Logistics technologies in mechanical engineering complex: the prospects for outsourcing applying

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Abstract. The current state of the mechanical engineering complex of Russia requires the application of new industry process management technologies. In this regard, we consider the technologies of the logistic approach associated with reducing the costs in material resource flow management. One of these technologies is applying of logistics outsourcing system into the external logistics system of mechanical engineering enterprises.

1. Introduction
Mechanical engineering is one of the largest branches of the national economy of the Russian Federation and consists of more than 200 sectors. The structure of the mechanical engineering complex includes such areas as automobile manufacturing (31%), heavy power engineering (more than 10%); electrical engineering and instrumentation industry (12%); tractor and agricultural engineering (about 4%); engineering for light and food industries (2%); engineering for urban utilities (2%); machine-tool industry (2%) and other types of mechanical engineering complex (in total 31%). The complex composition of mechanical engineering industry, the products of which are used in almost all sectors of the national economy, requires manufacturers to focus not only on procurement and production activities in the process of creating products, but also on distribution [1].

The world mechanical engineering market is developing at a higher rate than the Russian one. This is due to the factors of sectoral factors: an increase in the cost of intellectual technology, multi-stage production cycle and low capital turnover rate, a decrease in foreign investment, high costs of moving material resources associated with the differentiation of logistics distribution channels.

Experts of the RIA-Rating agency forecast trends to maintain industry growth rates of 3% per year [1]. This forecast is due to the growth of imports in some industrial areas, which makes it possible to judge about the existence of economic integration processes, as well as the ability of international enterprises to develop new territorial markets and confirms the need to develop cost management technologies in the logistics sector.

First of all, the application of the logistic approach in industrial production management is aimed at planning, accounting and reducing logistics costs, which currently make up at least 15% in the structure of all costs of engineering enterprises. As source of growth for engineering enterprises many scientists and experts consider the application of the logistics concept of industrial production management that implies the study of the full cycle of logistics process – the "supply-production-sales" [2].

2. Application of logistics technologies at mechanical engineering enterprises
The purpose of the logistic approach application at the mechanical engineering enterprise is the end-to-end management of material flows [3]. The logistic approach peculiarity is the feedback between the
links of the material resources management system and the development of internal and external logistics integration of industrial enterprises. The basic concepts in logistics are logistic flow and logistics technology. The concept of logistic flow means the flow of material resources and the associated flows of financial and information resources. Logistics technology is a standard sequence of logistic functions that has a certain theoretical basis - a conception.

The need for studying the logistics technologies arose in the period of combining two basic functions - transportation and storage of material resources. This was the reason for appearance of an appropriate logistic conception, the “technological” one. Despite the topicality in Russia of the technological conception that combines several types of logistics operations or functions, the integrated logistics conception is poorly being applied in various sectors of the country's economy.

In the scientific and educational literature, the concept of logistics conception is often used precisely as a technology for production process organizing, what distorts its original meaning as a stage of development of logistics in general.

When describing logistics process management system, as logistics conceptions are considered the following: MRP-I (Material Resources Planning) and MRP-II (Material Requirements Planning), DRP (Distribution Requirements Planning), production management technology OPT (Optimized Production Technology), the concept SCM (Supply Chain Management) is considered as a module of production systems [4].

In our opinion it would be more correct to consider the development of management systems, as well as the development of technologies, within the framework of existing or new conceptions of logistics management, and not vice versa.

The choice of a logistics management system depends on the following factors:

- feature of production and market of products distribution (or sales);
- identification of the classification group of the key logistic process (supply, production or sales);
- strategies of logistic costs management with a focus on their structural decomposition and choice in the predominance of storage or transportation costs.

The actualization of applying the supply chain management conception will require mechanical engineering enterprises to develop the following systems and technologies: JIT and JIS systems for managing the supply process, transition to the system of procurement on electronic platforms for reducing logistic costs and expanding the market of suppliers, as well as development of integrative processes in distribution through changes in the supply chain from the manufacturer to the final consumer.

There are barriers to the development of logistics outsourcing system in Russia, both in the engineering industry and in other industries and the agricultural sector. The issues of mechanical engineering enterprises transition to the system of logistics outsourcing, otherwise to the system of contract logistics, are lobbied poorly at the moment. This is due to the intention of the enterprises to control the logistics and production processes and the insufficient quality of logistics services in Russia.

It should be noted that the very concept of logistics outsourcing as a technology of logistics processes management in the manufacturing sector in Russia is not popular enough.

Meanwhile, logistics outsourcing is the transfer of non-production logistics functions to external service companies. Logistic outsourcing has lots of advantages. It allows the manufacturer to focus on the core business, to use the best experience in the organization of logistics processes, to provide active feedback between the manufacturer and the consumer, to help in costs reducing by applying the advanced technologies for delivery and storage.

Research of foreign scientists confirm the effectiveness of contract logistics in the following areas: the providing information on the goods route, customs declaration and customs clearance of cargoes, documentation preparing, organization of port cargo delivery, warehousing and storage in transit, coordination of transport deliveries, negotiating on transportation tariff, choosing carrier, monitoring the reliability of supplier [5].
Generalization of scientific developments and practical experience in managing the logistics of the enterprise made it possible to classify them according to key logistics process features and to the production process of the mechanical engineering enterprise, which is shown in figure 1. Possible combinations of supporting each other technologies in different production conditions are presented, planned and market ones.

**Figure 1.** Logistics processes, technologies and systems under the conditions of planned and market production.

The first character of logistics technologies division is its relation to the external or internal logistics flow. The field of internal logistics at the first stage of application of logistics technologies cannot be outsourced. This is confirmed by the experience of all industrial and agricultural organizations. According to the authors, the most effective is the transfer of external logistics functions to outsourcing. The arguments for maintaining the logistics internal field in managing the focus company are the following factors:

- the need to control the quality of incoming items and products of work in progress;
- the need for quality control and timely delivery of items in the production process;
- the need to comply with production standards and safety standards in the process of internal redistribution of the material flow;
- the need to correctly calculate the level of safety stock of materials and items under the conditions of planned production and application of MRP and OPT systems;
- the safety of quality of finished products in the warehouse and the reduction in the materials and parts delivery time.

The field of external logistics is the most free for applying the logistics outsourcing system and for transferring to external management the delivery processes of materials and parts from suppliers, as well as the provision of integrated transport and logistics services for the sale of finished products.
One of the most important aspects of the application of logistics technologies in the mechanical engineering industry is the organization of the distribution process. The lack of the necessary base of practical research in the field of organization of the distribution system of finished products, the lack of arguments for engineering companies transfer logistics processes of distribution to outsourcing, leads to the increase in costs. Understanding the problem, mechanical engineering enterprises conduct independent developments in optimization of logistics processes in corporate management [6].

3. Experience of logistics technologies applying in mechanical engineering complex

One of the most striking examples of the application of logistics technologies in the mechanical engineering complex is the formation and development of the corporate logistics system of KAMAZ PJSC. The basis for the development of the represented management system of enterprise is the division of logistic processes on the basis of relation to production, which enables specialization and improvement of the quality of individual processes in specific areas of work. The transformation of the enterprise into an industrial corporation led to the restructuring of the management system, the allocation of subsidiaries and the emergence of new divisions and branches in the management structure.

The main problem of subsidiaries in the field of logistics management is the lack of information systems that provide management of material flow and control of the movement of financial resources when returning products. It is noteworthy that the same problems are faced by agricultural organizations that refuse using logistics outsourcing and transfer functions for the technical support of product supply.

In 2013 top managers of KAMAZ PJSC recognized the need for further development of logistics technologies beyond the control of production process management and to develop external logistics [7]. In the field of internal logistics, as fragmented management decisions of KAMAZ PJSC were implemented such projects as “Synchronization of the truck production flow”, inventory management system, projects for manufacturing special containers for spare parts storage and packaging, the Logistics Center (hereinafter LC), having a network organizational structure, the SAP system (in German “Systeme, Anwendungen und Produkte in der Datenverarbeitung”), providing information support of material flows.

Since all the presented projects concerned only internal logistics, in 2015-2016 KAMAZ PJSC raised the issue of developing a strategy for reducing logistics costs. The project ”Transport costs reduction for JSC "KAMAZ" inter-plant transportation was developed as a part of this strategy. As basic problems of logistics management were considered downtime of cars, violation of terms of material resources delivery, the need to reduce transport needs by 25% by optimizing delivery routes. As a scientific method, the KANBAN system was applied, determined the problem areas of inter-industrial logistics processes. The application of the KANBAN system and the materialflows monitoring has resulted in the reduction of 56 units of own vehicles and 59 units of vehicles third-party companies.

The negative aspect of the experiment is the use of its own human resources (100 persons) forced to be engaged in mapping without the necessary skills. In terms of logistics functions transferring of transportation and transshipment of material resources to outsourcing, a mechanical engineering enterprise could reduce the costs of both the application of new logistics technologies and the cost of maintaining vehicles and transportation.

Taking into account the preference of mechanical engineering enterprises for independent control over the intra-production logistics processes, it is necessary to consider the prospect of implementing information logistics systems [8]. In mechanical engineering, such systems can be used for transportation, storage and processing of stocks of material resources entering production. Economic benefits by information logistics systems implementing in machine-building manufacture are as follows: reducing the time of logistics process, reducing the level of material resources in the field of production, improving the reliability of information. A key aspect of management by information logistics systems implementing is the formation of the conditions of their choice.

When choosing the information logistics system for a mechanical engineering enterprise, it is important to take into account the innovation of technology, the critical time of the logistics process and the functional area of management. As such functional area of management, in this case, transportation of material resources between production divisions of the mechanical engineering enterprise is considered. Among the systems for managing the material resources transportation the most well-known
are cargo selection systems and analytical systems, such as Gonrand, Videotrans, Espace Cat, ISCIS. Russian experts highlight the lack of information about these systems and the resulting complexity of the choice [9]. Meanwhile, the introduction of such systems can reduce both the time of selection of the carrier and the cost of delivery of material resources at the right time to the right place. For large corporate companies, the most suitable foreign system is ISCIS (the analytical supply chain management system) which allows transportation between the company's divisions. An additional advantage of this system is the ability to assess costs and calculate delivery efficiency, as well as the possibility of their applying in the management of external material flows.

4. Conclusion
The logistics technologies introduction is a prerequisite for development of modern mechanical engineering production complex. The actualization of logistics technologies application is associated with logistics costs optimization, which will free up a part of financial resources for developing the logistics infrastructure complex or investing scientific and technical developments.

As one of the promising technologies, the use of a logistics outsourcing strategy in managing external logistics of large engineering companies is considered. As promising areas of integration of logistics companies with mechanical engineering enterprises should be considered the field of consulting services in acquisition or development of logistics technologies, in organization the goods transportation including routing, handling and monitoring of goods in transit, as well as in documentary registration in the process of international delivery of goods.

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