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SELECTION OF MOST APPROPRIATE PROJECT ALTERNATIVES FOR REALIZATION OF INVESTMENT STUDY

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Abstract. *This paper presents the selection of most appropriate projects for realization i.e. investing. The selection has been performed according to methodological principles of the pre-investment study. Projects were ranked according to several influential factors simultaneously. This process is based on the method of evaluation of financial and market conditions that take into consideration already established technical solutions.*

1. INTRODUCTION

Financial assessment of projects ready for realization, i.e. investing, plays a very important role in today's intensive global market situation and uncertain economic conditions. However, financial assessment of individual projects cannot be performed without previous analysis of market, technological and technical solutions.

Subject matter discussed in this paper analyzes and, at the same time, solves the investor's dilemma whether to, depending on the conditions on the market, perform one of the following:

- modernization and expansion of planned investment,
- reconstruction of planned investment,
- construction of a new factory based on the existing production program and product assortment.

The problem is based on the individual analysis of projects according to methodological principles of the pre-investment study. These methods are based on the analysis of different alternatives relating to type of equipment, material inputs, energy sources, etc. The final aim is to make the decision about the realization of that project which gives

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such results which would justify the preparation of investment study, i.e. undertaking the investment process [1].

Financial evaluation of analyzed projects is based on the assumption that market, technological and technical solutions are already known, and thus they are not separately considered in this paper.

Financial and market evaluation of analyzed types of development projects is performed by the application of the project ranking method based on several influential elements. This method will be discussed in more details later in this text.

2. BASIC CLASSIFICATION OF PROJECTS

Strategic aims of a firm are attained by the realization of one or more individual projects.

The main aim of the project must be fulfillment of certain economic interests of the firm. These aims can be expressed through profit or creation of value for their owners.

In order to attain this main goal, various types of projects can be used: investment projects, technological innovation projects, company restructuring projects, financial consolidation projects, energy consumption rationalization projects, marketing projects etc. [2].

Bearing in mind that this paper discusses the field of investment projects, their classification from the engineering point of view has to be discussed.

Classification of projects from this point of view is extremely important because it refers to the status of the market that is one of the most important segments in a company's business system.

According to this classification, projects can be [3][1]:

- new investment projects,
- modernization and expansion projects,
- reconstruction projects.

The above described classification of projects creates a question whether identical methods and techniques of financial and market analysis can be used for different projects? There is no doubt that methods and techniques of financial and market analysis are utilized in almost the same way for various types of projects and can be standardized to a significant extent.

The most important methods and techniques associated with this analysis are cost calculation, financial reports analysis, company value assessment methods and, what is most important, methods for assessment of financial and market aspects of projects [3].

3. ABOUT FINANCIAL AND MARKET ASSESSMENT OF ANALYZED PROJECTS

In order to determine which of the analyzed project alternatives (classified according to the state of the market) is acceptable for realization, each of these alternatives should, under pre-defined conditions, undergo a financial and market assessment.

[1] Besides this classification, projects can also be classified according to the type of activity and their complexity [3].

This assessment is based on the following presumptions:

- net present worth (NPW) is greater than or equal to 0,
- internal rate of return (IRR) is greater than the individual discount rate (average weighed interest rate on sources of financing),
- net cash flow (liquidity) is positive every year.

After such an analysis is performed for each of the projects considered for possible investing, it is clear that the project having all other positive analyzed factors as well as the greatest positive net present value and internal profitability rate shall be accepted for realization.

Because of the fact that the procedure used to calculate NPW and IRR is not exact this means that the above-described method does not yield a totally exact solution for the selection of project to be realized. This fact is stressed even more by the subjective nature of manager's and program author's opinions.

Nevertheless, this method is acceptable and justified from the techno-economic point of view and has given satisfactory results so far in practice [4].

Bearing in mind the above stated reasons, authors prefer the use of method based on ranking projects according to several influential elements simultaneously [5,6].

4. PROJECT SELECTION BASED ON THE RANKING METHOD

Determination of methods and criteria to be used for project evaluation and selection poses as a problem in the process of project selection. Many of the methods do not give desired results because of the discontinuous character of variables involved. The project ranking method makes it possible to perform selection of projects suitable for investing on the basis of several influential elements simultaneously.

This method is characterized by comparison of different alternatives according to influential elements selected in advance.

Thus, the project ranking method starts from determination of influential elements and consequently awards each of these elements a certain number of points and, in such a way, defines the character of each of them.

The project ranking method, besides determination of the set of projects that will be subjected to selection, also contains several specific and very complex phases and activities such as determination and definition of influential elements. This is the most important phase in the application of the project ranking method.

Two problems arise and need to be solved [8]. The first refers to determination of the size of the set of influential elements. Should it be limited to a small number (e.g. several) of influential elements that are considered the most important for selection of projects, or should a greater number of elements be adopted and, according to the authors' opinion, in that way, most of the relevant influential elements included.

The first alternative provides for a faster and more efficient analysis and selection, but some significant elements might be left out. The second alternative makes it possible to include more relevant influential elements, but it is harder and more complex and might give unclear and fuzzy results, especially when quantitative analysis is concerned. Thus, the logical solution would be to adopt an optimal number of influential elements somewhere in-between the two alternatives.

The second problem refers to determination of the set of the most acceptable influential elements. This problem is as complex and significant as the first. In itself, it also represents a new problem of selection of the right alternatives.

In practice, this problem is usually simplified and solved by fast empirical and intuitive methods.

The solution of these two problems results in determination of appropriate influential elements to be used for the selection of projects.

Influential elements such as net present worth, internal rate of return, value of investments, payback period and the increase of market share are used in this paper.

It should be noticed that this is only one of applicable approaches and one set of possible influential elements for selection of projects suitable for realization in an investment process.

After the process of selection of influential factors is over, individual influential elements are quantified by their relative weight. These values are then used for further evaluation and selection. First of all, each individual influential element is assigned an appropriate weight coefficient, which reflects its relative significance compared to other elements and the entire set of elements. Thus, determination of weight coefficients must depend on the strategic objectives of the investor. Greater weight coefficient will be assigned to that element which participates to a greater extent in the realization of these objectives.

After the weight coefficients are assigned to each influential element, their character needs to be determined. If a certain element is defined as positive, it makes the entire project more acceptable, because its absolute value is higher. But if an element is rated negative, its greater absolute value means that the project is less acceptable. Thus, in order to determine the final number of points, the reciprocal value of these elements has to be used [8].

The next section of this paper gives an example that clearly illustrates the ranking method.

5. AN EXAMPLE OF RANKING

Based on given market, technological and technical solutions, company "X" has to analyze financial and marketing indicators in order to decide which of the alternatives (reconstruction, modernization and expansion type of investment or a completely new investment) to chose in order to undertake investment activities.

What is given is:

The following influential elements are adopted for the reconstruction project – Table 1:

Table 1. Analysis of the reconstruction project

Net present worth (NPW)	12.000 EURO
Internal rate of return (IRR)	15,72 %
Investment (I)	80.000 EURO
Payback period (PP)	3,30 years
Increase of market share (IMS)	0

Modernization and expansion project has the following values of influential elements –Table 2.

Table 2. Analysis of a modernization and expansion project

Net present worth (NPW)	23.000 EURO
Internal rate of return (IRR)	16,53 %
Investment (I)	115..000 EURO
Payback period (PP)	3,92 years
Increase of market share (IMS)	5%

According to the methodology for evaluation of investment justification, new investment has the following values – Table 3.

Table 3. Analysis of a new investment project

Net present worth (NPW)	31.000 EURO
Internal rate of return (IRR)	14,33 %
Investment (I)	235..000 EURO
Payback period (PP)	4,22 years
Increase of market share (IMS)	5%

Values of weight coefficients (t_j) as well as the character of each element are determined in the following way – Table 4 [2].

Table 4. Weight coefficient analysis

Influential Element	Weight coefficient (t_i)	Character of the influential element
NPW	25	+
IRR	30	+
I	15	–
PP	20	–
IMS	10	+
Σ	100	

Ranking of projects according to individual influential elements is explained on the example of net present worth (+) and investment (–):

Number of points to be assigned to element NPW for the reconstruction project is determined in the following way:

$$P_{ij} = n * t_j \frac{S_{ij}}{\sum_{i=1}^{3} S_{ij}} = 3x25x0{,}18 = 14$$

Where:

S_{ij} - net present worth for project i,

t_j - weight coefficient,

n – number of projects,

P_{ij} - points awarded to element j for project i

Table 5. Element: NPW

Type of Project	S_{ij} (EURO)	$S_{ij} / \sum_{i=1}^{3} S_{ij}$	P_{ij}
Reconstruction	12.000	0,18	14
Modernization	23.000	0,35	26
New invest.	31.000	0,47	35
Σ	66.000	1,00	75

The same procedure was used to calculate the values for modernization projects and for new investments.

Table 6. Influential element: Investment

Type of Project	S_{ij} (EURO)	V_{ij}	$V_{ij}/\Sigma V_{ij}$	P_{ij}
Reconstruction	80.000	5,37500	0,49114	22
Modernization	115.000	3,73913	0,34166	15
New investm.	235.000	1,82978	0,16720	8
Σ	430.000	10,94391	1,00000	45

where: V_{ij} - reciprocal value of the influential factor for project *i*.

Ranking of a project based on several influential elements is given in Table 7.

Table 7. Ranking process

Type of project	NPW Rank *Pij*	IRR Rank *Pij*	I Rank *Pij*	PP Rank *Pij*	IMS Rank *Pij*	Total Rank *Pij*
Reconstruction	3	2	1	1	3	3
	14	31	22	23	0	90
Modernization	2	1	2	2	1-2	1
	26	32	15	19	15	107
New invest.	1	3	3	3	1-2	2
	35	27	8	18	15	103

Based on individual influential factors and on performed ranking it can be concluded that modernization and expansion project should be accepted and realized. Thus, an investment study should be prepared for this type of project according to valid methodological principles of the World Bank.

6. CONCLUSION

Process of selection of a project suitable for realization is very complex and demanding and as such it calls for maximum responsibility of all personnel involved in its final shaping and preparation for realization. This preparation consists of preparation of the investment study for the project that has the best conditions for realization.

Selection of the most suitable project for realization, i.e. for investing is performed by the ranking method according to several influential factors and is based on the criteria related to financial and market evaluation of each of the analyzed projects.

REFERENCES

1. Handbook for the Application of Joint Methodology for Social and Economic Justification of Investments and Investment Efficiency in SFRY – Instructions for Preparation of Pre-investment Study, (in Serbian), Yugoslav Bank Society, Belgrade, 1988.
2. Dubonjić, R., Jovanovic, P., Pokrajac, S., Industrial Management, (in Serbian), "Grafoslog", Belgrade, 1998.
3. Plavšić, R., Soldat, D., Dubonjic, R., Milanovic, Lj. D., Knezevic, S. Preparation of the Investment Study, (in Serbian), "AŠ DELO", Zemun, 1998.
4. Documentation of the Institute for Investment Economics, Beogradska banka,a.d., (case study), Beograd, 1995 –2000.
5. Dubonjić, R., Milanović, Lj. D. Engineering Economics, (in Serbian), Faculty of Mechanical Engineering, University of Belgrade, Belgrade, 1997.
6. Mrdja, N., Financial Analysis Applied to Project Management, (in Serbian), "Ficom", Belgrade, 1999.
7. Levy, H., Marshall, S. Capital Investment and Financial Decisions, Prentice Hall, 1990.
8. Shtub, A., Bard, J., Globerson, S. Project Management, Prentice Hall, 1994.

KOMPLEKSNOST IZBORA NAJPOVOLJNIJIH PROJEKTNIH VARIJANTI ZA REALIZACIJU INVESTICIONE STUDIJE

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U radu je prezentovan izbor najpovoljnijih projekata za realizaciju u postupku investiranja. Izbor projekata izvršen je po metodološkim principima predinvesticione studije. U postupku razmatranja projekata po više uticajnih elemenata istovremeno, primenjena je metoda ocene finansijsko – tržišnih uslova koji se naslanjaju na poznata tržišna i tehnološko – tehnička rešenja.