Estimation of Economic Efficiency of Investment Decisions Information Support in the System of Economic Security of Enterprises

Maksym Slatvinskyi

Pavlo Tychyna Uman State Pedagogical University, Uman, Cherkasy region, Ukraine
sl.m@ukr.net

Abstract. The article is focused on the formation of methods of estimation the economic efficiency of using information technologies by making investment decisions in the system of economic security of enterprises. It was established that determination the efficiency of information security systems usage for investment decisions it is more appropriate to use probabilistic characteristics - the functions of distribution of probabilities of causing harm. The integrated indexes for estimating the effectiveness of information support with use for appointment the weight categories under the Fishburn's rule, was formed. The system of indicators of efficiency and risk was defined in order to calculate this index. Promising directions for future research are outlined.

Keywords: Information support system, Investment, Economic security, Fishburn's rule.

1. Introduction

An important area of information technology (IT) application is the provision of analytical information about the company's activities in the system of its economic security. In market conditions, developed analytical infrastructure provides the necessary competitive advantages, while its absence creates threats to the proper development of the enterprise and the preservation of market positions.

The main object of this article is to review the methods of estimation the economic efficiency of using information technologies by making investment decisions in the system of economic security of enterprises. This task is conditioned by the large-scale growth of IT use by making investment decisions. In this case, for investing in analytical tools, the issue of economic efficiency estimation is particularly relevant, since it requires significant costs, and it is not always possible to follow the benefits of classical indicators of enterprise activity.

The foregoing determines the significant practical value of the research and construction of the model of evaluation within its limits, since in order to substantiate the investment decisions in the system of economic security of enterprises, high-quality methods of economic efficiency of information analytical systems' implementation are required.

2. Definition of Economic Efficiency and Use of Information Support Systems

Formation of the strategy of enterprise development should include the cost of construction and ensuring the functioning of the information support system of investment decisions in the system of economic security. Information assets circulation, links between information resources, the functioning of the information systems in which they are processed, ultimately affect the financial indices of enterprises.

Publications of A. Butov, A. Gorbunov, E. Efimov, S. Simonov, E. Zinder are devoted to the evaluation of the economic efficiency of information systems. However, these works focus more on estimating the risks of breaking the work of information systems.

It is believed that the costs for information provision of investment decisions are effective if they meet the requirements of normative documents, as well as the concept of economic security of the enterprise. This is due to the fact that for the objective estimation of economic efficiency no universal methods are established.

Economic efficiency, as a rule, is considered as an excess of cost estimates of the results of the events carried out, over the total costs of their implementation in the estimated period [1, 3].

In accordance with the theory of system efficiency assessment, the quality of any object, including information support system, is manifested only in the process of its target function, therefore the objective is to evaluate the effectiveness of use [4]. In addition, the adoption of investment decisions is associated with uncertainty in the future, primarily as a result of the achievement of the results of the measures taken. The beginning of the investment project implementation in most cases is accompanied by uncertainty. In the process of project implementation its level is reduced, but the effectiveness of information systems can never be adequately expressed and described by deterministic indicators.

Certification, licensing and compliance with security conditions are not able to completely eliminate the uncertainty of information systems' characteristics and their individual elements, and do not allow prediction of accidental elements in decision making. Accordingly, only the probabilistic indicators can serve as an objective characteristic of the quality of information security systems, the degree of their suitability to achieve the desired level of economic security of the enterprise under the influence of random factors. The ability to achieve the objectives of economic security under given conditions, for example, with the use of the information support system is characterized by a certain degree of probability. Probability in this way should be based on a set of indicators and criteria for evaluating the effectiveness of information support systems for investment decisions in the system of economic security of enterprises. In this case, the evaluation criteria serve the concepts of suitability and optimality. Suitability means the fulfillment of all requirements of the information security systems, and optimality means to achieve one of the characteristics of extreme value with respect to the constraints and conditions of other properties of the system.

Usually, when developing information systems, there is a multicriteria task of comparing different variants of the structures of these systems. Among the indicators considered in the task are indicators of efficiency, which have probabilistic-time character of distribution functions. In particular, they include the probability of overcoming the system of protection of information for a certain time [2].

Thus, to evaluate the cost-effectiveness of the use of information systems for investment decisions most applicable probabilistic methods were used, according to which levels of security are transformed into confidence intervals of probabilities of the corresponding values of indicators. Estimation of the optimal level of enterprise economic security largely depends on the prevention of damage. To obtain a set of risk values you must know the distribution of random variables of damage. In most cases such estimates can be obtained, for example, with simulation modeling or by the results of active auditing [1].

So, at first, the determination of the efficiency of the use of information support systems for investment decisions can not be based on deterministic estimates. Secondly, to determine the effectiveness of the above measures, it is more appropriate to use probability characteristics - the function of distributing the probability of causing harm.

3. Current Approaches to the Evaluation of Costs for Information Support of Investment Decisions

Economic security of the company in general is a complex and specific process influenced by many external and internal factors. One of the main factors in the process of construction, organization and implementation of economic security of the enterprise is investment. The strategy of a high-level protection system can only be built in case if you conduct a preliminary analysis and estimation of the effectiveness of investment decisions.

By making investment decisions in the system of economic security of the enterprise, it is necessary to use a separate methodology, which allows conducting effective costs for the implementation of appropriate information support. However, not all approaches to estimating the cost of information provision of investment decisions can distribute funds in such a way that investment in the construction of the system economic security has become effective. According to statistical data, the cost of information security in the system of economic security is 30% of all costs of the enterprise spent on information systems, and the cost of protection of information systems should be about 20% of the cost of information resources of the enterprise [5]. However, only 10% of enterprises properly finance the information systems, 40% are exposed to significant risks of breaching the protection of information systems [6].

Thus, the problem of effective information support of investment decisions in the system of economic security of the enterprise has not yet been resolved. The results of conducted analysis show that such question as: the estimation of the effectiveness of information support of investment decisions, adaptation of such estimation to the current time, decision-making on the organization of investment turnover company in the absence of statistical data and parametric estimates, comparing the assessment of possible risks to new threats to economic security, are still actual.

The analysis of the approaches to estimating the cost of information provision for investment decisions has shown that they are limited only to the assessment of net discounted value and the assessment of the risks of violating the company's economic security. The main disadvantages of these approaches are that efficiency can be achieved by using them in combination.

Most of the existing approaches to estimation are oriented towards enterprises of economically developed countries, while the peculiarities of transformational economies (Figure 1) should include the calculation of the risks of economic security violations, which provides the assessment of the continuity of the operation of enterprise information processes.

By using the specifics of the approach to estimating the costs of information provision of the enterprise, used in transformational economies, practically different levels of risk are determined, such as: acceptable, critical, inappropriate, stable.

Determination of the acceptable level of risk in this case is based on such indicators: short-term information assets, security, justification of the cost of information resources. Estimates of each risk are different. Therefore, depending on the category of risk, the assessment of the risk of information security violation in the proposed model will be determined in different ways.
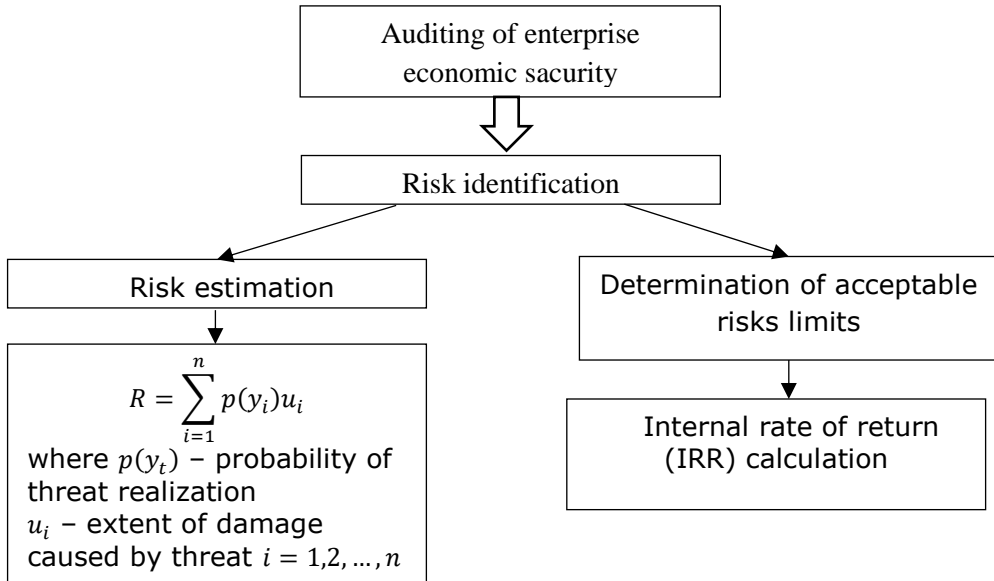
Fig. 1. Peculiarities of estimation of the information systems effectiveness in transformational economies

Thus, such approach to estimating the cost of investment decisions information support in the system of economic security of the enterprise provides an assessment of information risks in the form of calculating the amount of risks inherent in certain information system and system of economic security, taking into account not only the internal and external factors, but also certain conditions inherent in the system.

4. Model of estimation of economic efficiency of investment decisions information support in the system of economic security of enterprises

In the efficiency calculations, as a rule, there are two main components, namely: the result obtained from the implementation of the event and the costs necessary for its implementation. The final result of the implementation of information security measures is usually considered the loss prevention value. The loss prevention value P_i can be calculated, based on the probability of occurrence of the 1-st incident ($i = 1, 2, ... n$) and possible economic losses from it before and after the implementation of information security measures:

$$P_i = P'_i - P''_i, \tag{1}$$

P'_i, P''_i - losses from the realization of threats before and after the implementation of information support measures, respectively.

Then the total loss prevention value in all incidents is defined as:

$$P = \sum_{i=1}^{n}(P_i + R_i), \tag{2}$$

R_i – direct return of losses, for example, compensation by a third party, guilty of the economic security incident, funds received as a result of the application of penal sanctions to employees, guilty of incidents, insurance indemnity, etc.

After generalizing the conditions of the effectiveness of information support, let's define the integral criterion of the efficiency of information support of investment decisions in the system of economic security of enterprises, using the formula:

$$G = \sum_{i=1}^{N} w_i C \qquad (3)$$

w_i - is the Fishburn's weight index for the parameter of the estimation of the efficiency of information support of investment decisions in the system of economic security of the enterprise,

M - total cost of eliminating the consequences of the threat implementation and other reasons for the damage of the company's information support system.

Thus, the model of the efficiency of information support of investment decisions in the system of economic security of enterprises may be in different states S, which can be described as the following set of values:

$$S = \{s_1, \ldots, s_m\}, \qquad (4)$$

S – set of possible states of the model,
s_1 – initial state of the model,
s_m – final state of the model.

Each parameter has its own weight categories under the Fishburn's rule. This rule is defined by the formula:

$$w_i = [2/(N - n + 1)]/(N + 1)N \qquad (5)$$

w_i – Fishburn's weight index for the criterion of estimation the information support efficiency,

N – the total number of parameters of integral criterion of the efficiency of information support of investment decisions in the system of economic security of enterprises,

n – serial number of the parameter,
$i = \overline{1,8}$

Thus, the system of Fishburn's weight coefficients is formed. The conditions satisfying the system of Fishburn's weight coefficients are given by the equations:

$$W_i \in [0; 1] \qquad (6)$$

$$W^\Phi = \sum_{i=1}^{N} w_i = 1 \qquad (7)$$

where $i = \overline{1, N}$.

The obtained model may include the following parameters: NPV, return on investments, revenue from the use of the information system and risks.

The basis of the first two parameters is a unique mathematical model of estimation. Thus, the NPV approach is based on the NPV model with an equivalent annuity, and the ROI is based on the PI model.

Income D from the use of the information system can be estimated by the formula:

$$D = Cost_1 P_\sigma - Cost_2(1 - P_\sigma) \qquad (8)$$

P_σ – the probability of income provision,
$(1 - P_\sigma)$ – probability of losses,
$Cost_1, Cost_2$ – the units of information asset value.

The single risk of enterprise information security violation R is estimated by the formula:

$$R_i = p_i u_i \qquad (9)$$

p_i – probability of the threat i of economic security,

u_i – damage, caused by the threat i.

The subjective rist (*risk*) is determined in the following way:

$$risk = \frac{E}{M} \tag{10}$$

E – total number of risks,

M – number of all possible risks.

Total risk Q is determined by the formula:

$$Q = \sum_{i=1}^{n} R_i + risk \tag{11}$$

n – the number of threats to the economic security of the enterprise.

5. Conclusion

The developed model of economic efficiency of information support of investment decisions in the system of economic security of enterprises is different from other models that solve similar problems, in that:

1) it is completely formalized;

2) it is meant to be used at the enterprises with centralized document circulation, located in countries with a transformation economy;

3) it makes a comprehensive estimation of the cost of information support of investment decisions in the system of economic security of enterprises;

4) it allows you to determine the time intervals between changes of the amounts of costs intended for the information support system;

5) it increases the economic efficiency of information support of investment decisions in the system of economic security of enterprises.

For these reasons, the described model is a promising area for future research.

References

1. Bautov, A. (2003) Efficiency of Information Protection, *Open Systems*, No.07-08. (http://www.osp.ru/os/2003/07-08/183282/).
2. Gorbunov, A., Chumenko, V. (2013) Selection of a Rational Structure of Information Protection Means in ACS. (http://kiev-security.org.ua/box/2/26.shtml).
3. Efimov, E.N. (2011) Estimation of the Efficiency of Electronic Business Relationships of the Enterprise, *Problems of the Federal and Regional Economics: Scientific Notes,* Issue 14, pp. 68–75.
4. Pietukhov, G. B., Yakunin, V.I. (2006) *Methodological Principles of External Designing of Principled Processes and Purposeful Systems*, Russia, Moscow: AST.
5. Petrenko, S.A., Simonov, S.V. and Kislov, R.I. (2003) Information Security: Economic Aspects (http://www.jetinfo.ru/Sites/new/Uploads/2003_10.319A4A356B684F33A06E15C657633935.pdf).
6. Simonov, S.V. (2003) Technologies and Tools for Risk Management (http://www.jetinfo.ru/Sites/new/Uploads/2003_2.319A4A356B684F33A06E15C65763393.pdf).