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**DEVELOPMENT OF THE KPI SYSTEM OF LOGISTIC ACTIVITY**  
**OF AGRICULTURAL ENTERPRISE**

T. L. Sergeeva (a)\*, Yu. V. Lazich (b), D. O. Fedorov (c)

\*Corresponding author

(a) Yaroslav-the-Wise Novgorod State University, ul. B. St. Peterburgskaya, 41, Veliky Novgorod, Russia,  
Tatyana.Sergeeva@novsu.ru, tel. +78162770762 ext. 42,

(b) Yaroslav-the-Wise Novgorod State University, ul. B. St. Peterburgskaya, 41, Veliky Novgorod, Russia,  
kjuv@yandex.ru,

(c) Yaroslav-the-Wise Novgorod State University, ul. B. St. Peterburgskaya, 41, Veliky Novgorod, Russia,  
9165fd@gmail.ru

***Abstract***

The article proposed for consideration the system of key performance indicators (KPI) developed by the authors of the logistic activity of the agricultural enterprise. The choice of the object of approbation of these indicators – the Peasant farm I.I. Pireev – due to the fact that the logistics component in its activities is very large, and the formation of a system of indicators of improving the efficiency of logistics activities will allow the company to gain additional competitive advantages. The formed system of key performance indicators includes indicators for assessing the purchasing and sales, transport, and also the warehouse activity. The KPI logistics activities of an enterprise developed and presented in this article meet the following requirements: simplicity of calculations, availability of input data, relevance and utility. The following key performance indicators were proposed for the purchasing and sales department: order satisfaction, the use of investments in the information system, the number of orders processed per unit time. The key indicators of the efficiency of the transport department include: the use of investment in transport, the completeness of the ride and the average delivery time of the order to the consumer. For the logistics center and warehouse, the following KPIs are formed: return on investment in warehouse infrastructure and in the logistics center, time to prepare and complete the order. The article also presents the method of calculating the developed KPIs, which take into account the particularities of the company under investigation and the specifics of the market in which it operates.

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**Keywords:** Agricultural enterprise, logistics activities, system of key performance indicators.



## 1. Introduction

In August 2014 the Government of the Russian Federation decided to impose a ban on the import into the Russian Federation of an extensive list of products from countries that supported the imposition of sanctions against Russia. Due to the introduction of a food embargo, the share of imported goods in food commodity resources of retail trade decreased from 36% at the beginning of 2014 to 22% by the middle of 2016 (Berendeeva & Ratnikova, 2018).

Import substitution in modern conditions is one of the most relevant areas of agricultural development in Russia. Its goal is to create such a conjuncture of the domestic market of agricultural products, which will strengthen its position to Russian producers.

The results of the study (Berendeeva & Ratnikova, 2018) indicate a decrease in the price-quality ratio for food. In such a situation, Russian agricultural producers need to pay attention not only to increasing production capacity, but also to improving the quality and diversity of products.

The achievement of a competitive advantage in the market is facilitated by the decision of an enterprise to search for and implement such new technologies and management tools that will allow the company's strategic goals to be communicated to personnel. In the work of Drok and Nikonova (2016) proposes the development and implementation of a balanced scorecard (BSC), which provides control over the achievement of the goals of the organization, its departments and individual employees through key performance indicators (Key Performance Indicator, KPI).

In this regard, it seems relevant to the study, in which the KPI system was developed to improve the logistics of an agricultural enterprise operating in the Novgorod region. The object of the study was the Peasant Farm I.I. Pireev, the logistic component of which is very large, and the formation of a system of indicators for improving the efficiency of logistics activities will allow the company to gain additional competitive advantages. Please replace this text with context of your paper.

## 2. Problem Statement

Key performance indicators are the basis of a balanced system of organization performance indicators. Analysis of the KPI system allows you to: make a conclusion about the success of the enterprise; make timely decisions to improve the efficiency of the enterprise as a whole and its structural divisions; open promising areas of enterprise development.

The issues of determining, developing and applying a KPI system are considered by many economists. The introduction of the KPI system by Russian enterprises began several years ago, but there is still no uniform methodology for assessing key performance indicators.

Some authors consider KPI as an evaluation system that helps an organization determine the achievement of strategic and tactical (operational) goals. For others, KPIs are a criterion used to determine performance indicators that are relevant to achieving the goals and objectives of an organization and can be measured quantitatively. These definitions consider KPI, first of all, as a system of indicators that are essential for achieving the established goals and objectives of the organization (Zakirova, 2011).

Creating a really good KPI system requires not only the knowledge of the subject area and

experience in it, but also the active, creative use of intuition. Increasingly, KPIs are called an integral and unique indicator, regardless of its object (company, division, team, person). Some experts insist on the need for an “invention” of an integrated corporate KPI that would reflect the work of the company as a whole, taking into account its specificity (Shabalina & Podverbnyh, 2015).

The efficiency of the enterprise, its structural divisions and individual specialists of the company depends on the depth and accuracy of KPI development and the method of their calculation. Extremely challenging is the implementation of a KPI system that will improve existing business processes of the organization. There is no universal set of KPIs; their development requires a creative individual approach, since these indicators must take into account the company's characteristics, its competitive advantages, the specifics of the market in which it operates, the uniqueness of the technologies used, and the knowledge of the company's employees.

### **3. Research Questions**

The study involves finding answers to the following questions:

- What indicators can form a system of key performance indicators of the logistics activity of the studied enterprise?
- What is the method of calculating the key performance indicators of the logistics activity of the studied enterprise? Please replace this text with context of your paper.

### **4. Purpose of the Study**

The aim of the study is the formation of a system of key performance indicators (KPI) of the logistics activity of an agricultural enterprise on the example of a farm I.I. Pireev.

### **5. Research Methods**

In work the system approach is realized with a support on methodology of theoretical generalization and the analysis.

### **6. Findings**

Recently, more and more Russian companies are puzzled by the assessment of the contribution of logistics services to the final results of the company. Proper assessment of the effectiveness of logistics is often hampered by the absence of a well-thought-out system of reliable indicators and methods for calculating them.

A kind of “framework” that allows us to formulate a firm’s logistics strategy in the form of a set of operational goals that determine its market behavior and financial well-being is the Balanced Scorecard (BSC) method. It provides an opportunity to assess the degree of achievement of goals, the efficiency of business processes and the work of the company, its divisions and each employee using key performance indicators (KPI). Their linking with the employee motivation system increases the interest of the latter in achieving the company’s set goals and makes this interest constant (Sergeev, 2007).

BSC is projected onto the whole organization by developing individual goals within the framework of already developed corporate strategies and stimulates employees to understand their place in the company's strategy (Efimov, 2016). According to Nefedova (Nefedova, Redko, & Yanushevskaya, 2017), the BSC-based personnel management system is a mechanism for consistently implementing the company's strategic goals and key success factors through strategic maps and further monitoring their achievement through KPI, which show the potential for a dramatic increase in productivity (Orlova-Sheiner, 2009).

However, according to the research of Saplina and Kurlykova (2012), two or three key indicators are not enough to identify the causes of changes in the organization and for a comprehensive assessment of the performance of its logistics services. This leads to the need to develop a system of balanced indicators of logistics activities.

The introduction of a balanced scorecard can lead to a number of problems (Jumigo, 2009).

1) Problems associated with the choice of strategic goals: only short-term indicators or targets and indicators affecting only the financial sphere of the enterprise's activities are taken into consideration.

2) Problems associated with the choice of indicators: conflicting indicators are selected, their number is not optimal, their measurement is more expensive than the result obtained, or they have no relationship with the company's goals.

3) Problems related to the human factor: there is no regular measurement of indicators, the information collected is unreliable, and the opinion of a specific performer is not taken into account when introducing the indicator.

In the formation of the KPI system of logistic activity of the Peasant farm, I. I. Pireev, the system of planning and reporting indicators proposed by Sergeev (2007) and includes five gauges:

- the quality of logistics services for consumers;
- the use of investment in logistics infrastructure;
- general and operational logistic costs;
- the duration of logistic cycles;
- productivity / resource productivity of logistics infrastructure and personnel.

In this study, on the basis of existing methodological approaches, a system of key performance indicators (KPI) of logistics activities is formed, which reflect the specific development of the studied agricultural organization and meet the following requirements:

- simplicity of calculations (calculation of indicators should not take a lot of time from managers);
- availability of source data (variables);
- relevance and usefulness (the data should reflect the efficiency of logistic activities, and the conclusions and decisions made on their basis should be beneficial to the enterprise).

### **6.1. KPI Procurement and Sales Department**

As with any enterprise, for an agricultural organization it is very important to deal with consumers.

Due to the reduction in sales, loss of market share, there is a deterioration in the company's current solvency and a decrease in its business activity.

The following key performance indicators are proposed for the purchasing and sales department.

1) Fullness of the order  $F_o$ : a measure that reflects the proportion of outstanding orders.

$$F_o = \frac{N_{oo}}{T_{no}} \times 100\% ,$$

where  $N_{oo}$  – the number of outstanding orders for the period;  $T_{no}$  – the total number of orders for the period.

Sources of information for the calculation:  $N_{oo}$  – the number of invoices with acts of return for the period;  $T_{no}$  – the number of invoices for the period.

Justification of use: on the basis of this indicator, an increase in consumer requirements for the products supplied, a decrease in the quality of products and an increase in errors in order picking can be identified.

2) Use of investments in the information system  $I_{it}$  : the indicator describes how many rubles of investments in the information system fall on 1 order.

$$I_{it} = \frac{\sum_{i=1}^n C_i}{T_{no}} ,$$

where  $T_{no}$  – the total number of orders for the period;  $C_i$  – the cost of the  $i$ -th IT-technology;  $n$  – the number of used IT technologies.

Sources of information for calculation:  $C_i$  – license fees for the period for the  $i$ -th IT technology;  $T_{no}$  – the number of invoices for the period.

Rationale for use: analysis of this indicator gives an idea of the feasibility of further use of new IT technologies and on the reduction in the impact of previously used IT-technologies. Measurement by month due to the fact that payment for the use of software products, rental of cloud storage and host servers is based on monthly payment.

3) The number of processed orders per unit of time  $N_{po}$  : the indicator characterizes the labor productivity of the sales department and reflects the number of orders processed per hour of working time.

$$N_{po} = \frac{T_{no}}{N_{wd} * D_{wd}} ,$$

where  $T_{no}$  – the total number of orders for the period;  $N_{wd}$  – the number of working days in the period;  $D_{wd}$  – the duration of the working day.

The rationale for use: an increase in the value of this indicator indicates an increase in the productivity of the department's employees.

## 6.2. KPI transport department

1) The use of investment in transport: the indicator  $I_{to}$  describes how many rubles invested in the transport system accounted for one ride.

$$I_{to} = \frac{\sum_{i=1}^n PL_i}{\sum_{i=1}^n NR_i} ,$$

where  $PL_i$  – leasing payments for the  $i$ -th vehicle used for the carriage of goods;  $n$  – the number of leased vehicles used for the carriage of goods;  $NR_i$  – the number of riders on the  $i$ -th vehicle, leased.

2) Fullness of the ride  $FR$ : the indicator characterizes the share of unfulfilled riders.

$$FR = \frac{RB + RA}{RT} ,$$

where  $RB$  – the number of riders interrupted by a vehicle breakdown;  $RA$  – the number of riders interrupted by an accident;  $RT$  – the total number of riders. Justification for use: an increase in this indicator indicates the need for repair (replacement) of the vehicle or disciplinary action (dismissal) of the driver.

3) Average delivery time of the order to the consumer (per kilometer)  $\bar{T}$ : the indicator describes how much time on average it takes to execute a specific order per 1 km (in order to level the influence of the distance on the time of the order).

$$\bar{T} = \frac{\sum_{i=1}^n T_i}{\sum_{i=1}^n LR_i} ,$$

where  $n$  – the number of riders (sample size);  $T_i$  – time to perform the  $i$ -th ride;  $LR_i$  – the length of the route of the  $i$ -th ride.

Sources of information for calculation:  $n$  is initially it is supposed to take a sample in the amount of 10 riders;  $T_i$  is calculated on the basis of the time difference between loading and unloading; fixing time can be carried out as the head of the transport department, and with the help of specialized software;  $Di$  is fixing the distance can be carried out as the head of the transport department using Internet maps, and with the help of specialized software solutions (GPS trackers).

Rationale for use: a significant excess of this indicator will help to identify in a timely manner the use of vehicles of the enterprise for other purposes.

### 6.3. KPI logistics center and warehouse

1) Return on investment in warehouse infrastructure: the indicator describes how many rubles of net profit fall on the ruble of the cost of maintenance, repair and modernization of warehouse space ROIW.

$$ROIW = \frac{NP}{CWS + CWA} \times 100\% ,$$

where  $CWS$  – the cost of servicing the warehouse (real estate tax, payment of electricity and water, the cost of repairing storage facilities);  $CWA$  – the cost of upgrading the warehouse;  $NP$  – net profit. Sources of information for the calculation:  $RET$  are receipts for real estate tax, bills for electricity and water, contracts related to the repair of storage facilities;  $AM$  are agreements on modernization work, including the purchase of new equipment for the warehouse;  $FR$  is report on financial results.

Substantiation of use: the indicator will allow to evaluate the effectiveness of investment in storage facilities.

2) Return on investment in the logistics center ROIL: the indicator describes how many rubles of net profit fall on the ruble of maintenance, repair and modernization costs of the logistics center.

$$\text{ROIL} = \frac{\text{NP}}{\text{CLS} + \text{CLA}} \times 100\% ,$$

where CLS – the cost of servicing the logistics center (real estate tax; payment of electricity and water; the cost of repairing the premises of the logistics center); CLA – the cost of upgrading the logistics center; NP – net profit.

Sources of information for the calculation: CLS are receipts for real estate tax, bills for electricity and water, contracts related to the repair of the premises of the logistics center; CLA are modernization agreements, including the acquisition of new equipment for the logistics center; PLR is a report on profits and losses.

Substantiation of use: the indicator will allow to evaluate the effectiveness of investing in the logistics center.

3). Preparation time and order picking: the indicator reflects the total time spent on the passage of all sections in the process of pre-sale processing of vegetables for a particular type of order.

$$T_i = \sum_{j=1}^m T_j ,$$

where  $T_j$  – the time spent on the  $j$ -th process for the  $i$ -th order;  $m$  – the number of processes for the  $i$ -th order.

Rationale for use: a decrease in the rate indicates an acceleration of order processing. Formed in the framework of this study, KPIs are not standardized and mandatory for use, they may change when changing the development strategy of the agricultural organization.

## 7. Conclusion

The proposed system of key indicators of the efficiency of the logistics of an agricultural enterprise, developed in relation to the farm I.I. Pireev, however, can also be used for other enterprises that have a similar activity. It can provide the management of the enterprise with the necessary information that allows it to make management decisions in a timely manner, identify factors affecting the achievement of the company's goals and make adjustments to business processes. Using the KPI system makes it possible to: reduce the cost of logistics activities by monitoring and timely detection of problem areas; increase sales by improving the quality of logistics services and motivating the staff of the purchasing and sales department.

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