



CRITERIA FOR THE EVALUATION AND SELECTION OF CAPITAL PROJECTS

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Abstract. The growth of an enterprise's value as the basic aim of entrepreneurship is determined by long-term prosperity that is impossible without the implementation of a successful and permanent investment policy. Rational decision-making in the field of investment evaluation is necessary for other stages of the whole investment process. The article deals with a discussion of the results of a questionnaire-based research of enterprises in the Czech Republic that was performed by the Faculty of Business Administration in 2007. It makes use of the part of the research concerning the choice of decision-making criteria. The abovementioned regional investigation in the Czech Republic is then compared to similar pieces of research, both national and foreign. The published article is a part of the solution of the Faculty's research intention 'New Theory of Organizations' Economy and Management and their Adaptation Processes' registered in the Czech Republic under the document No. MSM 6138439905.

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Reikšminiai žodžiai: investiciniai sprendimai, investiciniai projektai, projektų vertinimo procedūros, hipotezių tikrinimas, empiriniai tyrimai.

Introduction

Investment decision-making is an important part of strategic decision-making in every enterprise because new investment projects essentially affect future economic results and the enterprise's prosperity. Successfulness of new projects dramatically contributes to the growth of an enterprise's efficiency. On the other hand, unsuccessfulness can lead not only to a considerable decline in efficiency, but it can even jeopardize its future existence. Successfulness or unsuccessfulness of projects thus considerably depends on the quality of the process of preparing, evaluating and selecting these projects.

The quality of investment decision-making is affected by a large number of factors, while the most important include the choice of the criteria for the evaluation and selection of investment projects. The aim of the present article is to present the results of an empirical research done at the Faculty of Business Administration of the University of Economics in

Prague (Kislingerová, 2008) and compare them with the results of other investigations into this issue.

1. Grounds for the Research

The empirical research of investment decision-making of the Faculty of Business Administration of the University of Economics in Prague was done in a form of a questionnaire and was aimed at the solution of a research intention MSM 6138439905 'New Theory of Organizations' Economy and Management and their Adaptation Processes'. This investigation was done before the period of economic and financial crisis at the end of 2007 in the chosen Czech enterprises (in total 252 well-filled questionnaires were received and elaborated). Each questionnaire contained 77 basic questions focused on an enterprise's economy and management and the rest 15 questions were aimed precisely at issues regarding logistics. The majority of the questions were multiple-choice allowing the respondent to choose

one or more variants or arrange answers in sequences of importance. There was a minimum of open-ended answers; however, the majority of questions included the possibility to insert the respondent's own answers. Primary outputs of the investigation were absolute frequencies of particular answers to separate questions of the questionnaire.

For testing the hypotheses of mutual dependence of the chosen characters in view, cross tabulations of these dependences were made in the light of worded hypotheses. They were tested by using a χ^2 test for goodness-of-fit.¹ 5% significance level was chosen as the base, and during the testing of some dependence even a lower significance level was accepted. In addition, the correlation coefficient and Spearman's test were used.

In addition to the research mentioned above, the results of other similar studies in the Czech Republic as well as in the U.S., Great Britain, Finland and Sweden were referred to.

2. Classification of the Criteria of Investment Decision-Making

In terms of qualitative outputs, projects of investment character can be characterized by three basic factors: **cash flows** or, in other words, the difference between receipts and expenditures resulting from investment; **real service life**; and **risk** that is run by the implementation of investment and for which the enterprise should require an adequate return.

There are many methods or criteria for the evaluation of capital projects; thus, the approach to these basic factors differs. The criteria for the evaluation of capital projects can be divided into two groups:

- **Static criteria** that consider mainly cash flows. They consider time in constraint mode and, in principle, they do not deal with risk. They include, for example, total investment income, net total investment income, annual average returnability, average payback period, payback period.

- **Dynamic criteria** that take into account all three factors, i.e. cash flows, service life and undergone risk as well. They involve, for example, net present value, internal rate of return, profitability index, benefit-cost ratio, discounted payback period.

During the evaluation of investments, other instruments mainly in connection with integration of the risk and uncertainty of this process of evaluation

are used. They include, above all, sensitivity analysis, scenarios and simulation techniques. The evaluation of investment projects is enabled by real options.

The choice of a criterion for evaluating investments reflects more aspects, mainly preferences of the decision-maker (impact on relative or absolute profitability, stress on short payback period, existence of the budget constraint), intensity and elaborateness of the application of particular criteria, relevance of the decision, time pressure or customs in the organization.

3. Knowledge and Conclusions from Own Research into the Criteria Applied in Investment Decision-Making

The question regarding the criteria used for the evaluation of investment projects was formulated as follows: 'Which criteria do you use at present for the evaluation of investment projects?'. Respondents could choose several possible answers.

The following research hypotheses were formulated:

1. Enterprises in the Czech Republic prefer methods that emphasize timely rate of return.

This hypothesis was formulated in connection with the research by Hájek et al (2001) which asked the respondents' (from manufacturing firms in Great Britain, the U.S. and the Czech Republic) opinion about the statement 'It is natural that managers on behalf of their own carrier support projects that bring result in the short run?'. 53.5% of British managers agreed with it, so did 62.5% of managers from the U.S. and 62.1% of Czech managers.

2. For the reason of better predicating ability, enterprises prefer dynamic criteria rather than static.

3. The choice of the criteria for the evaluation of investment projects depends on the size of the enterprise, namely, the usage of dynamic criteria increases with the growth in the enterprise's size. It is true that the bigger the enterprise is, the more sophisticated criteria for evaluating investment projects are used.

4. The choice of the criteria for the evaluation of investment projects depends on the type of ownership, namely, it is true that enterprises with foreign capital participation use more sophisticated criteria for the evaluation of investment projects than enterprises of national capital.

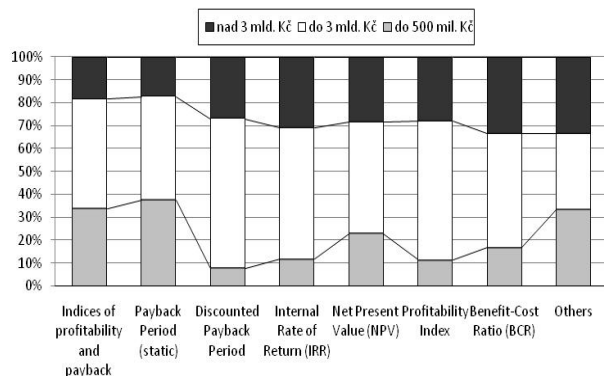
The primary data gathered through the empirical research, absolute and relative frequencies are introduced in Table 1.

¹ If the calculated value exceeds the critical value, given the number of degrees of freedom, the dependence of two qualitative characters can be regarded as proved.

Table 1. Criteria used for the evaluation of investment projects (Kislingerová et al, 2008)

Type of criterion	Criterion	Number	Take-off
static	Indices of profitability and payback	190	75 %
static	Payback period (static)	69	27 %
dynamic	Discounted Payback period	28	11 %
dynamic	Internal Rate of Return (IRR)	55	22 %
dynamic	Net Present Value (NPV)	56	22 %
dynamic	Profitability index (PI)	20	8 %
dynamic	Benefit-Cost Ratio (BCR)	8	3 %
dynamic	Others	9	4 %
Total number of questionnaires with one filled answer at least		241	x

Most respondents (more than 75%) use static criteria (but that does not mean that dynamic criteria are not used simultaneously). Only less than a quarter of respondents (22%) use dynamic criteria such as net present value (NPV) or internal rate of return (IRR) for the evaluation of investments. As the data shows, managers prefer using criteria focused on profitability and investment return (confirmation of hypothesis No. 1) and, unfortunately, static criteria for the evaluation of investment projects prevail (non-confirmation of hypothesis No. 2).

**Figure 1.** Usage of methods depending on the size of the enterprise, absolute frequencies (Kislingerová et al, 2008)

A situation that seems disconsolate at first sight is however usual in international confrontation (see Section 4.2 of the present article devoted to confrontation with other researches) as well, and this may not indicate the cut of more sophisticated criteria of dynamic character but the state when particular criteria are being used according to the investment purpose. In the first stage of the decision-making process, investments that after the quantification of receipts and expenditures do not meet the basic criteria of acceptability are evaluated as well; therefore, their possible risk is not taken in account. For this reason the usage of static criteria can be an adequate

instrument for rationalization in further examination of investment options. The mentioned state can be a signal of a proactive attitude of managers to the control of an enterprise's development through investments—possibilities of the location of an enterprise's liquid capital are being searched for more intensively. Many of them do not go through the first stage of decision-making for the reason of obvious inadvisability that is already disclosed by the static criteria. On the other hand, these grounds can be questioned because, according to the results of other studies (e.g. Švecová, 2005 or Dudek, 2003), most managers prefer more simple criteria mainly for the reason of insufficient knowledge of more sophisticated instruments and time pressure.

Figure 1 introduces the usage of the criteria for the evaluation of investment projects depending on the size of the enterprise measured by annual sales. Answers of respondents who did not mention the amount of sales were discarded.

Hypothesis No. 3 about the dependence of the choice of criteria on the enterprise's size was tested through a χ^2 test of fit. The value of the test criterion was 25.14, while 14 degrees of freedom and 5% significance level were chosen and the critical value of the test was 23.68; therefore, the hypothesis could be accepted and it was proved that the size of the enterprise influences the choice of the criteria for the evaluation of investments. In the research, a clear tendency of large enterprises' shift to the usage of dynamic criteria (NPV, IRR) was observed; however, it is not statistically provable.

The entrance of foreign capital into Czech enterprises is often a very important step towards the rationalization of decision-making processes on all levels of managing. For this reason we have worded the hypothesis No. 4 about the dependence of the choice of evaluation criteria on the type of ownership. Table 2 and Figure 2 show relative frequencies of using particular criteria depending on the majority ownership. It is obvious that profitability indicators, economic return indicators and IRR show more significant differences.

Table 2. Usage of the criteria for the evaluation of investment projects depending on the majority ownership of the enterprise, relative frequencies (Kislingerová et al, 2008)

Majority owner	foreign	domestic
Indices of profitability and payback	70 %	82 %
Payback Period	26 %	30 %
Discounted Payback Period	11 %	12 %
Internal Rate of Return (IRR)	26 %	18 %
Net Present Value (NPV)	21 %	25 %
Profitability index (PI)	8 %	8 %
Benefit-Cost Ratio (BCR)	5 %	2 %
Others	4 %	2 %

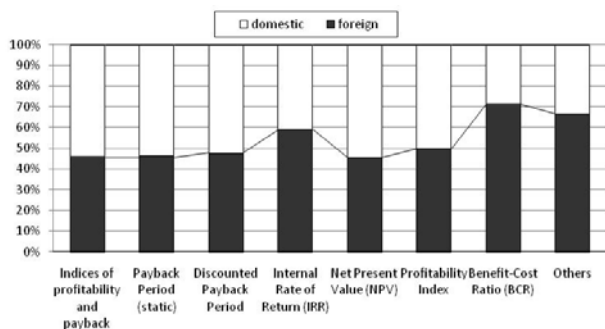


Figure 2. Usage of the criteria for the evaluation of investment projects depending on the majority ownership, relative frequencies (Kislingerová et al, 2008)

By the application of the Spearman’s coefficient of ordinal order, we got a correlation of 95%. Hypothesis No. 4 regarding the relationship between the criteria used and the kind of ownership was not confirmed. The reason is probably that due to the integration into the EU and worldwide influences of globalization processes, the effect of the trends of the environment on the Czech market is so significant that even domestic owners have accepted the attitudes of foreign owners.

4. Comparison of the Results of the Present Research with Other Studies

The preferences in using certain criteria for the evaluation of investments was a subject of many pieces of empirical research conducted in a form of questionnaire investigations. These studies differ not only in the scope and structure, but also in the way of asking questions and filling particular criteria and methods into a set of criteria that are examined in preference.

4.1. Comparison with Local Research

Table 3 shows relative frequencies of using particular criteria as presented in national scientific literature.

With reference to the investigations in the Czech Republic, we can voice presumptions rather than conclusions because the groups of enterprises under investigations are not entirely comparable. Studies A and C were aimed, in preference, at technologically developing enterprises, while investigations D and E dealt with the general principles of the choice of evaluation criteria. We can pursue a high measure of the application of some forms of the

criteria of a quick rate of return (payback period, discounted payback period or investment profitability). Almost all studies (except D) confirmed a lower measure of using IRR than NPV and most confirmed a considerable usage of static criteria as well.

Table 3. Comparison of the results of the present research into the usage of the criteria for the evaluation of investment projects with other studies in the Czech Republic²

Criterion/research	A	B	C	D	E	F
IRR	31 %	33 %	36 %	19 %		22 %
NPV	46 %	54 %	39 %	11 %	18 %	22 %
Discounted Payback Period	72 %	27 %	77 %			11 %
Payback Period	64 %	60 %	62 %		72 %	27 %
Investment Profitability	35 %	92 %	23 %	28 %	54 %	75 %
Profitability Index		42 %		8 %		8 %
Other DCF	5 %		11 %			3 %
Other not DCF	1 %	21 %	2 %	21 %	40 %	4 %

Figure 3 shows several criteria more often indicated by the respondents.

Payback period includes both static and dynamic criteria. Regarding the way in which the respondents have answered, i.e. a possibility of choosing criteria used more often, the index with the highest frequency was chosen from this group. Analogously, in the group of static criteria the procedure was the same. From Figure 3 one can again observe

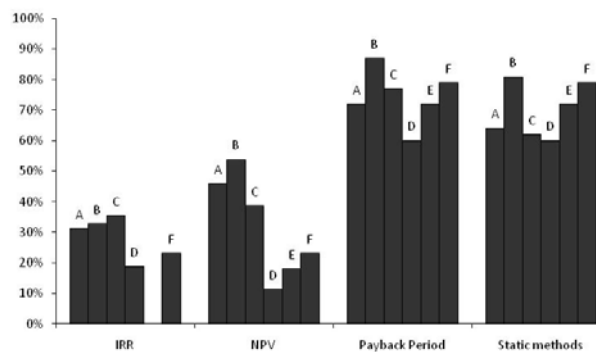


Figure 3. Comparison of the results of studies regarding the methods used in the evaluation of investment projects in the Czech Republic³

² Research A is introduced in Hájek et al, 2001; research B in Dudek, 2003; research C in Hynek, Janeček, 2006; research D in Švecová, 2005; research E in Kolařík, Pavelková, 2007; research F in Kislingerová et al, 2008.

³ Research A is introduced in Hájek et al, 2001; research B in Dudek, 2003; research C in Hynek, Janeček, 2006; research D in Švecová, 2005; research E in Kolařík, Pavelková, 2007; research F in Kislingerová et al, 2008.

a high measure of static criteria and indices emphasizing on-time return of investment. More technologically developed enterprises apply a higher measure of more sophisticated criteria than randomly selected enterprises.

4.2. Comparison with Foreign Research

Table 4 presents a comparison of several questionnaire investigations in the U.S., Great Britain, Sweden and Finland. Considering the results of studies in the Czech Republic, there is a visible preference in using dynamic criteria (IRR above all) that are even preferred to NPV (except research J).

Table 4. Comparison of the results of foreign research into the usage of the criteria for investment evaluation⁴⁵

Criterion / research	G (U.S.)	H (GB)	I (U.S.)	J (Sweden)	K (Finland)	L (GB)
IRR	49 %	81 %	76 %	23 %	54 %	55 %
NPV	21 %	74 %	75 %	52 %	50 %	52 %
Discounted Payback Period					35 %	53 %
Payback Period	19 %	94 %		78 %	63 %	68 %
Profitability	8 %	50 %		24 %	19 %	20 %
PI (IR)			55 %		6 %	

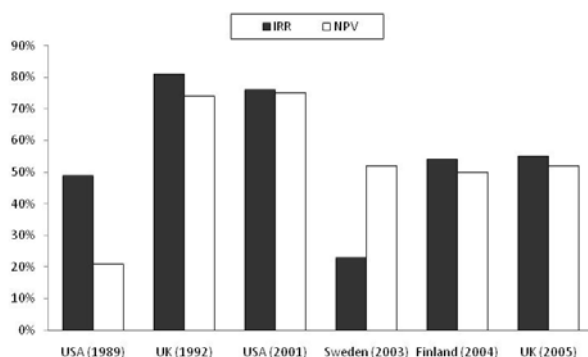


Figure 4. Using IRR and NPV as criteria for the evaluation of investment projects⁵

The tendency to use IRR, observed mainly in the U.S. and Great Britain, is probably a result of a rather different attitude to investment that is determined historically. On one hand, most Czech enterprises perceive realization of investment projects as a means of future development through gaining assets and then efficiently using them. On the other hand, according to the American attitude, investment is a temporary allocation of capital; therefore, IRR is preferred.

Although so far the indices of payback period prevail in the Czech Republic, in future a move towards the usage of more sophisticated criteria for evaluation is expected. This tendency is seen in the case of Great Britain presented in Figure 5 which summarizes the measure of using particular criteria for investment evaluation in large enterprises in years 1975, 1981 and 1992.

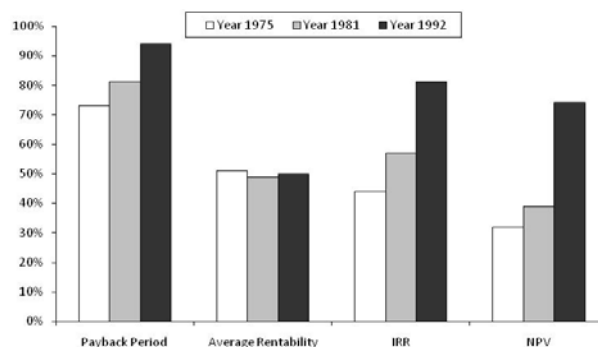


Figure 5. Criteria for projects' evaluation in large enterprises in Great Britain (Pike-Neal, 1996)

From Figure 5 it is clear that static criteria (represented here by average rentability) occupy a permanent place in the set of criteria. However, in contrast to NPV and IRR, the importance of which has increased sharply over the years, their position remained stable. Analogical development can be expected during the coming years in the Czech Republic, mainly in large enterprises. There is a logical focus on on-time payback period of investment, and while the measure of using NPV and IRR increases, the measure of using indices of payback period increases as well.

⁴ Research G in introduced in Shapiro, 1999; research H in Pike-Neale, 1996; research I in Graham-Harvey, 2001; research J in Sahdal-Sjorgen, 2003; research K in Liljebloom-Vaihekoski, 2004; research L in Hynek-Janeček, 2006.

⁵ Research G (the U.S., 1999) is introduced in Shapiro, 1999; research H (the U.S., 1992) in Pike-Neale, 1996; research I (the U.S., 2001) in Graham-Harvey, 2001; research J (Sweden, 2003) in Sahdal-Sjorgen, 2003; research K (Finland, 2004) in Liljebloom-Vaihekoski, 2004; research L (the UK, 2005) in Hynek-Janeček, 2006

Some other rather old pieces of empirical research into the application of the criteria for the evaluation of investment projects done mainly in Great Britain led to the following conclusions:⁶

- The size of the enterprise is an important factor affecting the measure of the usage of criteria related to discounted cash flows, namely, as the size of the enterprise grows, the measure of its application increases as well (this statement was proved by the results of investigations in large enterprises (Mills-Herbert, 1987), in enterprises of a medium range (McIntyre-Coulthurst, 1987) and in small enterprises (Nimako, 1987)).

- Even if the dependence of the application of IRR and NPV was not proved statistically, these criteria were more often applied by oil companies, enterprises with a continuous production process and organizations from the financial sector (Mills-Herbert, 1987; Scapens et al, 1982).

- Most frequently these criteria were used in water supply firms, contrary to medical organizations and local authorities (Lapsley, 1986).

Conclusion

The aim of the article was to analyze and evaluate an important area of investment decision-making, i.e. the criteria used for the evaluation and selection of investment projects with reference to the results of national empirical research as well as foreign investigations.

The knowledge gained from the present research into the criteria applied in investment decision-making have shown that static criteria are mostly wide-spread (above all, the indices of profitability and payback period), while their frequency is approximately three times higher than the frequency of dynamic criteria (NPV, IRR and IR). The testing of the interdependence of the usage of certain criteria for investment decision-making and the characteristics of the companies under investigation has led to a conclusion that the choice of the criteria is affected by the size of the enterprise, but it does not depend on the type of ownership (domestic or foreign). Similar studies in different enterprises in the Czech Republic did not bring markedly different results. A comparison of the results of some foreign investigations has shown a considerably higher measure of the usage of dynamic criteria both in the U.S. and in certain European states (Great Britain, Sweden and Finland).

With reference to the experience of advanced Western countries, in future, a gradual increase in the application of dynamic criteria can be expected in the Czech Republic. However, this tendency can be confirmed only by conducting an in-depth research into investment decision-making.

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⁶ In addition to confirming that payback period is a criterion applied most often, while in using discounted cash flows IRR is applied rather than NP.

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KRITERIJŮ TAIKYMAS VERTINANT IR PASIRENKANT KAPITALO PROJEKTUS

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Įmonės veiklos ilgalaikę sėkmę lemia investicinių projektų parengimo kokybė, jų vertinimo ir pasirinkimo kriterijai. Straipsnio tikslas – palyginti kriterijų taikymą vertinant ir pasirenkant investicinius projektus, remiantis Prahos ekonomikos universiteto Verslo administravimo fakulteto atliktais empiriniais tyrimais ir lyginant juos su atskirų pasaulio mokslininkų empirinių tyrimų rezultatais. Vertinant ir pasirenkant investicinius projektus įmonių savininkų požiūriu išskiriami statiniai ir dinaminiai kriterijai. Taip pat palyginami investicinių projektų vertinimo kriterijai remiantis atskirais metais vykdytais empiriniais tyrimais Čekijoje. Šie tyrimai rodo, kad tiek statinių, tiek dinaminių investicinių projektų vertinimo kriterijų svarba skirtingais metais skiriasi. Straipsnio autoriai daro išvadą, kad investicinių projektų vertinimo kriterijų pasirinkimą lemia įmonės dydis ir nepriklauso nuo nuosavybės rūšies (vidaus arba užsienio). Lyginant užsienio mokslininkų tyrimus su Čekijoje atliktais empiriniais tyrimais, nustatyta, kad JAV ir kai kurios Europos valstybės svarbesniais laiko dinaminis investicinių projektų vertinimo kriterijus.

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