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LOGISTICS CONTROL IN THE SYSTEM OF BUSINESS PROCESS MANAGEMENT AT ENTERPRISES IN THE TRANSPORT INDUSTRY

Perederii Nadiia, Marchuk Volodymyr, Ovdiienko Oksana. "Logistics control in the system of business process management at enterprises in the transport industry". The article examines the peculiarities of logistics activities of transport enterprises at the macro and micro levels. A transport enterprise can be considered an intra-production logistics system in which incoming material flows are transformed into transport services. The types of logistics activities of transport enterprises are analyzed, which are divided into four groups: "Supply Logistics", "Intra-Production Logistics", "Sales Logistics" and "Resource Logistics". A comprehensive indicator for determining the level of logistics controlling is proposed, which makes it possible to assess the state of logistics management. An algorithm for assessing the level of logistics controlling at transport enterprises has been developed, which consists of three survey stages. In the first stage, a survey of the expert group is conducted regarding the importance of each type of logistics activity in four groups. The second stage of the survey is the selection of the most important logistics and control indicators for further evaluation using the Delphi method. The third stage of the survey is determining the weight, points, and relative importance of each indicator.

A structural and logical scheme for the formation of logistics controlling indicators has been formed. On this basis, a system of basic logistics and control indicators for transport enterprises was developed. The developed model summarizes the system of logistic-controlling indicators, stages, and formulas for calculation and serves as a tool for determining the level of logistic controlling at a transport enterprise. The basis of the model is creating an objective system of logistics and control indicators for a specific enterprise. Using the

developed model for assessing the level of logistics controlling at a transport enterprise will provide the opportunity to obtain the necessary information for strategic and operational planning, as well as improve the management of logistics processes. Given the size and specificity of the enterprise's work, an essential task for managers is the formation of an information base for logistics management.

Keywords: logistics activity, logistics controlling, level of logistics controlling, supply logistics, intra-production logistics, sales logistics, resource logistics, a system of logistics and controlling indicators.

Передерій Надія, Марчук Володимир, Овдієнко Оксана «Логістичний контролінг в системі управління бізнес-процесами на підприємствах транспортної галузі». *У статті розглянуто особливості логістичної діяльності транспортних підприємств на макро- та мікрорівні. Транспортне підприємство можна розглядати як внутрішньовиробничу логістичну систему, у якій вхідні матеріальні потоки трансформуються у транспортні послуги. Проаналізовано види логістичної діяльності транспортних підприємств, які об'єднано в чотири блоки: «Логістика постачання», «Внутрішньовиробнича логістика», «Збутова логістика» та «Ресурсна логістика». Запропоновано комплексний показник визначення рівня логістичного контролінгу, який дає можливість оцінити стан логістичного управління. Розроблений алгоритм оцінки рівня логістичного контролінгу на транспортних підприємствах, який складається з трьох етапів опитування. На першому етапі проводиться опитування експертної групи щодо ваги кожного виду логістичної діяльності по чотирьох блоках. Другий етап опитування - виділення найважливіших логістично-контролінгових показників для подальшої їх оцінки за методом Дельфі. Третій етап опитування - визначення ваги, балів і відносної важливості кожного показника.*

Сформовано структурно-логічну схему формування показників логістичного контролінгу. На цій основі розроблено систему основних логістично-контролінгових показників для транспортних підприємств. Розроблена модель узагальнює систему показників логістичного-контролінгу, етапи, формули для розрахунку і служить як інструмент для визначення рівня логістичного контролінгу на транспортному підприємстві. В основі моделі є створення об'єктивної системи логістично-контролінгових показників для конкретного підприємства. Використання розробленої моделі оцінки рівня логістичного контролінгу на транспортному підприємстві дасть можливість отримати необхідну інформацію для стратегічного і оперативного планування, а також вдосконалення управління логістичними процесами. З огляду на величину і специфіку роботи підприємства для менеджерів важливим завданням є формування інформаційної бази для логістичного управління.

Ключові слова: *логістична діяльність, логістичний контролінг, рівень логістичного контролінгу, логістика постачання, внутрішньовиробнича логістика, збутова логістика, ресурсна логістика, система логістично-контролінгових показників.*

Передерий Надежда, Марчук Владимир, Овдиенко Оксана «Логистический контролинг в системе управления бизнес-процессами на предприятиях транспортной отрасли». *В статье рассмотрены особенности логистической деятельности транспортных предприятий на макро- и микроуровне. Транспортное предприятие можно рассматривать как внутрипроизводственную логистическую систему, в которой входные материальные потоки трансформируются в транспортные услуги. Проанализированы виды логистической деятельности транспортных предприятий, которые объединены в четыре блока: «Логистика снабжения», «Внутрипроизводственная логистика», «Сбытовая логистика» и «Ресурсная логистика». Предложен комплексный показатель определения уровня логистического контроллинга, который дает возможность оценить состояние логистического управления. Разработанный алгоритм оценки уровня логистического контроллинга на транспортных предприятиях, который состоит из трех этапов опроса. На первом этапе проводится опрос экспертной группы относительно веса каждого*

вида логистической деятельности по четырем блокам. Второй этап опроса - выделение важнейших логистически-контроллинговых показателей для последующей их оценки по методу Дельфи. Третий этап опроса - определение веса, баллов и относительной важности каждого показателя. Сформирована структурно-логическая схема формирования показателей логистического контроллинга. На этой основе разработана система основных логистически-контроллинговых показателей для транспортных предприятий. Разработанная модель обобщает систему показателей логистического-контроллинга, этапы, формулы для расчета и служит в качестве инструмента для определения уровня логистического контроллинга на транспортном предприятии. В основе разработанной модели лежит создание объективной системы логистически-контроллинговых показателей для конкретного предприятия. Использование разработанной модели оценки уровня логистического контроллинга на транспортном предприятии даст возможность получить необходимую информацию для стратегического и оперативного планирования, а также совершенствования управления логистическими процессами. Учитывая величину и специфику работы предприятия для менеджеров важной задачей является формирование информационной базы для логистического управления.

Ключевые слова: логистическая деятельность, логистический контроллинг, уровень логистического контроллинга, логистика снабжения, внутрипроизводственная логистика, сбытовая логистика, ресурсная логистика, система логистически-контроллинговых показателей.

Introduction. The logistics activity of the transport industry enterprises has many particularities and differs from enterprises in other sectors of the economy. Properly organized logistical support contains significant reserves for increasing the efficiency of management decision-making. The main emphasis of the logistics activities of transport enterprises is the synchronization of deliveries in time, selection of modes of transport, route optimization, information provision of the system regarding transportation needs and implementation possibilities, quality of service and packaging, etc. Taking into account the size and specificity of the work of transport enterprises, an important task is the formation of an effective management system for logistics business processes based on controlling, an innovative management tool in modern economic conditions. Controlling will allow not only to form an objective assessment of the state of the company's management system of logistics business process but also to ensure their proper information support, which is relevant for enterprises in the transport industry.

Recent research and publications analysis. The logistics and controlling integration form the concept of logistics controlling, which helps to determine directions for improving the management of material, financial and information flows in order to ensure the maximum efficiency of the enterprise as a whole. Logistics is aimed to optimize costs, associated with the organization of material flows. Controlling, as an integrated management function, uses these costs in the profit management system.

The use of logistics controlling for the management of logistics business processes emphasizes the importance of modeling and thorough research of indicators to improve the management system of the business process.

Evaluation of the effectiveness of the implementation of the enterprise's management system of the business process based on controlling ensures the integration of strategic and tactical management systems. In work [1], the effectiveness of the controlling implementation into the practice of business process management is proposed to be measured using a two-component integral indicator of the effectiveness of organizational design, which is based on diagnostics: the degree of the internal

environment capabilities usage and the degree of the business model rationality.

The application of logistics controlling increases the efficiency of the logistics system and makes it possible to identify and eliminate its "bottlenecks". This is achieved by the use of modern innovative logistics controlling solutions and provides an opportunity to provide the enterprise's top management with the necessary practical means to increase the managing logistics business processes efficiency.

Therefore, logistics controlling provides an opportunity to ensure an orderly and, if possible, continuous process of handling logistics data to identify deviations between the planned and actual values of logistics indicators, as well as to analyze these deviations to identify the causes of discrepancies.

The aim of the article. The research and formation of an indicators system of logistics controlling and, on their basis, to ensure the improvement of the logistics business processes management of enterprises in the transport industry.

The main material. Enterprises of the transport industry differ from industrial enterprises, firstly by their dual role in the functioning of logistics systems, which determines the specificity and peculiarities of the methodological tools of logistics controlling. For transport companies, the main logistics chain "supply - production - sales" is transformed into a chain "loading - transportation - delivery" [2, p. 55].

On the one hand, the transport enterprise is an element of macro-logistics systems that provide communication between stages of the logistics chain (advancement of material flow). On the other hand, it is a consumer of individual material flows, the final stage of the corresponding logistics chain. The transport enterprise acts as an intra-production logistics system in which incoming material flows (fuel, spare parts, aggregates, tires, etc.) are transformed into material services - transport. Transport enterprise as an element of macro- and micro logistics systems is presented in fig. 1.

At the macro level, transport enterprises act as elements of macro logistics systems. They ensure the rhythm of these systems and are sources of transport services. At the micro level, transport enterprises act as an intra-production logistics system and represent a number of interconnected subsystems that form certain integrity, and unity. These subsystems ensure the material flow entering the system, passing through it, and leaving the system in the form of transport services. According to the concept of logistics management, the construction of intra-production logistics systems should ensure constant coordination and mutual correction of plans and actions of supply, production, and sales stages within enterprises.

All elements of the micro logistics system closely interact with each other and have a single goal, which is subordinate to the functioning of the logistics system.

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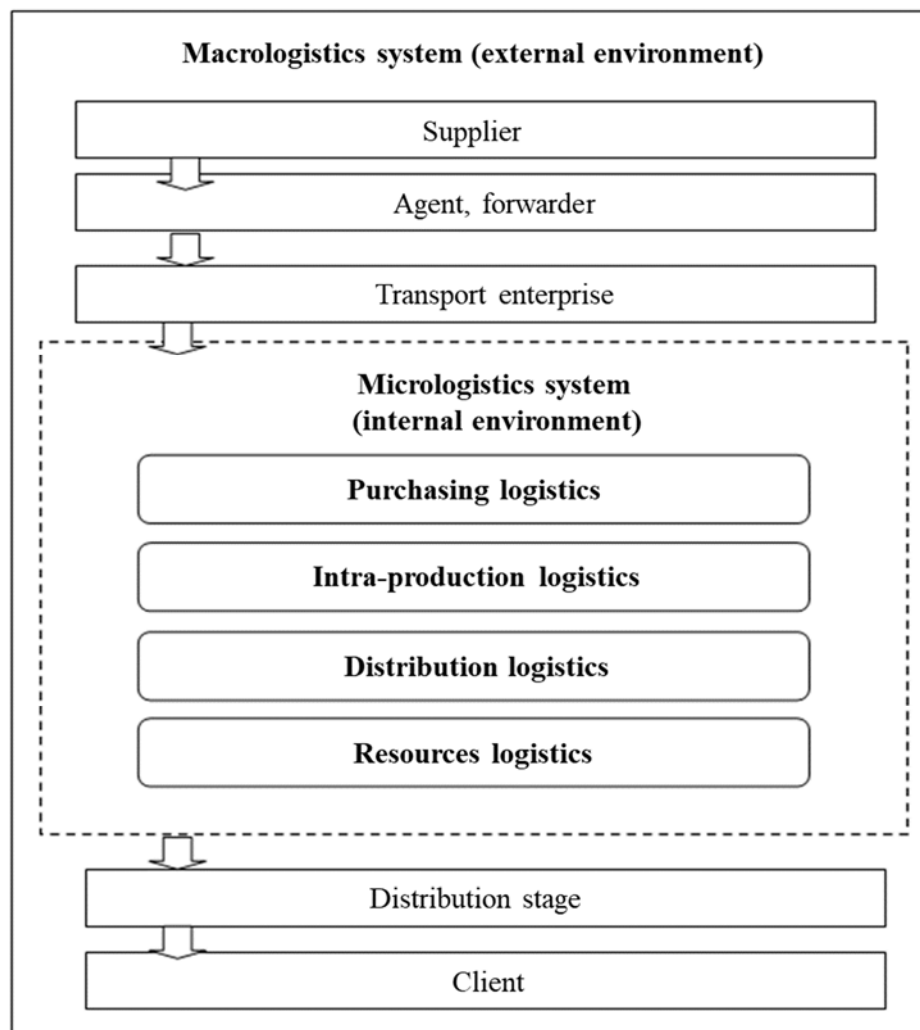
Figure 1 – Macro- and micro logistic systems of the transport enterprise

The purpose of the micro logistics system of transport enterprises is to satisfy the need for transport services of the required quality, in the required place, in the required quantity, at the required time, and with minimal costs. The micro logistics system of transport enterprises is a complete set of elements that interact with each other (fig.2).

Therefore, the micro logistics system of transport enterprises includes the following subsystems [3]:

− Procurement (material and technical support) - ensures the supply of material resources to the transport enterprise;

− Warehouses (buildings, constructions, devices, etc., where material stocks are temporarily placed and stored, and where material flows will be transformed);

− Inventory (materials that allow to respond quickly to changes in demand, and ensure the reliability of transport vehicles);

− Transport fleet (the rolling stock of the enterprise providing transport services);

− Production maintenance (maintenance and repairmen of rolling stock);

− Sales (the implementation of transport services);

− Information (communication between the elements of the micro logistics system, controlling the execution of logistics operations);

− Personnel (organization personnel engaged in logistics operations);

− Finances (circulation of funds necessary for managing the material flows of the micro logistics system of the enterprise).

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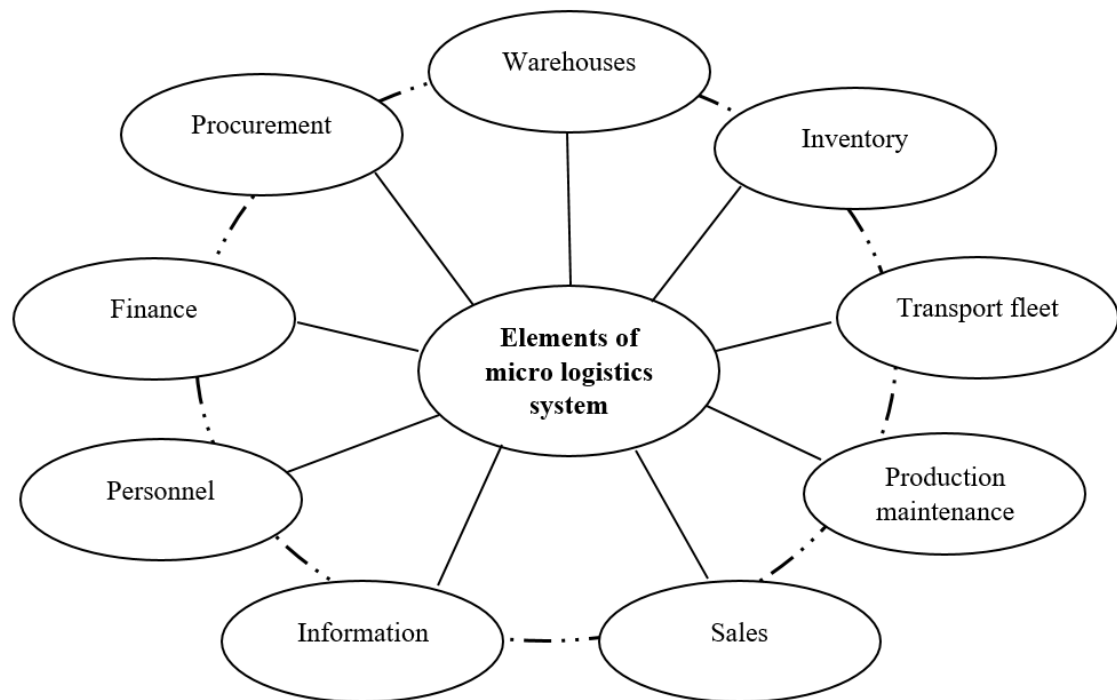
Figure 2 – The micro logistics system of transport enterprises

"Procurement", "Warehouses" and "Inventory" are subsystems in which the tasks of supply logistics for a transport company are solved. These tasks are formulated as the following statements:

− Material resources planning and forecasting;

− Nomenclature of consumed material resources optimization;

− Inventory management of the transport enterprises;

− Materials purchases and delivery organization;

− Material storage at the warehouse organization;

− Programs to save material resources development and control over their implementation;

− Control over the implementation of the cost estimate for supplies, etc.

"Transport fleet" and "Production maintenance" are subsystems in which tasks of intra-production logistics of transport are solved. These main tasks include:

− Transport services (main production) forecasting and planning;

− Maintenance and repairmen of rolling stock (auxiliary production management);

− Economic assessment of transport products;

− Main and auxiliary production operative management;

− Control over the quantity and quality of transport services, etc.

The main tasks of "Sales" at the transport enterprise contain:

− Transport type and mode choosing;

− Common planning of transport processes on different modes of transport;

− Rational routes development;

− Common planning of transport, warehouse and production processes, etc.

Subsystems "Information", "Personnel" and "Finance" solve the tasks of resource logistics. The content of resource logistics is largely determined by the list of problems solved by functional logistics, so it is appropriate to consider the problems solved by individual types of functional logistics [4].

Managers need to monitor the state of each type of logistics activity of a transport enterprise. A comprehensive indicator that shows the state of the management system of

the logistics business process is the level of logistics controlling. In order to assess the level of logistics controlling, it is necessary to create a group of experts to conduct a survey, which will allow managers to obtain information necessary for strategic and operational planning to assess the state of management of logistics business processes. The algorithm for evaluating the level of logistic controlling consists of three stages of surveying an expert gr; as a rule, it consists of 6-10 people with the necessary competencies.

The first step consists in surveying the expert group regarding the weight of each type of indicator in four groups in the enterprise's logistics activities: I "Supply logistics", II "Intra-production logistics", III "Sales logistics" and IV "Resource logistics" (table 1).

Table 1 – The system of main indicators for transport enterprises

Group name	Group description
I "Supply logistics"	- procurement logistics controlling (volume of supply, reliability of supply, the average cost of supply, costs of supply, total volume of transport costs for supply, number of suppliers, number of submitted orders, etc.); - stock logistics controlling (stock utilization level, stock holding costs, stock storage period, stock turnover, etc.); - warehouse logistics controlling (warehouse utilization rate, the average cost of warehouse space, warehouse freight turnover, storage costs, etc.).
II "Intra-production logistics"	- production logistics controlling (the number of vehicles, the technical readiness ratio of the transport fleet, the degree of transport usage, the utilization ratio of carrying capacity, transportation costs, transportation time, a total distance of transportation, average distance of transportation, costs of overloading, etc.); - internal transport controlling (operating costs for vehicles, labor-intensive maintenance, labor-intensive current repairs, vehicle utilization ratio, etc.).
III "Sales logistics"	- orders controlling (the number of transport services consumers, the total number of orders received, the volume of unfulfilled deliveries (transportations), the volume of transport operations, the reliability of deliveries, the quality of deliveries, the rhythm of deliveries, the uniformity of transportation of goods, sales costs, etc.).
IV "Resource logistics"	- information resources controlling (level of information support, speed of document circulation, etc.); - personnel resources controlling (personnel quantity, labor productivity, coefficient of total turnover of personnel, coefficient of stability of personnel, etc.); - financial resources controlling (revenue from logistics services, net profit (loss), the profitability of transportation, the share of logistics costs in revenues, the share of transportation costs in logistics costs, the share of logistics costs in the structure of total costs, etc.).

The result of the first step of this methodology is the formed equation for determining the level of logistics controlling (LLC) at the transport enterprise (1):

$$\text{LLC} = \alpha \text{ Su} + \beta \text{ IP} + \gamma \text{ Sa} + \delta \text{ Re} \qquad (1)$$

where α – weight determined by experts for group I "Supply logistics" (Su);

β – weight determined by experts for group II "Intra-production logistics" (IP);

γ – weight determined by experts for group III "Sales logistics" (Sa);

δ – weight determined by experts for group IV "Resource logistics" (Re).

The sums of the relative values of the indicators within each of the groups Su, IP, Sa, and Re will be calculated in the third step of this methodology.

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The basis of the model for determining the level of logistics controlling is the creation of an objective system of indicators for a specific enterprise. That is why the preparation of materials for conducting the second step of the survey is the formulation of the base of the indicator on the enterprise's activity. Built on these analyses and systematization of the indicator base, a system of indicators is formed to assess the level of logistics controlling at the transport enterprise.

The second step of the survey is the selection of indicators for their evaluation according to the Delphi method. At this phase, experts are invited to make a detailed analysis of the micro logistics system of the transport enterprise. Experts use the system of indicators to separate those that best reflect the implementation of tasks set before each type of logistics activity of the enterprise. Secondary indicators will be "screened out" each time. The survey is conducted until the experts reach a final agreement. The optimal quantity of indicators for each of the four groups is considered at the level of ten.

The second step of the survey is completed when the experts reach an agreement and allocate approximately ten indicators in each group. The analysis outcome is a compiled resulting table of indicators of logistics controlling with the most significant evaluation indicators.

The third step of the survey consists in determining the weight, points, and relative importance of each indicator. At this phase of the survey, each expert is offered a resulting table with the results of the second step. Their task is to evaluate each indicator relative to the strength of its influence within each group by type of logistics activity on a point scale from one to ten and determine its weight in percentages (1-100%). Each indicator is subjected to fundamental analysis.

The next step is to find the sum, and average values by weight and points, and calculate the relative importance of the indicators. Next, the sum of the relative values of the indicators within each type of logistics activity of transport enterprises is determined and the level of logistics controlling is calculated according to formula (1). The developed model summarizes the system of logistics controlling indicators, and stages, and serves as a tool for determining the level of logistics controlling at a transport enterprise (fig. 3).

LLC presented the level of logistics controlling management at the transport enterprise. Its result provides the management staff of the companies with important information for decision-making. Hence, it is considered if values are equal to:

0 – 2,0 – LLC is absent – the indicator value is too low. This specifies the crisis state of the company's logistics system and the practical absence of management of logistics business processes at this particular transport entity.

2,1 – 4,0 – LLC is low – logistics management does not solve the tasks given to it; a detailed analysis of indicators and the preparation of appropriate measures for each logistics activity are needed, in particular.

4,1 – 6,0 – LLC is average – the enterprise manages logistics business processes, but it does not allow to ensure the fulfillment of all the tasks given to it, namely, it does not allow to ensure a quick reaction to changes in the system, which in turn affects the quality of logistics service.
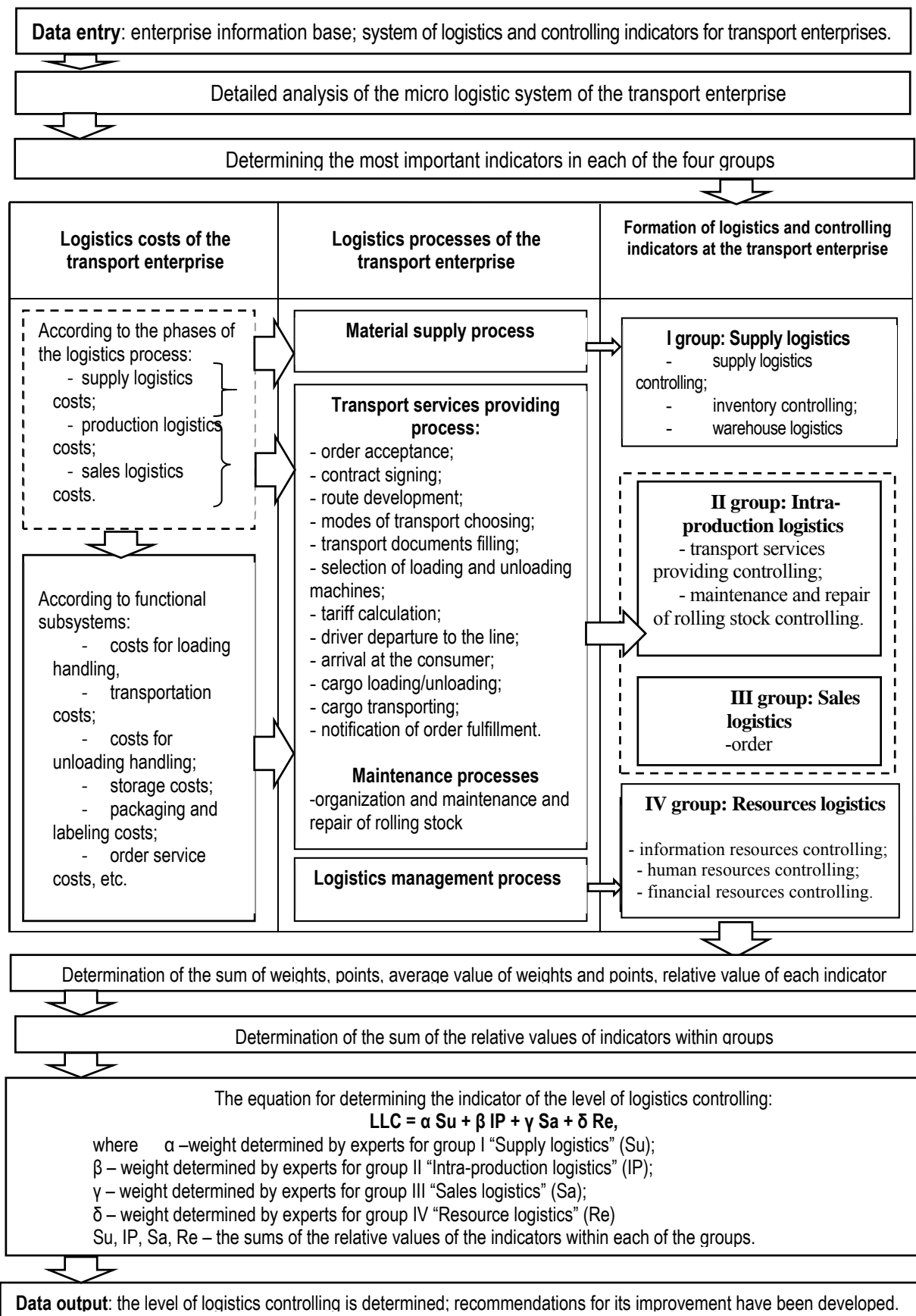
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Data entry: enterprise information base; system of logistics and controlling indicators for transport enterprises.

Detailed analysis of the micro logistic system of the transport enterprise

Determining the most important indicators in each of the four groups

Logistics costs of the transport enterprise	Logistics processes of the transport enterprise	Formation of logistics and controlling indicators at the transport enterprise

According to the phases of the logistics process:
- supply logistics costs;
- production logistics costs;
- sales logistics costs.

Material supply process

I group: Supply logistics
- supply logistics controlling;
- inventory controlling;
- warehouse logistics

Transport services providing process:
- order acceptance;
- contract signing;
- route development;
- modes of transport choosing;
- transport documents filling;
- selection of loading and unloading machines;
- tariff calculation;
- driver departure to the line;
- arrival at the consumer;
- cargo loading/unloading;
- cargo transporting;
- notification of order fulfillment.

According to functional subsystems:
- costs for loading handling,
- transportation costs;
- costs for unloading handling;
- storage costs;
- packaging and labeling costs;
- order service costs, etc.

II group: Intra-production logistics
- transport services providing controlling;
- maintenance and repair of rolling stock controlling.

III group: Sales logistics
-order

Maintenance processes
-organization and maintenance and repair of rolling stock

IV group: Resources logistics
- information resources controlling;
- human resources controlling;
- financial resources controlling.

Logistics management process

Determination of the sum of weights, points, average value of weights and points, relative value of each indicator

Determination of the sum of the relative values of indicators within groups

The equation for determining the indicator of the level of logistics controlling:
LLC = α Su + β IP + γ Sa + δ Re,
where α –weight determined by experts for group I "Supply logistics" (Su);
β – weight determined by experts for group II "Intra-production logistics" (IP);
γ – weight determined by experts for group III "Sales logistics" (Sa);
δ – weight determined by experts for group IV "Resource logistics" (Re)
Su, IP, Sa, Re – the sums of the relative values of the indicators within each of the groups.

Data output: the level of logistics controlling is determined; recommendations for its improvement have been developed.

Figure 3 – Model for determining the level of logistics controlling at transport enterprise
(developed by the authors)

6,1 – 8,0 – LLC is high – management of logistics business processes ensures compliance with regulatory requirements, but its individual elements require improvement and advancement.

8,1 – 10,0 – LLC is extremely high – the management of logistics business processes functions perfectly, successfully ensuring the fulfillment of all tasks set against it with the help of individual IT solutions. Reaching such indicator values is quite difficult in modern conditions of enterprise management practice.

General recommendations for the management of the enterprise have been developed for each LLC. In the absence of LLC (0 - 2.0), the management of the enterprise should take all possible measures for the functioning of the enterprise as a logistics system and use tools of logistics controlling in the management of business processes. With a low LLC (2.1 - 4.0), the management should take the initiative to implement the concept of logistics controlling in the management activities of the transport enterprise. With an average LLC (4.1 - 6.0), the management of the enterprise should undertake steps to improve the management of logistics business processes based on logistics controlling and pay special attention to the importance of consumers, personnel, and suppliers and the introduction of modern IT technologies. With a high LLC (6.1 - 8.0), the management of the transport enterprise must

maintain the current state of management and implement a wide range of logistics controlling tools. With an extremely high LLC (8.1 - 10.0), the management of the transport enterprise should pay special attention to the use of logistics controlling tools and the development and implementation of innovations in the transport services market.

Conclusions. The use of the developed model for assessing the level of logistics controlling at the transport enterprise makes it possible to obtain the necessary information for strategic and operational planning and control.

The system of indicators was formed for the purpose of detailed analysis of the state of each type of logistics activity of transport enterprises. The proposed indicator for evaluating the level of logistics controlling (LLC) enables management to periodically assess the state of logistics management. Based on the obtained results, managerial personnel can separate the logistics business processes that need to be improved. The implementation of the developed measures will make it possible to increase the efficiency of the management of logistics activities by transport enterprises, which will be seen during the next evaluation of the level of logistics controlling. Using a wide range of logistics controlling tools, managers can receive objective and reliable information for making management decisions..

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