. The costs of negotiations with contractors on supply logistics issues:

$$C_{NaC} = WS + HE + n \cdot C_{communication} + C_{travel} \quad (4)$$

where $C_{communication}$ is the costs of communication, including, phone negotiations, Internet services, telex, fax and other means of communication (calculated with use of developed standards), rubles;

n is the standard for the costs of communication;

HE — hospitality expenses, rubles;

C_{travel} is travel costs associated with the coordination of supply logistics issues (calculated using developed standards), rubles.

2.2. The costs of contracting:

$$C_{NaC} = n \cdot C_{communication} + C_{requests, auctions} + C_{LR} + C_{travel} + WS, \quad (5)$$

where $C_{communication}$ is the costs of communication, including, phone negotiations, Internet services, telex, fax and other means of communication (calculated with use of developed standards), rubles;

n is the standard for the costs of communication;

$C_{requests, auctions}$ is the costs of requests and participation of the company in auctions, rubles;

C_{LR} is the direct costs of legal registration of contracts;

C_{travel} is travel costs associated with the coordination of supply logistics issues (calculated using developed standards), rubles;

WS is the salary of a lawyer engaged in contracts with the contractors on supply logistics issues (calculated according to the methodology of accounting TC in supply logistics), rubles.

The standard for communications costs when searching for information changes depending on the number of counterparties (suppliers, logistics intermediaries) that were found when searching for information. Observations made at different enterprises show that, on average, 600 minutes per month are allocated for telephone communication (including telexes and faxes), 20 working days each consisting of 8 hours (a total of 160 hours per month) – for Internet services. Searching for information on one contractor on average

takes 20 minutes of telephone talks and 30 minutes of surfing the Internet. Based on the information received we calculated the standards needed to calculate costs in supply logistics.

3. The costs of measurement and control in logistics (C_m):

3.1. C_m when assessing potential sources of supply:

$$C_m = SW \cdot (1 - P_e), \quad (6)$$

where SW is the salary of the controller who makes the measurements (calculated according to the methodology of accounting TC in supply logistics), rubles;

P_e is the percentage of measurement errors ($P_e = 0.001 \div 0.002$).

3.2. C_m in assessing the quality of supplies:

$$C_m = C_{resources} + SW \cdot (1 - P_e), \quad (7)$$

where $C_{resources}$ is the cost of resources needed for measurement equipment in the supply and for measurement in assessing the quality of supplies, rubles;

SW is the salary of the controller who assesses the quality (calculated according to the methodology of accounting TC in supply logistics), rubles;

P_e is the percentage of measurement errors ($P_e = 0.001 \div 0.002$).

The models for evaluating TC help determine their level in supply logistics. The composition of TC can change depending on the specifics of work of the enterprise.

The values of TC obtained with the use of the alternative method are compared with the values of TC calculated according to the

methodology of information disclosure of TC on the basis of the ABC method for the purpose of their deeper analysis.

Further, we propose to systematize the obtained values of TC to determine their consolidated features, identify their patterns, since the types of TC are qualitatively and profoundly different, they have different properties, degrees of complexity, and development specifics.

The difference from the previous technique consists in obtaining the information about the aspect of TC: the amount of time spent on the performance of transactional activities, expressed in the form of wages, in the framework of the functions of supply logistics.

The alternative technique for information disclosure of TC in supply logistics involves the same stages, except for the following differences:

1. In the context of the alternative technique for information disclosure of TC in supply logistics, it is proposed to choose the amount of time spent on the given type of activity (number of hours) as the cost factor for all kinds of activities.

2. Requirements for primary documentation are generated as follows (*tab. 4*).

Due to the fact that the information disclosure of TC in supply logistics is carried out at the strategic management level and

at the operational level, it is necessary to use information on the wages of employees engaged in the strategic and operational management issues.

3. When calculating the costs of cost factors of one of the components of TC (salaries of the staff involved in transactional activities), it will be necessary to calculate the cost of one hour of each type of activity, which will vary depending on the level of management.

The accounting and managerial accounting data will serve as sources of information for the implementation of the proposed scheme for the assessment and informational disclosure of TC in supply logistics. In order to calculate TC in supply logistics, it is necessary to have the information about the average wage of employees and amount of the annual fund of working time. It will require additional analytical work on the informational disclosure of TC, and on the evaluation and development of optimization measures. The calculation of TC will be automated, which will facilitate the application of this methodology at the enterprise.

In order to reflect the actual parameters of the processes and real reserves for improvement of management activities, the application of the proposed methodologies is presented on the example of OJSC “Sollers — Naberezhnye

Table 4. Requirements for the registration of primary documentation on TC in supply logistics

No.	Economic operations	Первичный документ	Basis for establishing the code	Responsible service
1.	Payroll	Register of distribution of working time, job orders for contractor work	Types of works performed	Services, groups, departments
2.	Deductions from wages	Payslip	Type of payroll	Accounts department at the enterprise, finance department

Chelny". We analyzed logistics costs and TC included in them at this enterprise. The data for calculating TC of the enterprise were obtained from the reports of the enterprises on the accounts 25-1, 25-2, 26, 44, and the annual financial plan for 2009.

After calculating TC in supply logistics using various options, we compare the results obtained (*tab. 5*).

Thus, the highest level of TC in supply logistics has been determined by using the method of information disclosure of TC with the use of the model for selecting the key types of activities in supply logistics.

Having calculated the value of TC in the functional area "supply logistics", the enterprises carried out optimization of TC [1] to reduce total logistics costs. *Table 6* presents

Table 5. Results of calculating transaction costs

Functionality of supply	Amount of TC calculated according to the method of information disclosure of TC with the use of the model for selecting the key types of activities in supply logistics, rubles	Amount of TC calculated according to the alternative method of information disclosure of TC, rubles
Procurement management	2,485,624	2,573,863
Supplier management	1,568,650	1,639,725
Placing orders	114,659.5	186,556
Transportation	3,506,689	4,005,080
External materials handling	1,732,706	432,362
Warehousing	1,783,924.7	1,966,706
Inventory management	6,030,783	59,139
Return of packaging (defective product)	419,610.1	6,319,366
TC TOTAL	17,642,646	17,182,797

Table 6. Results of the analysis of economic indicators of OJSC "Sollers – Naberezhnye Chelny" before and after optimization of TC

Indicators	before 2009	after 2009	Deviation
			+,-
Revenue from the sale of products, thousand rubles	3 377 991	3 377 991	-
Cost of sold products, thousand rubles	3 269 074	3 230 246	-38 828
Direct costs, thousand rubles	2 822 058	2 802 885	-19 173
Marginal revenue, thousand rubles	555 933	575 106	19 173
Overhead production costs, thousand rubles	447 016	427 361	-19 655
Gross profit, thousand rubles	108 917	147 745	38 828
Profit from sales, thousand rubles	-322 953	-274 502	48 451
Profit before tax, thousand rubles	-1 518 420	-1 407 274	111 146
Net profit distribution, thousand rubles	-1 309 434	-1 206 043	103 392
Profitability:			
R of assets, %	-372.20	-264.95	107.25
R of own capital, %	-38.76	-35.70	3.06
R of sales, %	-9.88	-8.50	1.38
R of industrial activity (economic), %	-3.22	-2.71	0.51
R of productive capital, %	-13.51	-12.47	1.04
Total logistics costs, thousand rubles	3 875 142	3 855 828	-19 315

the results of the analysis of economic indicators of OJSC “Sollers — Naberezhnye Chelny” for 2009 prior to and after the implementation of optimization measures.

The implementation of measures to optimize TC resulted in a positive change in the total logistics costs by 19,315 thousand rubles, in a decrease in the overhead manufacturing expenses and self-cost on the whole by 38,828 thousand rubles, and also in a positive change in the indicators of profitability and cost-effectiveness. During the optimization for all types of TC it is forecast that there will be further increase in profit margins and productivity and decrease in net cost.

In modern conditions of tough competition on the commodity markets, it is a very challenging task to increase the company's profit by increasing production volumes, expanding markets and applying the policy of increasing prices. Therefore, the management of modern companies considers it a priority to reduce rationally its own costs in the areas of management, production, and logistics structures.

The functioning of logistics systems requires considerable resources: human, material, energy, information. In this regard, logistics costs account for a large share in the total costs of production and circulation. Transactions and related TC are an important part of logistics activities.

The share of the logistics component in the net cost of domestic products can reach 60%. In Europe, the cost of everything associated with delivery, storage and warehousing are 15% on average. The reasons for this contrast are

connected with the fact that in Russia prices are overcharged due to transportation and storage costs and disruptions of delivery dates, which has become a typical phenomenon in the relations between the Russian supplier and consumer.

The proportion of TC in the aggregate costs of the company is 1.5 to 20%, when the company is functioning on traditional markets; TC can increase up to 20–25% when it enters new markets. Specifics of the markets of some products can have great influence on the composition and structure of TC.

Thus, the problem of information disclosure an effective evaluation of transaction costs in logistics becomes a task of prime importance and is connected with effective management of the organization as a whole.

The proposed methods for information disclosure of transaction costs in supply logistics make it possible to distinguish them from the total costs of the enterprise, to avoid errors in their calculation thanks to minimizing the averaging of their value, which is so typical for traditional accounting systems. These methods also provide an opportunity to determine their real value, help obtain a large amount of information for managerial decision-making in other problem areas related to the logistics of supply, and determine possible ways of optimizing TC.

Alternative methods for information disclosure of TI in logistics, supply — tool reasonably accurate estimates of the value of the results of actions in terms of types of products. The technique provides information in the form understandable for the personnel directly involved in the business process.

If it is necessary to make a more detailed calculation of TC in supply logistics that requires a detailed clarification of the composition of TC, it is recommended to use an alternative method for information disclosure of TC, which will allow enterprises to identify possible ways of improving the cost parameters of activities,

to achieve improvements in efficiency and productivity, to identify the types of activities that involve the number of staff that exceeds the norm.

The choice of specific methods for information disclosure of TC in the logistics of supply will depend on the objectives of the enterprise.

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