European Proceedings of
Social and Behavioural Sciences
EpSBS

www.europeanproceedings.com
e-ISSN: 2357-1330

DOI: 10.15405/epsbs.2020.04.19

PEDTR 2019

18th International Scientific Conference "Problems of Enterprise Development: Theory and Practice"

EVALUATION OF PAYBACK PERIOD OF EPR-SYSTEMS

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Abstract

The introduction of electronic control systems (EPR) greatly simplifies the process of business management, transforming the complex and not always transparent process of management and control into typical functions that have qualitative and quantitative indicators. At the same time, when implementing electronic control systems, the manager has two tasks: the task of choosing an EPR system and the task of determining the effectiveness of spending money on the acquisition, implementation of EPR and subsequent support. Currently, there are many methods for evaluating the financial result of the introduction of information systems. When evaluating the economic efficiency of the ERP-systems use generalizing and private indicators. Generalizing indicators of EPR economic efficiency include the annual economic effect of EPR implementation and the payback period of investment costs. The annual economic effect of ERP implementation, defined as the difference between the annual savings (annual profit growth) and the reduced one-time costs of purchasing and implementing EPR, is the actual annual economic effect. One of the indicators that allows to assess the effectiveness of the EPR-systems is an indicator that directly affects the decision of the CEO to implement a particular EPR - the payback period for the acquisition and implementation of the EPR, taking into account its subsequent maintenance. The article summarizes the principles of determining the payback period of costs associated with the acquisition and implementation of the EPR-systems.

Keywords: EPR, investment costs, payback period, efficiency.

https://doi.org/10.15405/epsbs.2020.04.19
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Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

1. Introduction

The main purpose of the EPR-systems, regardless of the scope of application in the production sector or the provision of services, is to provide officials with the information necessary to make decisions in the field of their activities. The strategic direction of development of the ERP-systems is their intellectualization, which consists in the construction of formalized procedures for processing, interpretation and presentation of information in the form of some indicators (knowledge), allowing their use directly for management decision-making. Regardless of the application areas of the EPR-systems, they perform typical functions for data collection, data processing, including those aimed at obtaining summary indicators, data presentation, processing results and their interpretation for direct use by officials in decision-making.

The benefits of ERP are obvious: reduced time of execution of orders, the increase in orders and decrease the number of errors, workload optimization of personnel and production equipment, cost reduction, efficient production planning, calculation of planned and actual costs, monitoring of all stages of production, accounting and control of financial, production and management flow, the information, growth of productivity and profitability. The Russian market of the EPR-systems is characterized by a variety of offers, which on the one hand is good for customers, and on the other-makes the choice of the best solution extremely difficult (Kovaleva, 2007).

The choice of EPR is determined based on the effectiveness of the EPR-system. A number of independent information and analytical agencies assessed the effectiveness of ERP. The main criterion of efficiency is the reduction of operating and management costs by an average of 15%, and commercial-by 35%. CEO expects implementation of the EPR-systems positive effects: reduction of volumes of uncompleted production, reducing inventories, freeing up working capital, reducing credit debt and reduce manufacturing defects, increase sales volume, increase productivity.

Currently, there are numerous methods of assessing the financial result of the introduction of information systems. In assessing the economic efficiency of ERP use generalizing and private indicators. The generalizing indicators of economic efficiency of EER include the annual economic effect of the implementation of EPR and the payback period of investment costs. The annual economic effect of the acquisition and implementation of EPR, defined as the difference between the estimated annual savings and the estimated present acquisition and implementation costs, is the estimated annual economic effect. The annual economic effect of ERP implementation, defined as the difference between the annual savings (annual profit growth) and the reduced one-time costs for the acquisition and implementation of EPR, is the actual annual economic effect (State Standard 24.702-85).

2. Problem Statement

The problem of assessing the effectiveness of the EPR-systems was investigated by the authors Kaygorodcev and Kravchenko (2015). The authors propose a method of evaluating the efficiency and optimization of basic parameters of production and technological information systems, as well as a method of estimating the marginal (economically viable) dimensions of mathematical programming problems, implementing the strategic functions of the enterprise. Based on the use of the advantages of macropodid

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accented approaches to evaluating the effectiveness of information systems implemented in the enterprises of machine-building industry, producing products of high complexity, as well as industrial enterprises at the stage of feasibility study projects (Arya, Ahmad, & Anand, 2015).

In the conditions of EPR implementation, it is necessary to take into account the peculiarities of a particular organization (object of implementation) and the existing practice of investment activity in the company. Classical methods of assessing the effectiveness of investment projects suggest the need to assess the revenue and cost of projects with their subsequent integration in the calculation of the generalized cash flow from the implementation of the EPR-system. If the assessment of the cost part does not represent a significant complexity, then the assessment of the effects of the implementation of the EPR project is a key condition for making decisions on the feasibility of implementing an automated information management system in the company (Nesterov & Yakovlev, 2011).

3. Research Questions

According to the author of this article, the payback period of investment costs required for the purchase and implementation of the EPR-systems in the organization is one of the key indicators for assessing the feasibility of investments. The principle of determining the payback period of the management system, set out in this article, complements the methodology proposed by colleagues. At the same time, the author systematized the approach to determining the payback period of investment costs, and the proposed methodology can be applied both for enterprises of the machine-building industry and for other organizations specializing in the provision of services in the field of economic activity and trade (Gorshkov, Murgul, & Oliynyk, 2016).

4. Purpose of the Study

The payback period of investment costs aimed at the acquisition and implementation of EPR is a key indicator of the effectiveness of the acquisition and implementation of an electronic management system in enterprises. There are many approaches to determine the payback period of EPR systems. The author of the article focuses on the systematization of approaches to determine the payback period of investment costs in order to make a decision on the acquisition and implementation of the EPR-systems.

5. Research Methods

In the course of work on the article the author used methods of mathematical analysis, methods of math. statistics. The use of mathematical methods in the field of calculation of performance indicators of automated information management systems is often the main methodology used in the course of determining the needs of the organization and the goals facing software developers during the development and implementation of EPR (Maghsoudi, Sadeghi, Xiong, & Aminossadati, 2019). Mathematical methods accelerate the economic analysis, contribute to a more complete account of the influence of factors on the results of activities, improve the accuracy of calculations. The application of mathematical methods requires a systematic approach to the study of a given object, taking into account the relationships and relationships with other objects (organizations), the development of mathematical models that reflect the

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quantitative indicators of the system activity of employees of the organization, the processes occurring in organizations, improving the enterprise management system using computers (Maghsoudi & Sadeghi, 2019).

6. Findings

The payback period of any investment project (and in the case of acquisition at the expense of investment funds, the implementation and maintenance of EPR can be identified with the implementation of an investment project) is the most popular indicator of assessing the feasibility of investments (Gorshkov, Vatin, Rymkevich, & Kydrevich, 2018). The payback period, being a static indicator, shows the investor the return period of investments directed to the implementation of the project. The simple payback period is the ratio of investment costs associated with the acquisition and implementation of the EPR-systems to the average annual positive effect (annual savings, profit growth):

$PP=I_0/CF_{cr}$ (1)

PP – the payback period of EPR implementation in years;

I_0 – the amount of costs for the acquisition and implementation of EPR in rubles;

CF_{cr} - average annual effect associated with ERP implementation.

In some cases, it is not possible to determine the average annual positive effect of ERP implementation. In this case, the calculation of the payback period can be showed as:

$PP=n,\ if \sum_{t=1}^{n} CF_t > I_0$ (2)

CF_t - a positive effect associated with the introduction of EPR in a year 't';

n - the number of years.

A simple payback period does not take into account the change in the value of the investment over time. When calculating the effectiveness of investments, the value of money in future periods is taken into account and its value is given to a specific point in time (discounting). The calculation of the return on the acquisition and implementation of EPR can be carried out taking into account the discounted cash flows. The discounted payback period can be showed as:

$DPP=n,\ if\ DPP = \frac{\sum_{t=1}^{n} CF_t}{(1+r)^t} \geq I_0$ (3)

DPP - discounted payback period;

r – discount factor.

The payback period of investments related to the purchase and implementation of ERP depends on the beginning of the investment (software purchase stage) and the investment phases associated with the implementation and maintenance of the software product. The distribution of EPR implementation and maintenance costs over time increases the payback period of the total costs incurred by the company, and therefore the costs associated with the implementation and maintenance of EPR must be taken into account in the analyzed time interval.

The costs for the acquisition and implementation of EPR (I_0) consist of:

- Costs directly related to the purchase of an EPR system, one-time costs (I_1);
- Costs associated with the implementation of an EPR-system in the current business environment, input of primary information, development of directories, adaptation of software

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code, archiving and data transfer, testing, configuring interfaces, creating document templates, etc. – fixed amount payment and payroll staff of the organization involved in the process of implementing an EPR system for the entire implementation period (I_2);

- Costs associated with maintenance and software updates, maintenance of the existing software product, consulting services, acquisition of current versions of the software product, operating costs reduced to the analysed time interval, (I_3);
- Costs for acquisition, transportation, installation, adjustment and subsequent amortization of computer equipment, peripherals, communications, software, auxiliary equipment, office equipment, production and economic inventory, (I_4);
- Costs for adaptation and optimization of business processes to management in the conditions of the implemented an EPR-system, formation of quality management system, description of business processes, optimization of business processes - one-time and current costs, given to the analyzed time interval, (I_5);
- Costs associated with personnel retraining, training in specialized educational institutions, job training, certification, if necessary – one-time costs, (I_6).

The division of all costs into one-time and current, which include the costs of operation and maintenance, allows you to approach the evaluation of the results of automation more differentiated (Sari & Kuchta, 2013).

It should be noted that a number of organizations that implement EPR systems often neglect to use the management concepts inherent in the systems and do not change their business processes that have developed in the current economic environment. When determining the amount of investment costs required for the purchase and implementation of EPR, such companies are limited to the costs directly related to the acquisition, implementation and maintenance of management systems. This approach is not correct and leads to a significant decrease in the effectiveness of EPR and reduce the expected result. In the case of implementation of management systems in such organizations, only existing business processes are subject to automation, while business processes do not change. When deciding on the implementation of the EPR system, it is necessary to take into account that the management system will be effective as far as the company's personnel and business processes are effective. The fewer complications present in these processes), the more effective the EPR system will be and the more significant will be the effect of its implementation (Chernenko, 2002).

The total amount of costs can be expressed as:

$$I_0 = I_1 + I_2 + I_3 + I_4 + I_5 + I_6 \quad (4)$$

The indicators characterizing the effect of EPR implementation include

Direct indicators:

- Annual growth of the organization's revenues after the introduction of EPR, associated with an increase in economic activity, acceleration of business processes, the development of new products, (CF_r);
- Annual cost savings associated with resource savings, reduction of staff compensation Fund, optimization of management and operational processes, savings of other costs that are not included in the cost of production, reduction of inventory levels, (CF_c);

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Indirect indicators:

- Improving the productivity of personnel both directly at the implementation site and in related areas and industries (C_1);
- The increase in the share of output per employee (C_2);
- Optimization of the number of personnel (C_3);
- Reducing the time spent on the implementation of certain business processes, reducing the duration of the production cycle in the production of products (goods, works, services) (C_4);
- Improving the quality of products (goods, works, services) in view of the formation mechanisms of automated quality control and reduce scrap rate, which in turn leads to a reduction in expenditures related to elimination of defects of products (goods, works, services) (C_5);
- Obtaining opportunities (grounds) for further optimization of production processes and additional cost reduction (C_6).
- Other indicators that indirectly characterize the economic effect of the implementation of EPR in the organization - increase in market share by reducing the duration of service, increasing the degree of customer satisfaction, increasing the number of loyal customers, etc. (C_k).

The main difficulty of assessing the effect of the implementation of the management system is the need to compare similar indicators of financial and economic activity of the organization before and after the implementation of the EPR-system, as well as ensuring the possibility of accounting in the economic activity of the organization of the direct contribution from the implementation of the EPR. Often, the indicators characterizing the effectiveness of the EPR system implementation correlate with other indicators of the organization's activity, which have changed due to other reasons (implementation of quality management, optimization of business processes, cost reduction and increase of profit). It is often impossible to separate the contribution of EPR implementation from the results of other causes in the process of economic activity of the organization. At the same time, when determining the performance indicators of direct account management systems, it is possible to identify and determine the contribution from direct indicators and by scoring and ranking the values of indirect indicators to identify the contribution to efficiency made by indirect indicators.

It is possible to estimate the effect of ERP implementation using the balanced scorecard methodology (BSC). At the same time the company's goals are transformed into a system of performance indicators in four areas:

- Financial result;
- Improvement of internal business organization;
- Personnel training;
- Feedback from consumers.

BSC allows to assess not only the current state of the company, but also to predict its potential. Thus, it is possible to estimate the future contribution of EPR to the overall financial result. In the future, the company will be required to monitor the achievement of the goals and, if there are discrepancies between the planned and actual indicators, to implement corrective measures.

Thus, the total value of the effect associated with the acquisition, implementation and maintenance of ERP can be defined as:

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$CF_{cr} = \sum_{k=1}^{m} CF_{rk} + \sum_{k=1}^{m} CF_{ck}$ *(5)*

m – the number of indicators characterizing the effect of ERP implementation in the company.

The payback period will be defined as:

$PP = \frac{I_1 + I_2 + I_3 + I_4 + I_5 + I_6}{\sum_{k=1}^{m} CF_{rk} + \sum_{k=1}^{m} CF_{ck}}$ *(6)*

The author analyzed the payback period of investment costs of various companies that implement EPR. Based on the analysis of sources, it is concluded that if the payback period of EPR does not exceed 4 years, according to buyers of management systems, the project is considered acceptable for implementation (Panorama Consulting, 2017).

7. Conclusion

The payback period of investment costs associated with the acquisition and implementation of the EPR-systems is a key criterion for assessing the effectiveness of systems, allowing the Manager to make a decision on the possibility of investing money for the purchase and implementation of an automated information management system. The payback period is used as one of the simplest and fastest methods of determining the investment attractiveness of the project associated with the purchase and implementation of the management system, as well as for the operational comparison of the characteristics and feasibility of the introduction of systems at the stage of their choice: with the identity of the main parameters of the considered automated management systems, investments with a shorter payback period are less risky. The main advantages of the method of assessing the effectiveness of EPR can be called its simplicity and clarity. In fact, the payback period allows you to assess the investment risk from investments in the purchase and implementation of the management system.

However, the disadvantage of evaluating the effectiveness of management systems through the analysis of a simple payback period is that it does not ensure the accuracy of calculations, because it does not take into account the time factor. The simple payback period is represented by the normal return on invested capital. This indicator may not be of interest to the company's management and investors due to the fact that it does not indicate the number and timing of the possible receipt of additional income inflow, which is the main purpose of the introduction of EPR, as in the case of any other investment project. The discounted payback period is more interesting from the point of view of the availability of information about the time interval that will be required to obtain additional profit from the implementation of the management system (an alternative source of income with approximately the same level of risk). Analysing of discounted payback period allows more accurately predict the period of return of funds associated with the purchase and implementation of the management system and more accurately determine the effect of the introduction of the EPR-systems.

The accuracy of the assessment is enhanced by taking into account all the costs of the company, not limited only to the costs associated with the acquisition, implementation and maintenance of EPR: it is necessary to take into account the costs of adapting business processes and retraining of personnel. When assessing the effect of the implementation of the EPR-system, it is necessary to take into account both direct and indirect performance indicators.

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