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METHODS FOR DETERMINING ECONOMIC EFFICIENCY FOR COMPUTER INVESTMENT PROJECTS

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The topic of electronic project efficiency has become increasingly popular in the IT market. A mandatory requirement for the implementation of any IT project is represented by its economic justification. In the case of IT products, this statement is very true, as the risks are more extensive. The given article presents an analysis of the existing methods for evaluating the effectiveness of projects in computerization, as well as the characteristics of each method by identifying their advantages and disadvantages.

Thus, in order to give a clear answer regarding the efficiency of investments in IT projects, a series of indices have been used such as: Net Present Value (NPV), Profitability (PI) and Internal Rate of Return (IRR), as well as other indices by the method of simulation.

Keywords: *mathematical model, investment sources, capital investments, objective function, equation.*

METODE DE DETERMINARE A EFICIENȚEI ECONOMICE PENTRU PROIECTELE DE INVESTIȚII ÎN INFORMATIZARE

Tematica privind eficiența proiectelor electronice a devenit din ce în ce mai populară pe piața tehnologiilor informaționale (IT). O cerință obligatorie pentru implementarea oricărui i-proiect este justificarea economică a acestuia. În cazul produselor IT, acest lucru este foarte necesar, deoarece riscurile sunt mai extinse. În acest articol s-a făcut o analiză a metodelor existente de evaluare a eficacității proiectelor în informatizare, a caracteristicilor fiecărei metode prin identificarea avantajelor și dezavantajelor acestora.

Astfel, pentru a da un răspuns clar în ceea ce privește eficiența investițiilor în proiecte IT, au fost utilizați o serie de indici, precum Valoarea Actuală Netă (NPV), Profitabilitate (PI) și Rata Internă de Rentabilitate (IRR) și alți indici ai metodei de simulare.

Cuvinte-cheie: *model matematic, surse de investiții, investiții de capital, funcție obiectivă, ecuație.*

JEL Classification: *M310, M370, M150, C61.*

Introduction

The evaluation of the economic efficiency of investment projects in computerization (i-projects) is a mandatory component in the feasibility study. And, although it is not easy to estimate the future economic effect of i-projects, it is still necessary and this must be done regularly through simulation-based analysis that provides a lot of additional information in order to substantiate the investment decision in computerization projects.

Currently, simulation modeling represents one of the most powerful methods of analysis and is used both to solve management problems within companies and to model management at the macroeconomic level. The simulation is a computer experiment, and the only difference between such an experiment and a real one is that it is done with a system model, and not with the system itself. Thus, simulation is the only way to properly study the efficiency of i-projects without real experiments.

Based on the research carried out in this field, it can be mentioned that there are three main groups of methods that are used in determining the economic efficiency of projects, namely: **financial, qualitative** and **probabilistic**. Each method has its own advantages and disadvantages, as to determine the efficiency of i-projects, considering that the field of Information Technology (IT) is a complex one and not every activity can be evaluated through the financial component. Therefore, in order to illustrate more fully the final effect of the implementation of i-projects, in addition to financial methods, it is necessary to use non-financial analysis methods. From the above mentioned, one can note that the application of all groups of methods ultimately leads to a more adequate assessment of the effectiveness of i-projects.

1. RESEARCH METHODOLOGY: METHODS AND TECHNIQUES USED

A. Financial method

In economic practice, the financial method involves the use of several indices in order to determine the efficiency of i-projects. As a result of the research carried out, it results that each calculation index has a

different informational power. Therefore, the choice of the most effective indicators for the financial method must be made according to the needs and interests of the different users of the i-project.

The deepening of the analysis of the indices within the financial method, in order to determine the efficiency of the i-projects, supposes its examination from a factorial point of view. The purpose of the factor analysis is to determine the contribution of influencing factors on changing the efficiency of i-projects, as well as to identify solutions to improve its level.

The most used indices of the financial method for analyzing the efficiency of i-projects are: the **discounted duration of return on investment (R^i_d), the net present value (NPV), the internal rate of return (IRR)** [1, p.136-137].

B. Qualitative and probabilistic method

In any investment project, including computerization, it is mandatory to apply qualitative and probabilistic research, considering that the demand for new i-projects is growing in many branches with important problems where there are many unknowns and risks.

The investment risk is the probability of unforeseen financial losses in a situation of uncertainty of investment conditions. An objective approach to investment requires the use of evidence-based management mechanisms to ensure that existing risks are fully taken into account, that the effectiveness of ongoing activities is analyzed and that optimal decisions are taken in implementing investment projects.

Financial calculations are usually approximate, despite the mathematical clarity of the corresponding formulas. The reason for the approximations is the difficulty in identifying the future cash flow for an i-project and this is one reason why IT managers do not apply the values of NPV and IRR indices in the financial method [2, p.94; 3, p.17].

The qualitative research method of i-projects is used to discover the deep motivating factors that stimulate customers to use the software solution. Qualitative research allows the analysis of the phenomena studied in detail. However, they do not present the results in exact figures, shares or percentage values.

Thus, the knowledge and experience of the participants are studied, which represent a target segment, including their subjective opinion on certain issues subject to the study of the i-project.

The qualitative research method allows obtaining detailed information on consumer behavior and motivation. This technique is also used for:

- ✓ Strategic planning – to test ideas and decisions before implementing them;
- ✓ Discovering the needs and expectations of the target consumer group;
- ✓ Obtaining fast and efficient feedback from managers, experts and other people involved in the project;
- ✓ Confirmation of results and interpretation of data collected during quantitative studies;
- ✓ Testing the concepts of new products, package, design, slogans or advertising campaign before launching them on the market;
- ✓ Studying the positioning of the company and the i-project.

The analysis of the investment project must be performed as a complex system of organizational, technical and financial-economic actions, undertaken in order to carry out the investment initiative, which provides for capital investments in the real investment object and optimization of investments throughout the project life cycle. The documentary accompaniment of the i-project is made by the technical-economic justification of the efficiency of the investments and the elaboration of the business plan of the project. Determining the purpose and direction of investments, scale and deadlines represent other aims.

It is proposed to extend the classification of projects depending on the nature of financial flows (ordinary and non-ordinary), in which a specific group of atypical projects is highlighted. Thus, computing investment projects need to be analyzed in detail, taking into account real investment as a priority direction, which ensures stable positive trends in economic development.

2. RESULTS OBTAINED AND DISCUSSIONS

It should be noted that all indices used in **the financial method** also take into account the time factor in the calculations, because the time period of creation / procurement, operation, implementation and subsequent use of i-projects is in most cases more than one year, and there are expenditure flows and revenue flows and **the discount rate** must be applied to both flows.

The purpose of the discount rate is to bring future cash flows till present and to determine the evaluation of the efficiency of the investment, because it is clear that the financial means obtained today and those we

would have received a year later are in fact completely different in value, as well as in monetary terms and therefore, in such cases, it is necessary to take into account the time factor in the calculations.

This indicator is a key indicator for i-projects based on which the necessary value of investments is determined in order to obtain future revenues.

Thus, investments and operating expenses in different years are updated at the same time at the beginning of the reference year [4, p.12].

In order to determine the operational expenditure from different years, the expenditure is recorded until the beginning of the reference year, which is multiplied by the discount coefficient $\mathbf{d_n}$, and those performed and obtained after the beginning of the reference year are divided by this coefficient. The $\mathbf{d_n}$ coefficient is determined according to the formula [5, p.245-266]:

$$\mathbf{d_n = (1 + d)^n,} \quad (1)$$

where:

d is the **discount** rate;

n is the number of years separating the respective year from the reference year.

The discount rate is an established economic standard, used in assessing the efficiency of an investment project. The discount rate value can be set differently for different calculation steps. Therefore, in the case of the computer investment projects, the discount rate can be calculated using the weighted average cost of capital formula**.** (**WACC**) [5, p.255]:

$$\boldsymbol{WACC = \frac{E}{V} * R_e + \frac{D}{V} * R_d * (1 - T_c),} \quad (2)$$

where:

WACC – weighted average cost of capital (discount rate);

E – the amount of equity, funds planned to be invested in i-project;

D – the amount of borrowed capital;

V= E+D;

$\mathbf{R_e}$ **–** the cost of equity (risk-free alternative profitability is taken, which the company can get free cash, which is usually the income from deposits);

$\mathbf{R_d}$ – cost of borrowed capital (taken as the interest rate, in which the bank or borrower offers cash on investments in the project);

$\boldsymbol{T_c}$ – profit tax.

Generalizing the above mentioned, it is worth noting that, in order to determine the discount rate of i-projects, it is recommended to use the **CAPM** model (Capital asset pricing model). In this model, the discount rate is defined as the increased risk-free rate of return with the difference between the weighted average and the risk-free rate of return, obtained with the support of the coefficient of elasticity ($\mathbf{R_e}$) [6, p.7-12].

$$\mathbf{R_e = R_f + K\,(R_m - R_f),} \quad (3)$$

where:

$\mathbf{R_e}$ **–** discount rate;

$\mathbf{R_m}$ **–** weighted average rate of the market return;

$\mathbf{R_f}$ **–** risk-free rate of return;

K – the coefficient of elasticity of market return.

In the economic practice, real and potential investors are of particular importance for determining the rate of return without risk $\mathbf{R_f}$, in order to determine the causes and reserves to increase the return on permanent capital calculated on the basis of net profit.

One problem is to determine the **elasticity coefficient of the market return**, the role of which is to determine the efficiency of the i-project on the market, and if the company's shares increase with the market segment with the same score, then the elasticity coefficient is equal to one. If the market segment increases by one point, but also of the company's stock increases by twenty points, then, respectively, the elasticity coefficient of the market return will be equal to 1.2.

The cash flow represents the last thing used in financial methods to evaluate IT investments. Unfortunately, there are many practices for determining cash flow. Most often, *cash flow* is called gross cash flow (CFB), which is defined as the sum of non-monetary profits and income. However, when determining the feasibility study of investing in an i-project, the so-called net cash flow is used (free cash flow, CFN). Its essence is to bring a cash flow exactly to the form that can be used correctly in financial repayment calculations. Thus,

CFB = net income + non-monetary income

CFN = CFB + NWC (net working capital) + Inv (change in investment in fixed assets).

According to the research carried out, it has been found that the most widely used index in the financial method is NPV, that is, the current net income or net present value. Just the word "present" shows us that it contains the revenues from the i-project at the present time, not for amounts sometime in the future. NPV is determined by the classic discount formula.

Indices used to compare and determine the efficiency of i-projects by the financial method are: ***IRR, PI (EAPI), NPV (EANPV).***

In order to determine the mentioned indices, it is necessary to know all the data from the previous years and for the years of execution and operation of the i-project, in order to determine several input variables such as: *sales revenue, initial expenses, cash flow, discount rate,* etc.

The determination of the **input** variables in the years of operation of the investment can be done in two stages, respectively:

1. Identification of the determined factors and elaboration of the calculation model;
2. Simulation of the various possible future sizes of the determined factors with the retention of the other factors unchanged and determination of the: ***net value (NV), NPV, IRR, modified internal rate of return (MIRR), modified net present value (MNPV) and modified net rate of return (MNRR)***, etc., for each possible situation.

Simulation-based analysis provides a lot of additional information to substantiate the investment decision in a computerization project. Such analyzes reveal the impact of each factor on the NPV and suggest more rigorous control actions on the factors with negative influence, as well as actions to encourage the factors with positive influence.

The simulations regarding the probable identification of the efficiency of the investment projects must start from the estimates in order to know well the inter-conditions, but also the set of plausible solutions ($P>0$, $R^I>0$, $C^P<Q$, $CF>0$ and others) [7, p.303-309]. It is obvious that the simulation-based analysis starts with a basic, neutral situation, which is developed based on the estimated values for each key factor, and along the way, several scenarios are taken into account that answer a series of questions such as "what it would be if". The simulation-based analysis of the efficiency of i-projects provides the decision maker with the answer to such questions.

The MNPV and MIRR indicators accurately characterize the efficiency (profitability) of the project. If the data on tariffs is not known for a computerization project, the NV and IRR model will be used and, if there is only a discount rate, then NPV and DPI.

One can suppose that the cost of the i-project is known, which is worth 906,000 lei, and includes all the direct and indirect production costs necessary for the implementation of the investment project.

Table presents the forecast of the amount of cash flow (CF) that will be obtained after the implementation of the given project.

Table

Assessment of the economic effect of the investment project, thousands lei

Indicators	Investment size, thousand lei	Profit from the carried out investment over the years, thousands lei			
		1	2	3	4
Financial result	906	225	375	425	410

Source: developed by the author, based on the conducted study and scientific research.

Based on the data from Table, the indicators used in determining the financial performance will be compared using the financial method for determining the efficiency of the i-projects. For comparison, the following parameters of cash flows generated to identify the efficiency of the investment project will be identified, namely:

- *sum (NV, NPV, MNPV);*
- *profitability (NRR, IRR, MIRR, MNPV, MNRR);*
- *profitability index (DPI);*
- *payback period (TC, duration).*

Obtained results

Using the data from Table, the parameters in the "sum" of cash flows generated by the investment project for different mathematical models are determined. **NV** represents the arithmetic sum of all cash flows generated by the investment in the project (outputs and inputs) or the accumulated effect (cash flow balance) for the billing period [7, p.305].

This indicator is used to calculate liquidity and solvency ratios, sometimes for a rough estimate. The calculation is made according to the following formula:

$$NV = \sum_{t=0}^{t=T} CF_t - \sum_{t=0}^{t=T} (C_0)_t \,, \quad (4)$$

where:

T is the project implementation period, years;

CF_t – cash flow in t year (Cash Flow);

$(C_o)_t$ – cash outflow in t year (absolute value).

Acceptance criteria: NV > = 0 (the more, the better).

In the case of the indicated example, the actual cost after the implementation of the project will be:

NV = 225 + 375 + 425 + 410 - 906 = 529 thousand lei. (5)

Thus, analyzing the outcomes obtained as a result of the example based on the NV indicator, the project can be approved.

Based on the data from Table, the NPV for the investment project is calculated, which is determined by reducing the difference between the annual outflows and cash inflows for the researched i-project during the life of the project:

$$NPV = \sum_{t=1}^{t=T} \frac{CF_t}{(1+r)^t} - \sum_{t=1}^{t=T} \frac{(C_0)_t}{(1+r)^t} \,, \quad (6)$$

where **r** is represented by the discount rate.

Based on the presented example, the **NPV** index is equal to **109.53 lei**, at a discount rate of **14%.**

The NPV indices are a standard indicator widely used to assess the effectiveness of investment projects and determine an estimate of the effect of the investment at a given date till present, taking into account the different value of money over time. If the NPV is greater than 0, then the investment is economically efficient and, if the NPV is less than 0, then the investment is economically unprofitable (i.e. an alternative project, whose profitability is accepted as the discount rate, requires less investment to achieve a similar revenue stream) [8, p.68-75].

Comparing the results of NV and NPV, it can be seen that, although the investment project remains efficient, the calculation of NPV provides a lower predictive estimate of the change in the economic potential of the company if the project in question is adopted.

When calculating the NPV, a constant **discount rate** is usually used, but depending on the circumstances (e.g. rates), the discount rate may be differentiated over the years. If different discount rates are used during the calculations, then the calculation methodology from [5, p.11] is used. However, a project that is acceptable at a constant discount rate may become unacceptable.

If the discount rate and the level of reinvestment differ significantly, it is logical (in terms of accuracy) to calculate the NPV using the MNPV taking into account that the funds received as a result of the investment are reinvested at a different rate:

$$MNPV = \frac{\sum_{t=1}^{t=T} CF_t \ (1+d)^{T-t}}{(1+r)^T} - \sum_{t=0}^{t=T} \frac{(C_o)t}{(1+r)^t} \,, \quad (7)$$

where **d** is the level of reinvestment, the unitary share.

The MNPV indicator is determined as the sum of the current values of all projects, taking into account the discount rate and the level of reinvestment and cash flows [7, p.329].

Acceptance criterion: MNPV> = 0 (the higher, the better). In the case of the proposed example, the net present value changed after the implementation of the measures at the same discount rate of 14% and the reinvestment level, for example 4.5%, will be:

$$MNPV = \frac{225(1.045)^3 + 375(1.045)^2 + 425(1.045)^{31} + 410}{(1+0.14)^4} + 906 = -5,80\ thousand\ lei \quad (8)$$

Other parameters for assessing the risks of IT investment projects are the parameters of the group that determine the "profitability": **NRR, IRR, MIRR, MIRR (bar)** and **DPI**.

If there is no data on the discount rate and reinvestment level, then the **IRR** parameter is used.

It should be noted that the NPV index is used in determining the relative score, and the IRR or rate of return of the i-project is used in determining the absolute score of the project, this being the value of the reduction factor, when the NPV of the project is zero. If at the time of determining the NPV index we understand the current profit of the project in which it is wished to invest, then the internal rate of return is the bank interest rate on which no profit will be received. If we analyze the NPV's dependence on the discount rate, it is obvious that the profit from the project will decrease with the increase of the discount rate (see Figure) [9, p.125]. For the case when a project is fully financed by a bank loan, and the average risk-free bank interest rate is 12%, then it can be said that the i-project is beneficial.

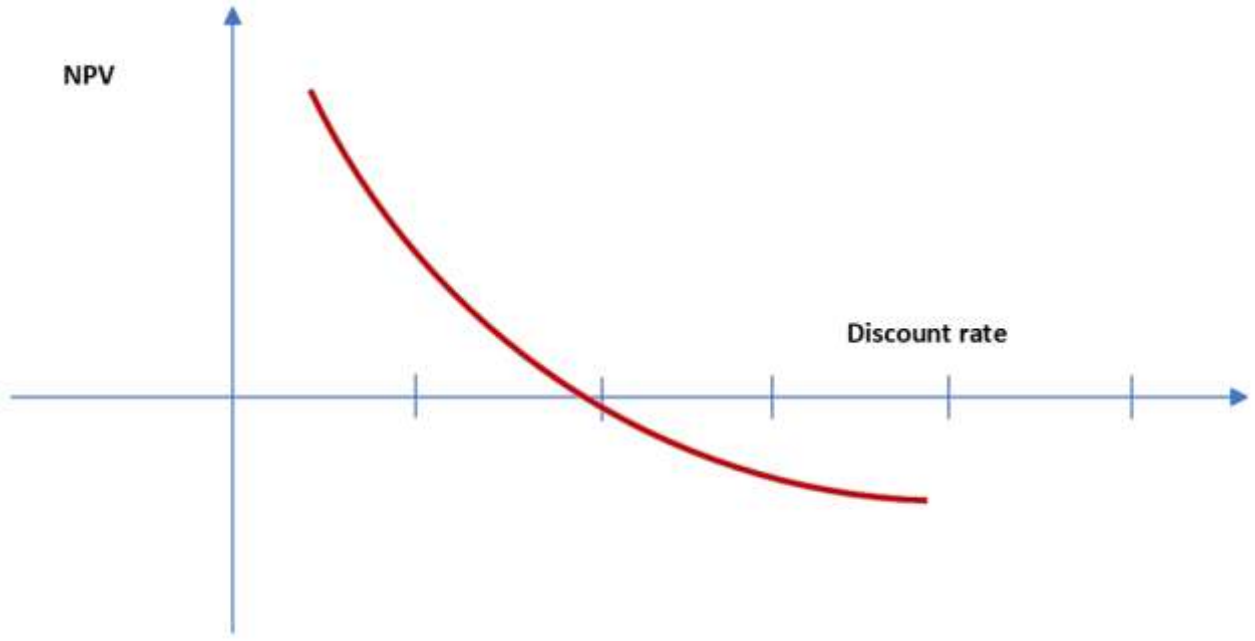

Fig.1. Dependence between NPV and discount rate.
Source: developed by author, based on the conducted study and scientific research.

The IRR index, in fact, determines the interest rate from the project implementation, and then compares this rate with the risk-adjusted repayment rate. If the repayment exceeds the risk-adjusted recovery, then the investments make sense. Unlike NPV, IRR is an absolute measure that allows not only decisions to be made on i-projects, but also to compare projects with completely different levels of funding and completely different budgets [9, p.126-130].

If the internal rate of return of the project is higher than the return required by the investor, then the project is accepted, sub-rejected.

That is, IRR = r, for which NPV = f (IRR) = 0. Thus, IRR is found by solving the equation:

$$NPV = \sum_{t=0}^{t=T} \frac{CF_t}{(1+IRR)^t} - \sum_{t=0}^{t=T} \frac{(C_0)_t}{(1+IRR)^t}_{n} = 0 \quad (9)$$

As a result of solving equation (9), we obtain an internal rate of return equal to: **IRR** = 19.23% (IRR> r). Therefore, with regard to this indicator, the project can be accepted. One of the options for changing the concept of reimbursement is to find the ratio of the sum of all discounted cash flows (investment income) to discounted investment expenses.

The result is a low return (DPI), where **r** is a barrier or a discount rate:

$$\mathbf{DPI} = \frac{\sum_{t=0}^{t=T} \frac{CF_t}{(1+r)^t}}{\sum_{t=0}^{t=T} \frac{(C_0)_t}{(1+r)^t}} \quad (10)$$

Acceptance criterion: DPI> = 1.0 (the higher, the better). Using data for example with **r** = 14%, we obtain a low rate of return equal to 1.5. Finally, the most accurate determination of the return on investment in relative values allows the determination of the index called *Modification of the Internal Rate of Return* (MIRR), which is the internal rate of return adjusted for the reinvestment rate. The MIRR value is determined from the equation:

$$\sum_{t=0}^{t=T} \frac{(C_0)_t}{(1+r)^t} = \frac{\sum_{t=0}^{t=T} CF_t\,(1+d)^{T-t}}{(1+MIRR)^T} \quad , \quad (11)$$

where: **d** it is, as before, the reinvestment rate in unit shares.

Using the parameters of the considered project with r = 14% and choosing d = 6.5% (in this case, the modified net present value will be 17.5 thousand lei), we obtain:

$$(1+MIRR)^4 = \frac{225*1,065^3 + 375*1,065^2 + 425*1,063^1 + 410*1,065^0}{906/_{1,14^0}} = \frac{1559,75}{906} \approx 1,72 \quad (12)$$

Thus, the modified internal rate of return is 14.55%, which is higher than the reinvestment rate (6.5%), which means that the project can be implemented.

The third basic indicator used in the financial method is the payback, the payback period (TC) of the i-project. In fact, this is an analysis of the return on funds based on the maximum return on investment. Today, quite often, IT companies set a maximum payback period for i-projects.

If to refer to the analyzed example, the return on investment will be 30 months, and we invest 906 thousand lei with an annual repayment rate of 300 thousand lei. In this case, the payback period of three years exceeds the maximum payback period established in the company. By researching the indices within the financial method, one can provide a complete understanding of the efficiency of the project investment, the profit and the economic effect that will be obtained from the IT project.

Each of the analyzed indices has both advantages and disadvantages. The net present value (NPV) takes into account the value of money, but does not take into account the risks of the project. In addition, this absolute indicator (money) does not allow us to compare projects with different levels of funding. The internal rate of return (IRR) does not take into account the cost of capital and, unfortunately, this index is a bit more complicated.

Finally, the payback period does not take into account the value in time of the funds. It is easy to notice that the NPV and IRR indicators complement each other and therefore, they are used only together in most projects, and the payback period indicator is used much less often.

The research of i-projects through the qualitative and probabilistic method consists in the scientific substantiation of the improvement of the methodology for evaluating the efficiency of real investment projects, namely:

1. Arguing the priority role of the financial evaluation of i-projects in the preliminary limits of investment research;
2. Propose modified concepts for the development of cash flows;
3. Formulation of improved methods for modeling the financial plan of i-projects;

4. Determining the range of application of static and dynamic methods for evaluating the efficiency of various types of real i-projects;

5. Extending the classification of risk factors and proposing methods of recording and calculation of risk factors.

Whether an i-project is required to be evaluated, the first step is to gather as much information about the project as possible. This can be done starting from a project sheet in which the main categories of information required in the evaluation process appear. The project file must contain elements regarding the project context: a brief history of the i-project (details about the origin, initiator), the summary of activities and methods of providing / ensuring the service, information about similar projects organized / carried out by other institutions / organizations, as well as details on the uniqueness of the project. Another element of the project file is the organizational structure (organizational chart, distribution of responsibilities), project documents, from which information must be extracted regarding: the purpose and objectives of the project, the strategies to achieve the goals and the objectives of the project with implementation plans, short, medium and long term results, the list of performance indicators, the results of previous monitoring, etc. After analyzing all this information, we already have an overview of the i-project and we are ready to move on to the construction of tools to obtain more detailed information or to verify certain data, if necessary.

The quantitative method is based on the same idea: objectives, priorities and indicators. The first method that can be mentioned is entitled the **Information Economy**. The idea of this indicator is that the top management of the IT company must organize a certain coordinate system according to which to determine the priorities in the development of the company's business and to prioritize the design criteria. And then the project is evaluated for compliance with the criteria developed and approved. Everything seems a bit abstract, but in fact this is a fairly easy method that companies use very often to compare the expected qualitative effect of the project with the desired effects.

To somewhat reduce the level of abstraction, this method is often combined with project portfolio management, when these effects are fully considered in the i-project portfolio as a whole.

Even more concrete in this approach is the introduction of the scoreboard. The idea is to adapt the Balanced Scorecard (BSC) approach [10, p.71-79], which represents a management system and a strategic planning tool, widespread in business and industry and in public state institutions, as well as in non-profit organizations. BSC improves external and internal communication and monitors an organization's performance based on its strategic objectives. In the past, the BSC has played the role of a performance measurement framework, and over time, the BSC concept has evolved and become fully a strategic planning tool.

Within the BSC, the attention of managers is directed to non-financial indicators with the role of assessing the degree of customer and employees' satisfaction, duration of processes and quality of results. The respective indicators, appointed among the early indicators specialists, help and facilitate the anticipation of the future financial performance of the company, because only with a motivated team, acting according to efficient, customer-oriented processes, on a market with satisfied consumers, high performance products in conditions of economic efficiency are offered.

As in traditional BSC, the IT Scorecard [10, p.73] selects four balanced directions (perspectives in BSC terminology) of the IT impact on the company's business. In the classic and most applicable case, these areas are the following: assistance in developing the company's business, increasing product quality (both for internal and external users), improving the quality of decision-making processes and increasing labor productivity.

The probabilistic method

Finally, the last group of methods for assessing the economic effect of i-projects is the probabilistic one. There are generally two of them: the Applied Information Economics and the Real Option Evaluation (ROV) [11, p.28-33].

The method of applied information economy is quite commonplace; this is a slightly modified qualitative method of information economy. Its idea is to determine, for each of the declared objectives of the i-project, the probability of accomplishing it and then to deduce from this the probability of improving the business processes within the company.

In any i-project, there are five parameters: project revenue, project costs, project complexity, the underlying cost of the resulting solution and the life cycle of the implemented IT system. It should then be assessed

how much these parameters can be influenced along the way, consequently, the more rigid the project is, the stricter the framework is set and the less interesting it is.

For example, there are two different i-projects. If the first project has a decision support with a clear scheduled cost per year, fixed in the support contract with service providers and it cannot be reduced in the future, then the second project has no fixed support costs and there is a possibility that after some time it becomes less critical for the company.

The statistical method

The statistical method (some refer to it specifically probabilistically, because the effect that is possible, according to statistics, is not necessary at all) joins the probabilistic methods of assessing the economic effect of an i-project. The number of implementations of various IT technologies abroad and also the fact that statistics are kept quite clear and precise, allows some qualitative findings to be made. Of course, there is truth, and there are statistics, however, only when the economic effect of the future i-project is justified.

Conclusions

Following the carried out research, it can be concluded that the evaluation of i-projects is a very complex one. The multitude of methods available for evaluation allow managers to select the most appropriate one using the simulation procedure. There are currently no studies to show which method is better. It is important that the selected method allows the most accurate estimation of the efficiency of the i-project, which will allow a correct decision to be made regarding:

- classification and prioritization of development projects;
- determining the resources to be committed to the project and how these resources will be used;
- the impact of changes and the support needed for a rescheduling.

As a result, projects can be more easily managed and controlled, resources are better adapted to real needs, and clients will receive the developed project, which will not exceed the planned budgets.

Generalizing the above, it should be mentioned that the comparative research through simulation of NPV, PI and IRR indices, used to determine the efficiency of i-investment projects, represents a characteristic way of treating imprecise and incomplete relative information and offers the possibility of analyzing several variants of decision and choosing the best project option.

Thus, the simulations in an i-project are based on the creation of a model from the decision-making variables involved, which reproduce the mechanism related to the decision-making situation, and which, based on some starting information and the effects they generate, choose the designed decision-making variant that corresponds to a set of predetermined decision criteria.

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