

POSSIBILITIES FOR IMPROVEMENT OF SUPPLY LOGISTICS

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Abstract: *The supply logistics is one of the important activities in the organization. The paper examines an approach for improvement of the supply logistics. The approach consists of three phases. The first phase includes the necessary preparatory activities as determination of supply logistics processes, development of a goals and indicators system of supply logistics, identification of problems in logistics processes and development of the interactions between supply processes, logistic problems and logistic goals. The second phase involves carrying out a preliminary analysis of the supply based on the collected information and proposing activities for improving logistics performance. The third phase involves further analysis of the results of the application of activities for the improvement of logistics activities based on an assessment of the achievement of logistics objectives. Approbation of the approach in an enterprise that manufactures a wide range of products for final consumption is presented and possibilities for improvement of supply logistics are discussed.*

Key words: LOGISTICS, SUPPLY, CONTROLLING OF SUPPLY

1. Introduction

Competitive position of the manufacturing enterprises directly depends on the smooth operation of the production system. Logistics service for the production system from the supply logistics is a major factor that has a direct impact on its performance [4]. Achieving of logistics service objectives depends largely on the effective management of logistics quality [5]. It is therefore necessary to develop an approach to continuous improvement and control of quality of supply logistics. The improvement approach includes the following activities, namely:

- Development of a universal process model of supply logistics [3];
- Development of a goals and measures system of supply logistics, which consists of enterprise-specific goals and indicators for their quantification [6,9];
- Development of a fault tree of supply logistics, which consists of fault trees of individual supply logistics processes whose main purpose is to reveal the fault causes [1,2];
- Development of an early warning system, which determines the specific conditions of the evaluated goals for the corresponding period based on the estimated actual and forecasted values, and predefined warning and control limits [12];
- Development of a static model of the interactions between processes, faults and logistic goals [7];
- Development of a dynamic model of the interactions between processes, faults and logistic goals, taking into account the actual values of goals indicators [8];
- Development of a model for classification of fault causes.

The aim of this paper is to present a methodology for the practical realization of an approach for the quality improving of the supply logistics in specific manufacturing organization.

2. Expose

Experiments on an approach for improving the quality of supply logistics performed in an organization which manufactures a wide range of end products. The entire activity of the company is concentrated in a workshop.

Manufacturing of the products is oriented according to the customer orders as the type of production belongs to the low volume with high variety. Due to the strong competition, one of the most important goals of the company is to provide its customers with products manufactured to order as soon as possible with just meeting deadlines. In this case, the provision of production through supply logistics plays a crucial role, because all necessary for the assembly of the end products is sourced from external organizations - suppliers. Ensuring a high level of service of the production system by buying products can hardly be realized only through the creation of inventories, as the high purchase and storage cost of the products would greatly reduce the profit. To ensure and improve the quality of supply logistics of the organization, it is necessary to detect and correct the problems in a timely manner.

Approach to improving the quality of supply logistics passes through three stages.

The first phase includes the necessary preparatory activities for development of the individual components as follows:

- Determination of supply logistics processes [11];
- Determination of logistics objectives and indicators and linking them into a system [12];
- Identification of problems in logistics processes, their causes and effects and development of fault trees for logistics processes, as well as evaluation of problems impacts on logistics goals [12];
- Grouping supplied products;
- Determination of the warning and control limits of the indicators used to measure the logistics goals.

The second phase involves conducting a preliminary analysis of the supply logistics based on the collected information and developed target values in the first phase as well as proposing activities to improve logistics performance.

The third phase involves further analysis of the results from the application of the activities for the improvement of logistics performance based on an assessment of the state of logistics goals.

First phase. Approach implementation preparation

1. Determining the logistics processes in the supply

Definition of logistics processes within the supply is based on interviews with managers and staff members from all departments which have interaction with the supply of the production unit. For this organization is established that all products supplied pass through the same process of supply logistics. Defining requirements and placing orders for supply is held by the heads of production department. Supply department is responsible for the placing of orders, their monitoring and control. Tasks associated with the receipt of the purchased products, verification of goods received, storage and issue of materials for production are carried out by the warehouse.

2. Defining the system of logistics objectives and indicators

On the second stage have been identified logistics goals and indicators required for their quantification [10]. Discrepancy in the estimates for goals "Delivery accuracy" respectively "Service level" is obtained. In both cases, it has been determined that the indicator "delivery dependability" is the most important goal that needs quantification. Furthermore, for the goal "inventory cost" it has been found that it can be measured only by the measures "average cost of inventory". Through analysis of the defined processes, goals and indicators we have established the type of necessary business data needed to fully assessment of the quality of the supply logistics.

3. Identification and assessment of supply logistics problems

The third stage involves the identification of problems in logistics processes as well as building the fault trees. In this regard, for several weeks a study and the faults log in the organization has been conducted. In this connection daily registration of all problems was carried out, a list of the type of problems (faults) was created and

frequency of their occurrence was determined. Through further discussions with staff from relevant departments the list with other causes of faults and their frequency of occurrence was extended. Forty-six kinds of problems in logistics processes were identified such as replenishment supply orders placed late, unplanned allocation of certain materials, misinformation requirements, not timely issue of materials, lack of demand forecast, supply late, incorrect ordering of material, delivery of less than the required material, incorrectly determine the materials requirements and many others.

After the group, which included staff from various departments who have working relationships with the procurement process, identify and evaluate the faults causes it is passed to the second step, namely the impact assessment of the faults causes on logistical goals. This evaluation was carried out by the heads of the respective departments. In this connection, the second discussion was performed whose main task was to assist the matrix creation that reflects the effects of different processes on selected objectives. This matrix is a necessary component for building an interactions model between the objectives, processes and faults.

4. Identification of groups of purchased products

On the fourth stage the supply products are grouped. Reported data from prior periods were used as basis for the grouping. For this purpose, two analyzes were conducted.

The first analysis consists in the classification of the purchased items according to the value criterion - ABC analysis. In the second analysis delivered products have clustered according to the frequency of the item requirements - XYZ analysis.

Subject of analysis was the production unit requirements of purchased products, which are satisfied by inventory. Classification of items that should be purchased for the production unit within the study period is presented in Fig. 1.

Besides evaluation of products in value and uniformity of consumption an assessment of the ability to undertake replacement of items with similar items or delivery from other sources was also made.

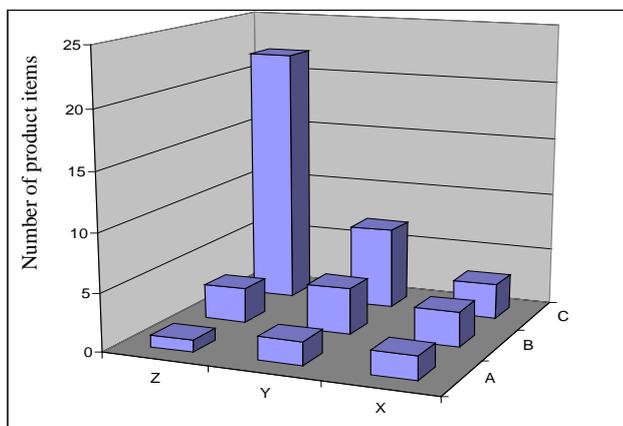


Fig. 1. Classification of the purchased products

The result showed a high correlation between the ability to replace the supplied products and value dispersion of purchased products. Thus for 93% of the articles of the category "A" and for over 65% of products from category "B" there are not alternative sources of supply or replacement options. In contrast to that, products of category "C" often are replaced and addition for this there are available a lot of alternative supply sources.

Based on the analysis of supplied items and conducted classification four separate product groups were discriminated - fig. 2.

Product Group I

The first product group covers products that have a high share in the value of total consumption, so inventory of them must be done in very small quantities. These items are part of each final

product. Therefore, demand fluctuations of these products are extremely weak.

	A	B	C
X	Group I		Group IV
Y	Group II	Group III	
Z			

Fig. 2. Development of groups of purchased items

Product group II

It consists of high-value items, which are required in small quantities and which are consumed by the production unit irregular depending on the product modification. Moreover, there are hardly any options for replacing these items with analogues or delivery from other sources.

Product group III

This group includes all stocked products, which account for a relatively high value share in the total value of the purchased items. Since the use of these products depends on the product modification, the fluctuation in the consumption of these products is high.

Product Group IV

This separate group includes articles of class "C" in the ABC analysis. Inventory of these products must be managed on a "replenishment point". The lot size of the supplied products on the basis of annual requirement of these items is determined. For this items multiple sources of supply are available and they have a great opportunity for interchangeability.

5. Determine the warning and control limits of the goals indicators

On the fifth stage of the preparatory phase the values of the warning and control limits for different goals are determined. For these goals for which the enterprise already established target values they on the respective groups of items had been distributed. For example, the target values for inventory cost according to the shares corresponding to the actual distribution of the value of the items in the product group are allocated. The goals which do not have standard values, the relevant standards were established based on an opinion by the managers of relevant departments. Based on the goals standards the values of the warning and control limits were set.

Second phase. Condition analysis

In order to assess the objectives and to display the most important causes of faults continuous registration of the reported data in the respective departments within seven months was conducted. The obtained data were processed and analyzed using the approach for controlling the quality of supply logistics. In view of the comparability of the collected data duration of each period at 20 working days was set.

Objectives condition visualization for the period was carried. This is defined based on the current conditions of the objectives for each group of products, which are summarized in the overall condition of the objectives. Color of the line point to the condition and length shows number of item groups that have the same state in terms of the goal. Establishment of a number of indicators in the relevant state provides a comprehensive cease of the goals states.

The situation in the first period is characterized by a large number of variations of the reported goals values from target values. From all item groups 33% of groups are located in the red section of the targets, and the remaining 42% in the yellow sector, which constitutes a warning that they may cross control limits in the near fu-

ture and to fall into the sector with adverse values. Goals related to level of service and the delivery time are particularly threatened.

Based on the identified objectives conditions can be derived most important causes of faults that have affected these conditions. We use the indicator the estimated ratio of faults, wherein the causes of the faults are sorted according to the decrease of the value of their ratio. For this period as more important causes of faults were found delays in placing orders, unplanned allocation of materials from inventory stock, not registered purchased materials and wrong picking of supplied products.

The last three problem causes are directly related to the operation in input warehouse and they explain the poor values of the indicator level of service which describes the service grade of the production unit. However it is difficult to show a direct connection between the cause of the problem, which has the largest aggregate error rate and variance in the goals variables, which are characterized by the greatest deviation from target values. After we examined in parallel other objectives we established that delays in placing orders has a negative impact on almost all goals, and therefore may be concluded for a certain dependence. Further analysis of this cause of problem showed that 56% of all orders in the company during this period were released late. We registered as late all orders whose filing date is the date that is obtained by reducing the time needed for entry into warehouse subtracting promised due date for order fulfilment by supplier.

The results from the study were discussed with management and relevant staff. For each cause of problems the management propose actions for their elimination or for restricting the negative consequences. Respectively employees who will be responsible for implementation of the measures and timetables for their implementation were identified.

Third phase. Interpretation of results

After having identified the causes of problems and their impact after six months a second analysis of the objectives of supply logistics was performed. The main task of this analysis was to examine the effectiveness of the proposed approach and the efficiency of the implemented measures. In this regard, an evaluation and analysis of data reported in the interval between the first and second analysis. The results from analysis showed that for the seventh period condition of the objectives has improved. Number of goals within the red sector has decreased from eight to three. The part of the objectives within the yellow sector has changed slightly, while those in the green sector have increased by 17%. Improved condition of the objectives of supply logistics compared to that of the preliminary analysis finds its explanation in the calculated coefficients of the causes of problems. The average value of the aggregate error rate has decreased by about 40%, ie from 425 to 260, and the maximum value of the ratio from 1052 to 586.

In addition, it was found that the causes of problems that were identified in the preliminary analysis and which are characterized by the highest values of the aggregate factor reduced its relative importance compared to other problems. Based on this finding could be concluded that the causes of problems that were identified in the preliminary analysis, based on their values as the most important, actually had a strong influence on supply logistics and activities for their removal led to real improvement the values of goals parameters.

To analyze the effectivity of the improvement activities of supply logistics, it is necessary to visualize the change of aggregated rate of the problems of each error for a specified period. This makes it possible to trace the impact of planned and implemented activities to eliminate or reduce the causes of problems.

After the conducting the activities for limiting the causes of problems that show a positive result additional positive effects are found. They consist in reducing the probability of occurrence of a problem for each cause by one to two percentage points.

3. Conclusions

After approbation of the approach for improving the quality of supply logistics jointly discuss the results of its implementation with management and staff involved in data collection and the development of activities was conducted. The main findings can be summarized as follows:

- The implementation of the approach has a positive impact on the organization and it can be successfully used to detect causes of problems that can not be uncover by conventional means.

- As main disadvantage can be identified relatively high labor costs by determining the processes, objectives and indicators, as well as the causes of faults.

- Since these expenses can be considered as a single, continuous use of this approach and its benefits will outweigh the one-off higher initial costs.

- Applying the approach creates a good basis for the implementation of a process of continuous improvement of the supply logistics.

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