BUSINESS PROCESSES IN THE SYSTEM OF AUTO-RECYCLING

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ABSTRACT

The article considers the organizational aspects of the process of recycling automotive components of decommissioned vehicles. The conceptual model of supply chain management in an auto-recycling system is designed. The problem of duplication of logistics and marketing functions is indicated, the role of logistic controlling in optimization of business processes is shown by forming an integrated database of auto-recycling and a system for supporting the life cycle of auto components of decommissioned vehicles.

Keywords: automotive industry, business process, supply chain, auto recycling, logistics, marketing, controlling.

Background. *In developed countries, recycling of motor transport waste has become widespread. The European level of recycled autowaste is about 80–85 %. Automotive industry consumes 10 % of mined and recycled materials. On average, about 20 % of ferrous metals, 7 % of lead, 13 % of nickel, 35 % of zinc, and 50 % of copper are spent on production of machines, spare parts, structural and operational materials from the total volume of resources. To produce one ton of car components, approximately 150 tons of natural raw materials are needed [5].*

In Russia today, the situation develops when, with the huge potential of the auto-recycling market, with availability of real reserves of resources for processing, profile enterprises are idle or their capacities are loaded only by 20–30 %. At the same time a worn out car contains ferrous and non-ferrous metals, plastics and rubber products, glass, ceramics, wood, textiles and so on. That is, there is a non-used or little-used source of secondary material resources.

In addition, the environmental aspects of recycling automotive wastes are also extremely important. Repeated use of them will reduce the technogenic impact on the environment, reduce the need for landfills for waste disposal, and reduce consumption of energy and water resources.

Objective. *The objective of the authors is to consider various business processes in the system of auto-recycling.*

Methods. *The authors use general scientific methods, comparative analysis, economic assessment method.*

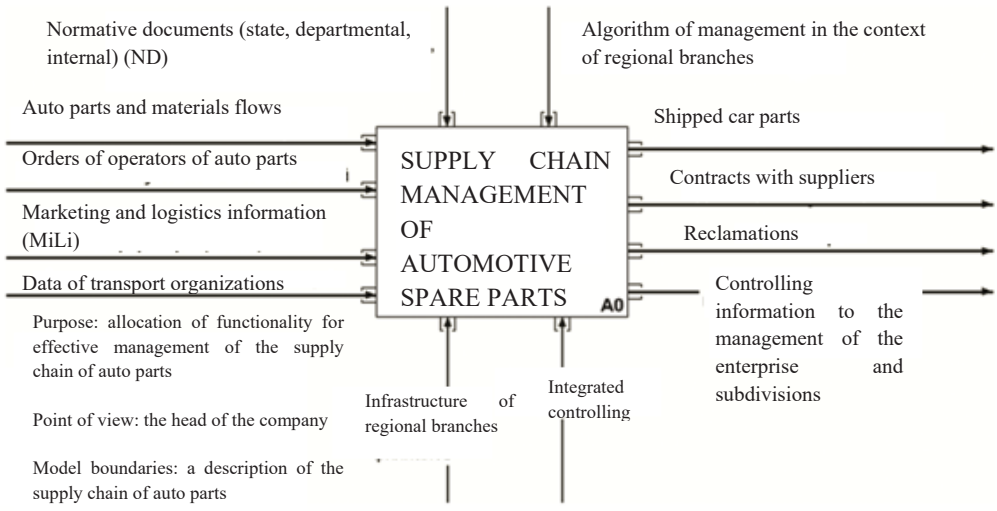
Results.

Context of supply chains

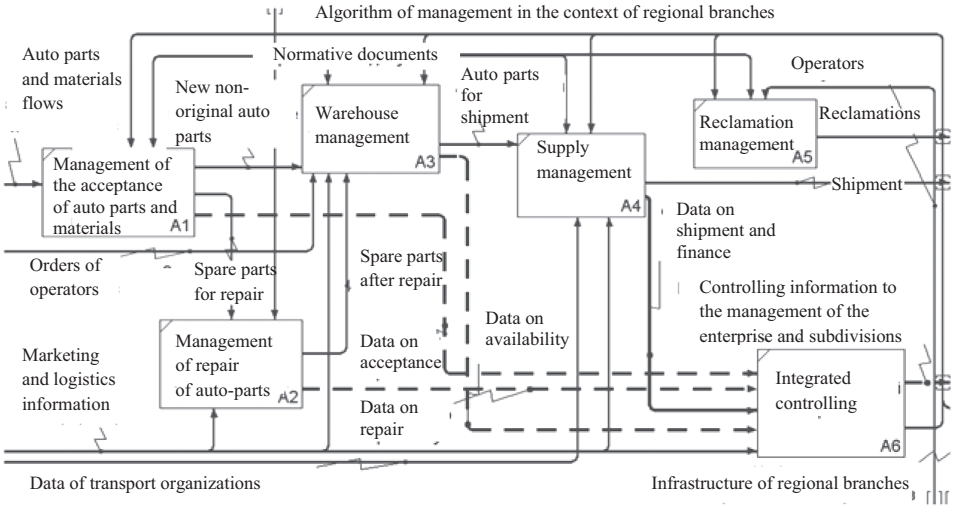
The issues of organization of the recycling process of a decommissioned vehicle (DV) and its waste, the legislative and financial and economic problems of constructing a recycling system become more urgent every year.

The life cycle of the car includes a lot of tasks for a car owner regarding maintenance, repair and recovery of the car after the cases of its damage, insurance and car services are forced to engage in their solution. At the same time, economic factors remain essential at all stages. Actually, they have also determined the formation of a dynamically developing secondary market for auto parts. According to the analytical data, during the period of active driving a driver spends about 1200–1500 US dollars per year for repair and maintenance of a car, which contributes to creation of a favorable climate for a car service [2].

Auto components after disassembly of an unusable car or its damage in case of an accident can be restored. Tasks of this kind are fully solved within the framework of autorecycling. Its process involves collection and delivery of decommissioned vehicles to dismantlement facilities, where an assessment of their technical condition, removal of gasoline, oil,



Pic. 1. Context IDEF0-diagram of the process of supply chain management of auto parts (A0).



Pic. 2. Decomposition of the process of supply chain management of auto parts (A1–A6).

liquids and other harmful substances that are prohibited for disposal at landfills are carried out. From the used vehicles parts and blocks are dismantled that are suitable for recovery and sale as spare parts (this is about 20–25 % of a car mass). Approximately 15 % of the mass is sent for recycling. About 60–65 % passes grinding and further processing at the shredding plants [4].

Using the BPWin simulation tool in Pic. 1 a contextual diagram of data flows is shown for implementation of the company's business processes, which sells new non-original auto spare parts, repairs and restores auto parts of previously insured cars for later sale. These functions are part of the logistics chain of auto-recycling. Contextual IDEF0-diagram conceptually simulates a business process and has a star-shaped structure, where in the center there is the main process (A0) – management of supply chains of auto parts, connected to external sources and recipients of information.

In the context diagram of the process of managing the supply chains of auto parts (A0), the data flow at the input is represented by:

- *data on supplies of spare parts and materials;*
- *data on availability and range of consumers of auto parts;*
- *data on marketing and logistics research of the auto parts market;*
- *data of transport organizations.*

The data flow at the output from the system includes the following elements:

- *data on shipments of auto parts;*
- *data on reclamations;*
- *complex information of the controlling service to the management of the enterprise and functional subdivisions.*

To manage the system of turnover of automobile parts, regulatory documents (state, departmental, internal), as well as an algorithm for managing regional branches of the company that perform the functions of the general process of auto-recycling, are needed. A key mechanism for managerial decisions is an integrated controlling system, which comprehensively integrates external and internal information resources. The organizational and technical tasks are accomplished by regional branches.

In Pic. 2, the context diagram is decomposed to highlight the control function of the supply chain management of auto parts in the following sequence:

- *management of receipt of auto parts (A1);*
- *management of repair of auto parts (A2);*
- *warehouse management (A3);*
- *management of supply of auto parts (A4);*
- *reclamation management (A5);*
- *integrated controlling (A6).*

Management of acceptance of auto parts and materials (A1) is carried out as the auto parts and materials arrive.

Repair management (A2) is built in accordance with regulatory documents (state and departmental standards for quality assurance and safe operation of auto parts), uses modern production technologies for processing dismantled auto parts, includes the entire arsenal of production logistics.

Warehouse management (A3) is conducted on the basis of data on the presence of auto parts, customer orders, regulatory documentation requirements for storage and transportation of spare parts in the warehouse economy, and warehouse logistics technologies. Stage A3 is functionally connected to the blocks A1 and A2, at this stage the chain of the auto parts flow is branched into two flows. The first comprises new auto parts, in the factory package, provided with the technical accompanying documentation of the manufacturer, the second one concerns the auto parts after decommissioning of vehicles that have been left out of service or the auto parts after repair. Repaired parts are packed and accompanied by technical documentation prepared directly by the auto-recycling company.

Supply management (A4) is the process of transferring auto components to consumers when marketing and transport logistics technologies are implemented.

The claim of consumers of goods to the enterprise as a result of violation of the terms of the contract regarding supply of products, performance of works, provision of services, quality of auto components and other disputable issues is carried out through reclamations (A5).

The supply chain management algorithm allows to maintain the optimal balance of auto parts receipt and functioning of the company's trading and repair

Table 1

Integration of logistics and marketing functions in business process management

Nature of the production management function	Logistics	Marketing
Development of product assortment structure	+	+
Management of production processes (repair)	+	–
Selection of equipment and development of technological processes	+	–
Material and technical support of production	+	–
Preparation of production for industrial consumption	+	–
Selection of the transport model in the distribution system	+	+
Service system management	+	+
Dispatching production facilities	+	+
Designing of production and transport-warehouse capacities	+	+

Note: «+» – supports implementation of the function; «–» – does not support implementation of the function.

areas through integrated controlling (A6). In the course of controlling, data on the results of each functional section and a comprehensive study of marketing and logistics information are processed, thereby providing information and analytical support to managers at all levels of the enterprise in their efforts to achieve strategic and operational goals of business [1, 6].

Logistics and marketing

As a rule, the activities of companies that recycle auto parts are not detailed. At the same time, scientific literature testifies to the relevance of this topic. In our opinion, the social role of recyclers engaged in the return of auto parts into the life cycle of a car is great. In fact, thereby the company assumes responsibility for the quality of parts commensurated with the responsibility of the manufacturer of new parts.

Thus, the issues of safe operation of a car make the activity of recyclers an ecologically and socially significant in matters of life safety and preservation of human health. Therefore, the recycling company must use modern technologies to bring auto parts that came after dismantling of decommissioned cars to the level of quality of goods that meet all safety standards. According to the accepted requirements, the basis of effective logistics activity of the recycling company are:

- *equipping with modern equipment of the company's repair and trading areas;*
- *ensuring the production of high-tech equipment and information systems;*
- *application of a unique system of accounting and maintenance of the life cycle of goods;*
- *use of modern materials and innovative technologies in the field of car repair;*
- *high speed of information exchange between structural subdivisions and functional units of the company, suppliers and consumers.*

The structure of the zonal functionality of the company, shown in Pic. 2, covers all areas of logistics and marketing. The peculiarity of modern enterprises is combination of a number of technologies of warehouse and trade zones in one room. In a market economy, coordinated development of the marketing and logistics activities of the enterprise has become vital. The economic literature uses definitions like «logistics marketing» and « marketing logistics» [7]. Terminological preferences in approaches are determined by the authors in accordance with the specifics of economic entities that are now in a difficult situation. Decrease in production volumes, reduction of consumer demand, changes in legislation become a weighty reason for transformation of the market structure, and therefore the accents in the concept of recycling companies are also changing.

In the context of the study of the process of managing the supply chain of spare parts, it is necessary to note the changes in the [Russian] law on priority of repair over the cash payment in compulsory motor third party liability insurance ([in Russia it is called OSAGO], which came into force on April 28, 2017. Following the implementation of legislative acts, there may be changes in the concept of company management, when the consumer will give preference to new auto parts. Despite the fact that the scientific community generally recognizes the existence of problems of interaction between marketing and logistics, there is no common opinion on the interfunctional coordination of these spheres [3].

Analyzing the interaction of logistics and related services of the enterprise in managing the distribution of flows, you are convinced that each of the activities is focused on its local goals and functional interests. This is due to duplication of the logistic service indicators and the parameters characterizing the marketing mix in the preparation of management information [8]. For example, for logistic and marketing purposes, the functions of locating an enterprise, developing a product, an assortment structure, manufacturing and packaging, planning a transport and warehouse network, managing internal and external transport, and planning services are characteristic (Table 1).

Disagreements in the interaction of marketing and logistics include imperfection of traditional organizational structures, application of existing accounting standards, lack of planning and optimization of the individual indicators of functional units. To solve these problems, the authors turn to construction of process-oriented organizational structures.

Analyzing the peculiarities of contradictions in the interaction between marketing and logistics, it seems important to conclude that it is necessary to introduce flexible, mobile tools integrating various functional areas of the enterprise into the system of management solutions. The relevance of such tools is most significant in the activities of large companies, when there is a geographic location of the organization with sufficient isolation of regions. In this case, certain rights are delegated to branches in the decision-making process. If the territorial unit is given the status of relative independence, then the divisional structure prevails here.

It should be noted that coordination and integration of logistics and marketing activities on the principles

of integrated controlling are significant in the management of companies with a divisional structure. In this regard, the coordinating function of controlling should be considered as result-oriented management support. It extends not only to development, coordination and integration of individual plans of the company into a single document, but also to internal production accounting. The complex task of controlling is planning with an integrated system of planning and control calculations based on information from internal production accounting.

Investigating the functions of marketing and logistics, it should be borne in mind that marketing is mainly focused on external transactions to the organization, logistics – on internal transactions. The integration role of controlling is the function of consulting and servicing, preparing and implementing solutions that orient the product, functional and regional divisions, product groups and services, program activities and projects at all levels of management to achieve the company's objectives. Measuring the results of logistics business processes based on controlling principles can become a condition for implementing a logistics strategy, as it provides the feedback necessary for effective management [6].

Integrated controlling makes it possible to establish and monitor quantitative and qualitative indicators, contributes to an integrated approach to making logistics decisions. The central element of controlling is a monitoring system that uses the resources of the corporate information system. Based on the results of the monitoring, decisions are made about corrective effects regarding logistics business processes. In our opinion, the organization of monitoring following the principles of controlling logistics is especially relevant for enterprises with a divisional structure.

The introduction and development of the principles of controlling logistics in the system of auto recycling enterprises should be considered the basic concept in creating an integrated data bank on the material, technical and information status of the elements of vehicles that have been out of service or the database of controlling software for managing the auto-recycling system. The development of such an integrated data bank will increase the level, quality and safety of services in the secondary market for auto parts.

Conclusions.

1) The conceptual model of business processes (model of supply chain management) of the enterprise in the system of auto-recycling at the example of the company's business processes, which sells new non-original auto parts, repair and restoration of auto parts of previously insured cars for subsequent sale is designed.

2) The problem of duplicating the functions of logistics and marketing in the process of managing the production system of auto-recycling is indicated. The necessity of introducing into the system of management solutions of flexible, mobile tools integrating the functional resources of various areas of the enterprise with a divisional structure is grounded.

3) The role of integrated controlling in optimization of business processes of an enterprise in the system of auto-recycling based on information and analytical support of managers at all levels in the process of making managerial decisions to achieve strategic and operational goals of business is singled out.

4) It is shown that logistic controlling in the management of companies in the system of auto-recycling can be a central link in development of an integrated database and a system for supporting the life cycle of all types of automobile components of decommissioned vehicles.

REFERENCES

1. Anankina, E. A., Danilochkin, S. V. Controlling as an instrument of enterprise management [*Kontrolling kak instrument upravleniya predpriyatiem*]. Moscow, UNITI publ., 2002, 279 p.

2. Eremeev, I. A., Malysheva, T. V. Marketing logistics as a factor in development of auto-recycling [*Marketingovaya logistika kak factor razvitiya avtoretsiklinga*]. *In: Institutes and mechanisms of innovative development: world experience and Russian practice / Collection of articles of VII international scientific-practical conference*. Kursk, 2017, pp. 363–367.

3. Kandilov, V. P., Semenova, O. Yu., Malysheva, T. V. Information support of the system of indicative management of social and economic development of the Republic of Tatarstan [*Informatsionnoe obespechenie sistemy indikativnogo upravleniya sotsial'no-ekonomicheskim razvitiem Respubliki Tatarstan*]. *Voprosy statistiki*, 2010, Iss. 9, pp. 56–60.

4. Malysheva, T. V., Ganeeva, G. A. Organizational and economic features of distribution logistics of petrochemical industries [*Organizatsionno-ekonomicheskie osobenosti raspredelitel'noi logistiki neftehimicheskih proizvodstv*]. *Vestnik Kazanskogo tehnologicheskogo universiteta*, 2014, Iss. 21, pp. 432–435.

5. Mitrokhin, N. N., Pavlov, A. S. Utilization and recycling of cars: study guide [*Utilizatsiya i retsikling avtomobilei: Ucheb. posobie*]. Moscow, MADI publ., 2015, 120 p.

6. Sergeev, V. I. Research of the state of logistic controlling at Russian enterprises [*Issledovanie sostoyaniya logisticheskogo kontrollinga na rossiiskih predpriyatiyah*]. [Electronic resource]: http://www.lscm.ru/index.php/ru/po-godam/item/745. Last accessed 15.02.2018.

7. Trifilova, A. A. Marketing logistics: study guide [*Marketingovaya logistika: Ucheb. posobie*]. N. Novgorod, NNGASU publ., 2011, 83 p.

8. Shinkevich, M. V., Malysheva, T. V. Improvement of the mechanisms of regulation of scientific and innovative activity at the regional level [*Sovershenstvovanie mehanizmov regulirovaniya nauchno-innovatsionnoi deyatel'nosti na regional'nom urovne*]. *Vestnik Belgorodskogo univesiteta kooperatsii, ekonomiki i prava*, 2016, Iss. 5, pp. 142–151.

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