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Preliminary Assessment for the Effectiveness of the Principles of Logistics Information Management System

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***Abstract*– The basic evaluation of the effectiveness of control automation identifies their strengths and weaknesses. Based on the analysis offered the basic principles of estimating the economic efficiency of logistic Information Management System (LIMS) defined the main directions and the main difficulties of such estimation.**

***Index Terms*– Manufacturing, Logistics, Information Management Systems, Control System and Economic Evaluation**

I. INTRODUCTION

IN a market housekeeper one of the most important factors influencing the decision to manufacture any products, is an economic factor. Under such a factor in the future we shall understand a set of economic (technical and economic) indicators that determine the feasibility of manufacturing and marketing products. The use of such indicators can also link together different views of the same product, i.e., precisely the economy is the basis of dialogue between the developer and his products by the customer (the user).

II. THE PROBLEM AND SOLUTION

The above fully applies to Logistics Information Management Systems (LIMS), which are knowledge-intensive and difficult to manufacture products with very limited marketing. At the same time be aware that LIMS - is primarily a system of economic management company, focused on achieving goals such as reducing costs or increasing profits from the purchase, storage, production and marketing enterprises [1]. This means that it is a set of economic indicators to determine the objective function LIMS as a whole, which was later transformed into the goal of creating the individual elements of functional and provides parts [2], which include LIMS.

Analyzing the existing methods of economic assessment of Automatic Control System (ACS), we note the following points: Firstly, the economic justification desirability of creating a site-specific Automation Management System (AMS) is related to the definition of general and comparative cost-effectiveness [3]. Secondly, the overall economic efficiency should reflect the absolute magnitude of the positive changes in the outcome of management, achieved through automation of enterprise management. In this case, the following summarizes the [3], [4].

An annual increase in profits as a result of the operation λ_{year} ACS, which is calculated by the formula:

$$\lambda_{year} = \left\{\frac{A_2 - A_1}{A_1}\right\} n_1 + \left\{\frac{c_1 - c_2}{100}\right\} A_2 + \Delta n^A \qquad (1)$$

A_1, A_2 - Where the annual volume of Products of the before and after the introduction of a new version control system, thousand USD.

c_1, c_2 - The cost of 1 USD output before and after the introduction of a new version control system, cent.;

n_1 - profits from sales to implementation of the new version control system;

Δn^A - additional profits by reducing the unnecessary loss of (fines, penalties, penalties) with the introduction of a new version control system, thousand USD:

Annual savings of λ_λ, which is determined by the formula;

$$\lambda_\lambda = \lambda_{year} + \lambda_k + E_H[\Delta O_c^A + \left(\frac{K_\circ}{1000}\right)(A_2 - A_1)] \qquad (2)$$

Where, λ_K - savings from improved Quality Assurance products from its customers, thousand US $.

E_H - Standard ratio of economic efficiency of capital investments;

ΔO_c^A - changes in the value of working capital as a result of the introduction of a new version control system, US $.

$K_\circ$ - Industry specific capital investments for 1000 USD increase production;

An annual economic effect of λ, which is given by:

$$\lambda = \lambda_\lambda - E_H K_D^A \qquad (3)$$

Where, K_D^A - costs associated with creating new version control system, USD:

Economic efficiency of one-time costs of creating ACS, which is defined rates;

$$T = K_D^A / \lambda_\lambda, \quad E_P = \lambda_\lambda / K_D^A \tag{4}$$

Here T - payback period one-time costs, years, E_P, - the estimated coefficient of efficiency of non-recurring costs associated with creating a new version control system.

Third, the definition of comparative economic performance of ACS is [3] in the presence of:

Number of qualitatively comparable versions of the draft AMS for a particular company - based on the rate of annual economic impact;

A number of technology options for comparable individual constituent elements of collateral ACS - based on a formula adjusted costs of the form [4]:

$$\lambda = \left[Z_1 \frac{B_2}{B_1} \bullet \frac{P_1 + E_H}{P_2 + E_H} + \frac{(N_1' - N_2') - E_H(K_2' - K_1')}{P_2 + E_H} - Z_2 \right] \bullet A_2 \tag{5}$$

Where, Z_1, Z_2 - given the cost per unit, respectively, and the base of the new instruments of labor, USD;

$\frac{B_2}{B_1}$ - factor productivity growth means a new unit of labor compared with baseline; B_1 and B_2 - the annual volume of production, produced using the base unit, respectively, and new instruments of labor;

$\frac{P_1 + E_H}{P_2 + E_H}$ - Rate of change of the life of the new instruments of labor compared to the base;

P_1 and P_2 - share of royalties from the book value of a full recovery (renovation) and a new base of labor

E_H - normal rate of efficiency of capital investments;

$$\frac{(N_1' - N_2') - E_H(K_2' - K_1')}{P_2 - E_H}$$

Save the current cost of operation and related deductions from capital investments over the life of the new instruments of labor compared with the baseline obtained by a consumer USD;

K_1', K_2' - related capital investments by using the customer base and new instruments of labor, based on the volume of products manufactured using the new work, USD.;

N_1', N_2' Driving operational cost of the consumer when using them and a new base of labor based on the volume of products manufactured using the new Labor USD.;

A_2 The annual production of new means of labor in the settlement year, in natural units;

In cases where the effect of improving the quality of production not determined directly, take into account the additional effect for the manufacturer by increasing product prices. Then the formula (5) becomes:

$$\lambda = \left[Z_1 \bullet \frac{B_2}{B_1} \bullet \frac{P_1 + E_H}{P_2 + E_H} + \frac{(N_1' - N_2') - E_H(K_2' - K_1') + (\beta_2' - \beta_1')}{P_2 - E_H} - Z_2 \right] \bullet A_2 \tag{6}$$

Where, β_1', β_2' - the price of annual production volumes, reduced to a comparable physical volume before and after automation, rub.

In the general case of cost-effectiveness of new automation equipment is defined in the consumer per year of service according to the formula:

$$\lambda = (Z_2 - Z_1) \bullet A_2 \tag{7}$$

Here λ - the annual economic effect, USD; Z_2, Z_1 - Reduced costs per unit of output produced by the base and new technology, USD;

A_2 - annual production of a new technique, in natural units.

P - Realization period of economic effect is proposed to calculate using the expressions:

$$P = \frac{1}{P_2 + E_H}; \; P = \frac{E}{(1+E)^{T_C} - 1} \tag{8}$$

Where T_C - service life of new technology (system);

E_H - regulatory efficiency ratio;

E - Standard to drive in a comparable form of multi-cost which generally no more than E_H.

It should be noted that the development LIMS economic project based on the following provisions:

- The goal of the operation LIMS possible only by carrying out administrative tasks of optimization of costs (profits), i.e. planning and management tasks, while they should be regarded as a basic element of a complex set of managerial tasks of the necessary information for solving optimization problems;
- projected to increase economic efficiency LIMS realized most fully, not only because of its implementation, but also due to optimization of structures Building automation, with the most convenient method of typing should be considered as structures of automation objects with a guarantee of a win;
- Used for economic evaluation indicators should be LIMS technical and economic, that is, should provide a satisfactory transition from a system-wide evaluation to assess the functionality and providing parts of the system.

It should be noted some methodological difficulties in applying this technique in practice.

The problem lies in the calculation of key indicators of management after the introduction of ICS. So, preliminary calculation of efficiency (of the formula (1) - (4)) is based on the following key indicators: the annual volume after the introduction, the cost per unit of production after the introduction of IMS, an extra profit by reducing production losses. However, the technique proposed for the calculation of these indicators are not always applicable to modern LIMS.

Thus, for the calculation of the annual volume of production is proposed to use the growth rate of output [3]:

$$\gamma = (100 - \varphi_2)/(100 - \varphi_1), \quad (9)$$

Where φ_1, φ_2 - a loss of working time from the general fund of working time before and after implementation LIMS. Determination of loss of working time (φ_1, φ_2) produced by factor analysis on the influence of tasks the automated system to remove the individual components of these losses. To this end, all loss must be made in the dismemberment of the institutional reasons related to the deficiencies of the current system of governance

The use of factor analysis involves tasks like challenges comparable before and after the introduction of Information Control System (ICS), i.e., it is assumed that the functional structure of the company does not undergo significant changes in the process of automation. Itself, however, the efficiency of enterprise management system, conceived to reduce costs in its operation in relation to the investment of funds for reconstruction, not fully describe the economic results of the organization of automated production management. The economic feasibility of control systems is manifested primarily in changes in facility management. This creates a specificity of effect size, which can be obtained from the automation control.

Modern design methodology involves the analysis of ICS and reconstruct business processes to achieve significant improvements through the use of automation .Thus, the definition introduced in the paper [5] the term BPR (Business Process Reengineering) is as follows: BPR - fundamental rethinking and radical reconstruction of business processes to achieve significant improvements in critical important in today levels of performance criteria such as cost, quality, service, speed. "Thus, the use of factor analysis for the calculation of these indicators is possible only in case of similarity of functional tasks compared before and after the introduction of ICS. In addition, these estimates do not cover all of the results from the introduction of LIMS. For example, the effect of ICS on increase of the product quality is taken into account only because of higher product prices (equation (6)). Next, we consider an additional list of components LIUS effect. Thus, the introduction of IMS contributes to the rhythm of production, which leads to a significant reduction of unproductive expenditure. Savings from the reduction of unproductive expenditure is derived from the decrease in downtime and payment of overtime, reduction of losses from the marriage. The other components considered economy from the introduction of ICS is reduced such spending unproductive nature of the non-production costs such as fines and penalties for violations of commercial contracts for the supply and marketing.

In addition, the effect of the components has an important place LIMS release working capital by the amount reducing of the work in progress and inventories under control automation. This effect is ad hoc and reduces the production assets of the enterprise. The practice of creating LIMS shows that a one-time effect of reducing working capital can be significant.

Change the value of current assets is determined by the growth of output, as well as the relationship between growths in output current assets, taking into account reductions due to implementation of the system. The decrease in working capital requirements determined by the formula [3]:

$$\Delta O_C^A = O_C[1 + (\gamma - 1) * \theta_{Ob}] * \varpi_{Ob} \quad (10)$$

Where O_C - volume normalized working capital to implement ICS; θ_{Ob} - dependency ratio of working capital growth from growth in output; ϖ_{Ob} - coefficient reducing the need for working capital as a result of the introduction of ICS. Carrying out the calculation of cost-effectiveness of automated control is complicated by the fact that the savings obtained by implementing the system, interwoven with the results, the company offered to accompany other activities to improve technology and production organization. This creates a large risk of double counting. Hence, performed feasibility study requires the solution of the question to what extent the positive results of the enterprise associated with the introduction of computer technology, and to what extent - other measures to introduce new technology at the plant.

III. THE RESULTS AND DISCUSSIONS

Finally, the main methodological difficulty in determining the cost-effectiveness of ICS is the ability to answer the question of a quantitative measure of the influence functions and tasks to be solved by a particular system, the results of management.

The study of experience in creating MIS shows that in terms of quantitative impact on the performance of economic activity of a business problem to be solved within the system can be divided into two groups.

The first - the problem of direct and unambiguous quantitative mapping on the results of any production.

The second group - includes, on the basis of electronic data processing tasks of the traditional production planning and accounting. They are in the aggregate increase the overall level of organization of control elements that affect the outcome of the enterprise. To investigate the effectiveness of automation, it is necessary to identify real-life loss and missed opportunities in manufacturing, as well as to assess the impact of ACS on their elimination. Under the sources of economic effectiveness of automation refers to the real possibilities of improving production and business and financial activities of the enterprise, improve production efficiency by improving its management.

Sources of LIMS efficiency - potentially existing in the enterprise production reserves and lost opportunities that can be implemented at improving the quality of economic management under the influence of various functions of the system being created. In determining the effectiveness of LIMS considered the following:

- Increased output by more rational use of existing production equipment, raw materials, fuel and labor resources, optimize the production program of the company;
- Increase in productivity of production workers by reducing lost work time and downtime of production equipment;
- Establishing the optimal level of reserves of material resources and the volume of work in progress;
- Improving product quality (reduction of marriage, raising the grade) and the savings consumers;
- Reduce the cost of output by a possible reduction in administrative staff;
- Reduction of losses affecting the decrease in profit before tax of the enterprise (fines and penalties paid for violation of contract terms).

These lines LIMS efficiency should form the basis of modern methods of quantitative estimates effect of the create a functional and provides parts of such systems.

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