
THE APPLICATION OF METHODS FOR EVALUATING INVESTMENT EFFECTIVENESS BY ENTERPRISES

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Abstract

An investment decision should be based on properly carried out economic calculations. Calculation of the effectiveness of a given investment project includes several steps. The most important of them include preparation of data and assessing the cost-effectiveness of the investment, analysing the level of risk related to its realization, as well as making an investment decision on this basis.

This paper presents the results of research into the application of methods for evaluating investment projects by entrepreneurs. The research included non-discounting (PB, ARR, BEP) and discounting decision tools (NPV, IRR, DPB), as well as methods for assessing risk exposure (scenario analysis, sensitivity analysis, simulations). Discounting methods for examining investment effectiveness were verified using specific numerical data (a case study).

WYKORZYSTANIE METOD OCENY EFEKTYWNOŚCI INWESTYCJI PRZEZ PRZEDSIĘBIORSTWA

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Słowa kluczowe: inwestycje rzeczowe, metody oceny efektywności, małe i średnie przedsiębiorstwa.

Abstrakt

Podjęcie decyzji inwestycyjnej powinno być oparte na właściwie przeprowadzonym rachunku ekonomicznym. Rachunek efektywności przedsięwzięcia inwestycyjnego obejmuje kilka działań. Do najważniejszych z nich należą: przygotowanie danych i sporządzenie oceny opłacalności

inwestycji, analiza poziomu ryzyka związanego z jej realizacją oraz podjęcie na tej podstawie decyzji inwestycyjnej.

W artykule zaprezentowano wyniki badań dotyczące wykorzystania przez przedsiębiorców metod oceny projektów inwestycyjnych. Badania obejmowały niedyskontowe (PB, ARR, BEP) i dyskontowe narzędzia decyzyjne (NPV, IRR, DPB) oraz metody oceny ekspozycji na ryzyko (analiza scenariuszowa, analiza wrażliwości, symulacje). Dyskontowe metody badania efektywności inwestycji zweryfikowano konkretnymi danymi liczbowymi (studium przypadku).

Introduction

Comprehensive and reliable assessment of the economic effectiveness of an investment is one of the crucial elements which influences developmental decisions made by enterprises. Under market economy conditions, people depart from intuition and instinct in the assessment of investment projects. Potential investor-entrepreneurs, already at the stage of a feasibility study, should answer the question: *Will the realization of a specific material investment be cost-effective and what profits will it bring?* (OLKOWSKA 2004, p. 64).

The effects of wrong decisions concerning an investment can be significant for the company, and in particular, for its future financial condition. Therefore, each investment decision must be based on properly carried out economic calculations, which require proper selection and application of methods for evaluating the economic efficiency of an investment (GRANOSIK, PRZEKOTA 2006, p. 8).

Both business theory and practice confirm that there are no universal methods which could be regularly used while making developmental decisions. The character of applied methods depends on the scale and the type of the investment, the specificity of a given industry, the country of the investment project, sources of financing the project, etc.. Economic calculations, particularly in the case of long-term and risky investment undertakings, should be prepared on the basis of several methods of assessment (TOWARNICKA 2003, pp. 94-95). The most accurate decision criteria are discounting methods, which take into consideration the fact that the value of money changes over time.

Before using any specific mathematical formulas for calculating the cost-effectiveness of material investments, certain values should be defined that determine this effectiveness. They include: the lifetime of the project, investment expenditures, net profit, financial surplus and discount rate (NOWAK, PIELICHATY, POSZWA 1999, pp. 240-241).

The aim of this paper is to present the results of research concerning the level of usage and of the usefulness of methods for assessing the effectiveness

of material investments from the point of view of business practice. This paper presents the results of a survey. The analysis of a case study provides further examination of the issue. The case study was intended to show the value of a pragmatic approach of investors to the profitability of the project and the effectiveness of the capital involved. The case study was used for presenting a cost-efficiency calculation for a joint venture undertaking.

Methods and characteristics of the community under analysis

The survey was conducted in 97 small and medium enterprises in north-eastern Poland. This group included investing entities and those planning to invest in projects that create or extend material investments. Entrepreneurs participating in the study represented companies situated in the area of the province of Warmia and Mazury.

The survey concerned the extent to which methods of assessing investment projects are applied by entrepreneurs. Research included non-discounting (PB, ARR, BEP) and discounting decision tools (NPV, IRR, DPB), as well as methods for assessing risk exposure (scenario analysis, sensitivity analysis, simulations).

The survey was anonymous and its results were verified as to the completeness of the provided answers, as well as the reliability and repetitiveness of indications in various groups of questions.

Depending on the type of conducted business activity, there were seven groups of enterprises distinguished:

- construction engineering (10.3%),
- industry (12.4%),
- transportation (8.2%),
- trade (17.5%),
- hotels, restaurants (7.2%),
- other services (28.9%),
- mixed activity (15.5%).

Small companies (with no more than 49 employees) were the dominant group in the examined community; they constituted over 60% of the total population under analysis. The length of business experience of the companies participating in the survey was various. About 55% of companies started their activity in the period of 1991-1998. Almost 31% companies were entities that began their operations before 1991 (mostly in industry and construction engineering fields). Among the entities with the shortest market experience (1999-2004), the prevailing ones were enterprises providing other

services (insurance, veterinary, hairdressing, cosmetics, plumbing, and health care).

The dominant group in the examined sample was composed of individual persons running a business (40.2%). Subsequent positions were occupied by joint-stock companies, partnerships, cooperatives and entities with other organizational and legal forms.

The practical usefulness of methods for assessing cost-effectiveness of investments is presented based on a specific example. A case study was prepared with this aim, concerning the calculation of economic effectiveness of material investments in the company. The results obtained formed the basis for answering the fundamental question as to whether the realization of a given investment project is justified from the point of view of cost-effectiveness.

The assessment of the economic effectiveness of an investment was carried out based on dynamic (discounting) criteria for selecting a project: NPV, IRR and DPB.

The following calculation formula was used for establishing NPV:

$$\text{NPV} = \sum_{t=0}^n \text{NCF}_t \cdot \frac{1}{(1+i)^t} - \sum_{t=0}^n I_t \cdot \frac{1}{(1+i)^t}$$

where:

- NPV – net present value,
- NCF_t – net cash flow in subsequent years,
- i – discount rate,
- $t = 0, 1, 2, \dots, n$ – subsequent year of calculation period,
- I_t – capital investments in subsequent years of calculation period.

Internal rate of return (IRR) was determined by the following relation

$$\text{IRR} = i_1 + \frac{\text{PV} \cdot (i_2 - i_1)}{\text{PV} + |\text{NV}|}$$

where:

- IRR – internal rate of return,
- i_1 – level of discount rate at which $\text{NPV} > 0$,
- i_2 – level of discount rate at which $\text{NPV} < 0$,
- PV – level of calculated on the basis of i_1 ,
- NV – level of calculated on the basis of i_2 .

Another decision criterion was discounted payback period (DPB). With this aim, the following formula was applied (ROGOWSKI 2004, p. 146):

$$DPB = \frac{PVI}{\sum_{t=m+1}^n \frac{NCF_t^+}{(1+i)^t}}$$

where:

- PVI – net present value of investment expenditure,
 NCF_t⁺ – discounted positive net profits in subsequent periods
 t=m+1 to n life cycle of investment venture,
 i – discount rate.

Results

The results of the research revealed the extent to which measures for assessing investment profitability are applied in the analysed enterprises. The research proved that entrepreneurs saw the need to apply specific calculation formulas which could enable them to assess the accuracy of developmental decisions.

Table 1
 Methods for assessing economic effectiveness applied by the examined enterprises
 (% indications)*

Methods for assessing economic effectiveness	Classes of enterprises, as regards size	
	small	medium
<i>Static (non-discounting) methods</i>		
Accounting rate of return (ARR)	9.1	14.2
Payback period (PB)	45.5	33.6
Break even point (BEP)	36.4	26.1
<i>Dynamic (discounting) methods</i>		
Discounted payback period (DPB)	3.6	11.9
Net present value (NPV)	9.1	38.2
Internal rate of return (IRR)	3.6	35.9

Source: results of a survey

* Entrepreneurs could indicate more than one method for assessing effectiveness.

The survey revealed that the most often used method for assessing economic effectiveness in small enterprises was payback period (PB). This was the decision criterion that was the most appealing to investors' imagination. Among medium enterprises, the method that was most often used was

NPV, which “is the most accurate one in theory”. Internal rate of return (IRR) and payback period (PB) proved to be slightly less popular.

The research revealed that a relatively large percentage of companies used only one method of investment profitability assessment or a combination of two methods.

Each business decision is based on the forecast of future operating conditions. Therefore, it is based on predictions that are always charged with a certain dose of uncertainty (SIERPIŃSKA, JACHNA 2003, p. 232). Assessing the full reliability of the results of calculating the profitability of the developmental investment venture requires taking into consideration the risk associated with the planned investment.

The results of empirical research indicated that respondents included the issue of risk into their calculations of cost-effectiveness of investment ventures only to a small extent. The most popular technique of including risk into effectiveness calculation proved to be scenario analysis, which was indicated by 11 surveyed enterprises (11.3%). Ten respondents (10.3%) mentioned sensitivity analysis, which is a quite simple analytic product, consisting in examining the effects of future changes in the development of basic variables of the venture on its effectiveness. One enterprise (about 1%) applied the Monte Carlo simulation method. None of the entities under examination carried out risk analysis based on the theory of probability (probability and statistical methods). Entrepreneurs did not use the method of risk-adjusted discount rate. The most frequently applied combination of investment risk analysis was sensitivity analysis with scenario analysis.

Discounting methods of examining investment effectiveness were verified using specific numerical data. A case study was prepared with this aim, concerning calculation of economic effectiveness of material investments.

The object of the analysis was a company with a majority share of foreign capital. The examined company “Z”, operating as a limited liability company, was established as a *joint venture company* on the basis of specified legal procedures (OLKOWSKA, ROSŁON 2005, p. 406).

The investment project included the construction of manufacturing plant and the purchase of specialist technological lines.

One of the stages consisted in the identification of financing sources for the investment (financial engineering). The following activities were taken into consideration while preparing financial engineering:

- estimating own means of investors,
- determining total investment expenditures,
- establishing the difference between free cash flow and total investment expenditures,
- determining proportions of means from various sources of financing (Fig. 1).

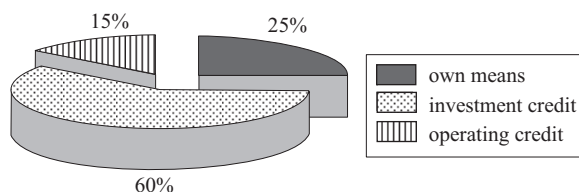


Fig. 1. Sources of financing capital expenditures
Source: own work on the basis of business plan data of the company “X” Ltd.

An assessment of the effectiveness of the venture was conducted for the case study, based on discounting methods (NPV, IRR, DPB).

The method of net present value (NPV) provides the most universal and objective assessment of investment projects. Net present value is the difference between discounted incomes and expenditures related to a given undertaking.

Table 2 presents the numerical data that are necessary to calculate net present value (NPV) of the investment.

Table 2
 Net present value of investment joint venture

Years	Investment expenditures (PLN)	Free cash flow (PLN)	Discount coefficient for $i=12\%$	Discounted net cash flows (PLN)
2004	- 1,250,000		1.0000	- 1,250,000.0
2005	- 4,939,000	1,376,283	0.8928	- 3,180,793.7
2006		2,336,767	0.7972	1,862,870.6
2007		2,719,381	0.7118	1,935,655.3
2008		3,594,759	0.6355	2,284,469.3
2009		3,564,097	0.5674	2,022,268.6
Total NPV				3,674,470.1

Source: own work.

Estimated NPV of the investment, at 12% rate, was PLN 3,674,470.1, which allows to regard it as profitable ($NPV > 0$). Positive NPV level means that the investment profitability rate is higher than the minimal threshold rate determined by the discount rate assumed in the calculation.

Another applied measure for assessing the effectiveness of investment was internal rate of return (IRR). This is a discount rate, compensating the present value of expected financial streams from the venture and the net value of expenditures associated with its realization.

Table 3 presents values that are necessary to establish the internal rate of return for the investment.

Table 3
Values used to determine internal rate of return for an investment project

Years	Net cash flows (PLN)	Discount coefficient for i=39%	Discounted net cash flows (PLN)	Discount coefficient for i=40%	Discounted net cash flows (PLN)
2004	- 1,250,000	1.0000	- 1,250,000.0	1.0000	- 1,250,000.0
2005	- 3,562,717	0.7194	- 2,563,018.6	0.7143	- 2,544,848.7
2006	2,336,767	0.5176	1,209,510.5	0.5102	1,192,218.5
2007	2,719,381	0.3723	1,012,425.5	0.3644	990,942.3
2008	3,594,759	0.2679	963,035.9	0.2603	935,715.7
2009	3,564,097	0.1927	686,801.5	0.1859	662,565.6
Total			58,754.6	-	- 13,406.6

Source: own work.

IRR of the examined undertaking was precisely calculated, based on the above data.

$$\text{IRR} = 39 + \frac{58754.6 \cdot (40 - 39)}{58754.6 + |-13406.6|} = 39.8 (\%)$$

The internal rate of return was 39.8 %, which proves the high profitability of the joint venture project under analysis. This will cover the costs of foreign capital servicing, which was 12%. Additionally, this will provide significant profits for partners – investors, at the level of the difference between a threshold rate of return and calculated IRR.

Another decision criterion applied was payback period. In order to eliminate the drawback of this criterion (consisting in overlooking the effects of changes in money value in time) the method of discounted payback period was applied. The function of this criterion is identical as in standard payback period, but here cash flow is discounted (PLUTA et al. 2000, p. 63).

Discounted payback period was established by applying the proper formula:

$$\text{DPB} = 3 + \frac{632267.8}{1935655.3} \cdot 12 = 3.4$$

Discounted payback period was 3 years and 4 months. This will be shorter than the 4-year threshold period assumed by the investor. Therefore, another decision tool proves the profitability of the analysed investment.

Summary

Necessary conditions of achieving success by the company include maintaining financial liquidity and ensuring profits in the long-term perspective. Therefore, the choice of cost-effective investment projects is very important for company operations, particularly while establishing long-term developmental strategies.

On the basis of the research conducted, it is clear that entrepreneurs realized the need for applying specific calculation formulas to assess the accuracy of their developmental decisions. It should be emphasised that simple decision tools, such as payback period and break-even point were frequently used. Complex (discounting) methods were used mostly by medium business entities, related to foreign capital. Entrepreneurs employing no more than 249 persons most frequently used a universal decision tool – NPV. This criterion, in combination with IRR and DPB, formed the basis of a profitability assessment of a joint venture project (case study).

However, entrepreneurs quite rarely used risk analysis methods. Scenario analysis and sensitivity analysis proved to be popular techniques of taking risk into account in the effectiveness calculation. None of the examined entities used probability-statistical methods or the risk-adjusted discount rate method.

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