

Information system for managing material flows of manufacturing enterprise

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Abstract. Theoretical issues, guidelines and practical suggestions for diagnosing the management of material flows of a manufacturing enterprise using the example of "KraMZ" are discussed in the article. The following tasks in accordance with the purpose of the study were formulated: to develop and study the material flow management system of the production enterprise "KraMZ", to evaluate the functioning efficiency of the developed material flow management system of this enterprise.

1. Introduction

In modern conditions of market relations formation, the approach to the management of production at industrial enterprises is radically changing. In these conditions, the product manufacturer is required to expand the variety of manufactured goods, to preserve the time intervals between the purchase of raw materials and the delivery of products to the final consumer, high readiness for changes taking into account market requirements, provided that high quality products and lower costs are ensured [1].

The effective implementation of production processes in a developing market environment can be ensured by modern approaches to managing material flows, which allow optimizing the process of goods movement from material support to marketing of finished products [2].

2. Development of a material flow management system

In order to manage successfully the material flows of the enterprise, it is advisable to allocate a special logistics service that would manage the material flow, starting from the formation of contractual relations with the supplier and ending with the delivery of finished products to the buyer [3].

The main goal of such a logistics center being created will be to provide management and control functions over all the material flow processes of an enterprise [4].

Using the logistic method in managing material and information flows in practical activities will ensure [5]:

- 1) flexible response to changing consumer priorities;
- 2) a significant reduction in the time intervals between the acquisition of raw materials and supplies of products to the final consumer;
- 3) minimization of inventory;
- 4) acceleration of the process of obtaining information;
- 5) effective use of production and labor resources of the enterprise.

Such a management system concentrates on itself practically all processes, that is, on the basis of the existing demand for products, available and anticipated orders, general production schedules, distributed among the workshops are formed. Based on the planned volumes, supply schedules are developed to ensure the production process without downtime. Such a system links a complex production mechanism into a single whole. Moreover, the management system is an interconnected structure for the implementation of certain functions on the basis of a single management of the logistics center of the enterprise.

Using a pushing material management system based on the concept of RP using the MRP2 system will allow the enterprise [6]:

- to receive up-to-date information on the current results of the enterprise's activities as a whole and with full details on the selected elements, which can be individual structural units, specific customer orders, types of material resources, and others;
- to carry out activity planning, both in the long-term and operational modes;
- to optimize production and material flows; reduce stocks of material resources, work in progress and finished products;
- to carry out planning and control the entire cycle of the production process with efficient loading and use of production facilities, all types of resources to meet the requirements of customers;
- to automate the work of the structural units of the enterprise, while having full financial control over the operations carried out, coordinate the shipment of products and compliance with contractual deadlines for fulfilling obligations;
- reduce non-manufacturing costs.

The practical implementation of this corporate information system is built as a single complex of software, technical and organizational solutions covering all production, technological, financial and business processes, while uniting all structural divisions into a single information space [7].

Table 1. Evaluation of the effectiveness criteria of the existing and proposed system management of material flows of "KraMZ" LLC.

Effectiveness criteria	Existing system							Proposed system						
	Experts					Total score	Average rating	Experts					Total points	Average rating
	1	2	3	4	5			1	2	3	4	5		
1. Cost-effectiveness	7	7	8	7	8	37	7.4	8	9	8	8	9	42	8.4
2. Effectiveness	8	7	6	8	6	35	7	10	9	9	10	10	48	9.6
3. Flexibility	7	6	6	5	7	31	6.2	9	8	8	9	8	42	8.4
4. Synchronicity	4	5	3	4	5	21	4.2	8	9	8	9	8	42	8.4
5. Decision making efficiency	6	7	5	7	6	31	6.2	9	10	10	10	10	49	9.8

3. Evaluation of the effectiveness of the proposed management information system

To assess the material flow management system, we will use such key criteria as profitability, efficiency, flexibility, synchronism and efficiency [8]. Moreover, in the part of the analysis, the experts evaluated the significance of the allocated parameters for the material flow control system.

Now, being based on the available criteria, we will evaluate the presented material flow management system of "KraMZ" LLC and the existing one. The assessment is carried out by a group of experts on a ten-point scale. Full compliance with the criterion is the maximum level and corresponds to a value of 10, the minimum compliance is 1 [8].

The results of the material management systems for the two systems are presented in Table 1.

The main problem link in the existing material management system assessment of "KraMZ" LLC is synchronism. In other words, there is no consistency between structural units in the planning, management and coordination processes at all stages of the movement of material flows.

In the planned system, this problem is practically solved, the synchronism indicator has doubled.

Table 2. Comparison of performance indicators LLC "KraMZ" before and after improvement of material management system.

Indicators	Units of measurement	Before upgrading the material management system	After upgrading the material management system	Change
Logistics Costs				
General Logistics Costs	thousand rubles/.m.ec	5 635	4 912	-723
Including:				
– warehouse	thousand rubles/.m.ec	1 571	1 053	-518
– transport	thousand rubles/.m.ec	2 185	1 843	-342
The utilization rate of vehicles for carrying capacity	-	0.8	0.7	-0.1
Utilization rate of warehouse space	-	1.2	0.9	-0.3
Demand Response				
Stock of goods	days	5	3	-2
Average Delivery Pending	days	4	3	-1
Supplier Lead Time	h.	0.2	0.2	-
Change in the time of execution of contracts with suppliers	days.	7	4	-3
Customer satisfaction				
Defective rate in 1st delivery	%	0.5	0.3	-0.2
Late delivery rate	%	0.3	0.05	-0.25
Incomplete supply level	%	0.6	0.2	-0.4
Number of claims	Number per month	5	4	-1
One customer service time	h.	0.17	0.12	-0.05
Customer Waiting Time	h.	0.13	0.08	-0.05

The proposed management system ensures coordination of all structural divisions of “KraMZ” LLC in the planning, procurement, production and marketing of products.

The results obtained clearly demonstrate the growth of performance indicators for each designated criterion in the designed system.

After an improved measure of synchronicity, decision-making efficiency is increased. The MRP2 system, in which the entire control complex is implemented, allows you to quickly detect failures in the execution of orders, and, accordingly, to timely eliminate them.

Thus, on the basis of the expert method, we can conclude that in the proposed material flow management system of “KraMZ” LLC there was an increase in the highlighted performance indicators of the system. The key aspect is that in the planned system, the speed of decision-making is increased, and accordingly, production downtime associated with the delay of raw materials or material resources is reduced.

Based on the available data on costs and other indicators of “KraMZ” LLC, as well as expert opinion on changes in indicators, is presented in Table 2.

Such indicators show a certain effectiveness in the whole of the planned material management system of “KraMZ” LLC and individual indicators of such a system in particular. From the above investigation we can conclude that the construction and operation of the material flow management system is based on the following conceptual provisions:

- implementation of the principle of a systematic approach, which is manifested primarily in the integration and clear interaction of all elements of the control system, clear and streamlined interaction of structural units;
- optimization of the production cycle;
- increased productivity in all parts of the production and distribution of material flow;

4. Conclusions

The effect of the application of the proposed material management system is to reduce non-production costs of resources and time, because in accordance with the principle of logistics, part or all of the components and materials must go directly to the structural units, bypassing the stages of accumulation and storage. This leads to lower costs for processing, accounting and storage of funds and to save significant financial resources.

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