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Taking Account of Managerial Options Within the Frameworks of Taking Investment Decisions

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Abstract: The use of the traditional discounted methods as tools by taking investment decisions to a large extent relies on the ability of economists and financial analyst to provide substantiated estimates in respect of the expected cash flows within the investment projects being analyzed at each stage of the accounting period. The basis of these estimates is made of the initial assumptions in respect of: the future level of business activity, actions of competitors, cost of the factors of production, volume of sales, etc. Since, each of these elements is characterized by high level of uncertainty the estimated figures in the best case represent only the outlines of the future results of activity aimed at implementation of the investment projects. In the study, the improvement of the system of assessment of investment projects is proposed that is based on the methodology of analysis of hierarchical structures that allows estimating the investment projects by the ratio scale at each stage of the accounting period having included in the estimate the 'cost' of managerial options.

Key words: Discounted methods, investment decisions, cash flows within investment projects, managerial options, methodology of analysis of hierarchical structures, pairwise compassion matrix, ratio scale

INTRODUCTION

Within the frameworks of performance of innovative activity it is often necessary to take decisions as to investing capital into new buildings, facilities, machinery, equipment, raw materials stock used in the production, i.e. to take investment decisions. In this study, it is assumed that a certain (IP) Investment Project lies at the heart of each investment decision.

In the national and Foreign practice the discounted methods of taking of the investment decisions gained the most widespread (Berens and Khavranek, 1995; Bierman and Schmidt, 2003; Hogarth and Makridakis, 1981; Cooley *et al*., 1976; Myers, 1974; Seitz, 1990; Kalugin, 2006).

At the same time the decision to use the indicator of the (net present value NPV) of investments as the leading criterion attracts more and more followers.

The investment projects often feature managerial possibilities (options) the fulfillment of which was not possible before:

- Increase in the project scale in case if it is successful
- Sale of the project in case of failure
- Development of the related kinds of activity using the experience gained within the first project, etc.

Since, the forthcoming administrative possibilities are diverse and various and the moment of occurrence is not certain it is traditionally considered to be unreasonable to include them in the estimation of the project cash flow. In this case, the NPV calculated according to the traditional procedure is adjusted (Bierman and Schmidt, 2003):

$$\text{The real (actual) NPV} = \text{Traditional NPV} + \text{cost of managerial options}$$

In this regard, it shall be noted that any estimates relating to future events in this case to future IP cash flows and managerial possibilities drawn in the form of absolute values are almost always unreliable. At the same time an enterprise manager quite may estimate that the cash flow of one IP at the t-st stage of the accounting period cf_t, substantially exceeds the cash flow of another IP. However, it is much more difficult to estimate exact volumes of the cash flows cf_t^i (i-IP-number, t-number of the time period). Therefore as follows from the practice of the enterprise managers one may quite rely on the relative estimates in respect of the future events.

In the study, the improvement of the system of assessment of investment projects is proposed that is based on the methodology of analysis of hierarchical structures (The Analytic Hierarchy Process, AHP) (Saaty, 1977, 1989, 2008). The latter allows estimating the investment projects by the ratio scale at each stage of the accounting period having included in the estimate the 'cost' of managerial options.

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PROCEDURE

Let's assume, we need to order five alternative investment projects (IP_1, ..., IP_5) in the conditions of great uncertainty in terms of the cash flows.

Based on the AHP let's represent the procedure of design of the pairwise comparison matrixes in respect of the criterion 'cash flow of the zero period' cf_0" (investment costs) using the forecast of the investment costs in respect of the projects being analyzed (Table 1).

- Since, the estimated investment costs by the projects IP_2 and IP_3 appear to be the same without estimating them in the form of a certain amount we make an assumption that they are equal by the value, i.e. in the position (2, 3) of the matrix (Table 2), we enter the number 1 which means according to the 9-score ratio scale the "same relevance"
- The first project (IP_1) is worse than the second (IP_2) and therefore, slightly worse than the third one (IP_3) that's why in the position (1, 2) and (1, 3), we put the number 1/2 the inverse value of the intermediate value between the 'same relevance' and 'some prevalence of relevance'
- Since the first project (IP_1) is much worse than the fourth and fifth ones in the positions (1, 4) and (1, 5) of the matrix the numbers 1/3 and 1/9, respectively, are put

The second project (IP_2) is worse than the fourth (IP_4) and the fifth (IP_5) in the positions (2, 4) and (2, 5) of the matrix the numbers 1/4 and 1/9, respectively are put.

- The third project (IP_3) is also worse than the fourth (IP_4) and the fifth one (IP_5) in the positions (3, 4) and (3, 5) of the matrix the numbers 1/2 and 1/9, respectively are put
- The fourth project (IP_4) is also worse than the fifth (IP_5) in the position (4, 5) of the matrix the number 1/5 is put
- The rest of positions of the matrix under consideration according to the AHP were filled up with inverse values

Table 1: The forecast of investment costs by projects

IP_1	IP_2	IP_3	IP_4	IP_5
52000	50000	50000	45000	40000

Table 2: The pairwise comparison matrix IP as against the criterion cf_0

cf_0	IP_1	IP_2	IP_3	IP_4	IP_5
IP_1	1	1/2	1/2	1/3	1/9
IP_2	2	1	1	1/4	1/9
IP_3	2	1	1	1/2	1/9
IP_4	3	4	2	1	1/5
IP_5	9	9	9	5	1

As the result the IP pairwise comparison matrix appeared to be as follows (Table 2).

MAIN PART

Let's introduce the term of the function of estimation of (φ_t) IP i respect of the "cash flow at the step t". This function may be presented in the tabular form as follows (Table 3).

By assumption the issue of forecasting the absolute values of cash flows (cf_t^i) is complicated. This is why, we calculate the relative values of the IP cash flows (IP 'weights'). Let's construct the hierarchy of the IP ordering problem IP (Fig. 1).

Here it is suggested that each of the projects has the same duration of the life cycle namely, 4 years. The IP pairwise comparison matrices from the perspective of criteria 'the cash flow at t-st stage of the accounting period' are designed according to the above-mentioned procedure and are not presented because of the limited volume of the study. The processing of the pairwise comparison matrices consists in determination of the Eigen vectors corresponding to the maximum Eigen values (Table 4).

The next stage according to the AHP is the procedure of determination of the weights of criteria themselves within the context of the decision-making (the leading criterion):

$$W_k = (0.453, 0.270, 0.146, 0.086, 0.046)^T$$

The final stage of the IP evaluation by many criteria according to the AHP is the synthesis (hierarchic weighing) that is formally expressed in the form of a matrix product:

$$\begin{bmatrix} 0.045 & 0.348 & 0.222 & 0.203 & 0.404 \\ 0.080 & 0.215 & 0.152 & 0.299 & 0.263 \\ 0.084 & 0.348 & 0.203 & 0.134 & 0.229 \\ 0.187 & 0.032 & 0.360 & 0.322 & 0.052 \\ 0.604 & 0.056 & 0.063 & 0.042 & 0.052 \end{bmatrix} \times \begin{pmatrix} 0.453 \\ 0.270 \\ 0.146 \\ 0.086 \\ 0.046 \end{pmatrix} = \begin{pmatrix} 0.182 \\ 0.154 \\ 0.184 \\ 0.176 \\ 0.304 \end{pmatrix}$$

Table 3: The function of the IP estimation from the perspective of the cf_t criterion

	The set of projects (IP)			
Parameter	IP_1	IP_2	...	Ip_m
Cash flow (estimated)	cf_t^1	cf_t^2	...	cf_t^m

Table 4: IP ranking in respect of the criteria 'cash flows'

IP	$W(IP_i/cf_0)$	$W(IP_i/cf_1)$	$W(IP_i/cf_2)$	$W(IP_i/cf_3)$	$W(IP_i/cf_4)$
IP_1	0.045	0.348	0.222	0.203	0.404
IP_2	0.080	0.215	0.152	0.299	0.263
IP_3	0.084	0.348	0.203	0.134	0.229
IP_4	0.187	0.032	0.360	0.322	0.052
IP_5	0.604	0.056	0.063	0.042	0.052

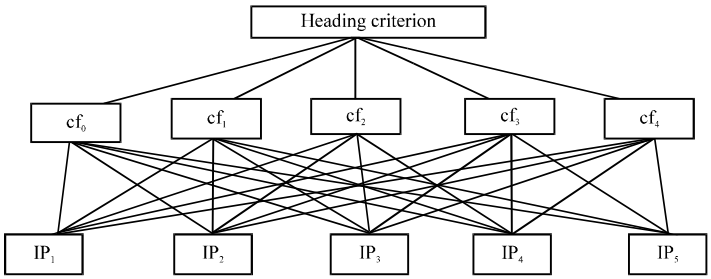

Fig. 1: Hierarchy of the IP ordering problem

The components of the obtained column vector determine the following IP ranking:

$$IP_2 \prec IP_4 \prec IP_1 \prec IP_3 \prec IP_5$$

Therefore, the most preferable is the project IP_5 its 'weight' as compared to the others is rather significant and makes 0.304.

SUMMARY

The forecasts and plans of economists and financial analysts as is reasonably noted by many authors steady demonstrate their imperfection and incompleteness. This is why, the use of traditional indicators as tools of making investment decisions in the best case represent only the outlines of the future results of activity aimed at implementation of the investment projects.

In the study, the improvement of the system of assessment of investment projects is proposed that is based on the methodology of analysis of hierarchical structures that allows estimating the investment projects by the ratio scale at each stage of the accounting period having included in the estimate the 'cost' of managerial options.

CONCLUSION

The proposed method of IP evaluation within the frameworks of investment activity features higher degree of generality as compared to the similar, traditional NPV criterion. The study also presents the methodological recommendations for design of the pairwise comparison matrices of IP being evaluated which increases its practical relevance.

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