

Algorithmization of the Process of Preparation of Capital Investment Project

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Abstract

This article describes the analysis of capital investment project organization. Investment and innovation distinctions are examined. The criteria of investment decision-making are advanced. In this article the algorithm of investment project working-out and evaluation is suggested. The investment project development is illustrated by an example of investment planning of building unit (slab "Verto") producing and selling concern. The description of work during the successive steps of investment project realization is included. Project basic data, organizational structure of slab "Verto" producing concern, project implementation schedule, and working scheme are determined. Primary results of financial and economic index calculation are presented. The presence of indeterminateness of decision-taking in project various steps algorithm of realization is proved. Multistage model for investment problems solving is suggested. Problem solving model application allows diminishing indeterminateness due to experts' knowledge of investment project organization taking into account.

Keywords: Decision-making, investment project, the algorithm of the project, project evaluation, uncertainty.

1. Introduction

Investment and innovation projects development and calculation are carried out by schemes and algorithms (Methodical Manual for Capital Investment Project Efficacy Estimation and their Financing Selection. Russia Goskomprom, 31st march, 1994. № 7-12/47 // – M.: 2006, A.V. Tychinskii. Company Innovation Policy Management: modern approaches, algorithms, experience. – Taganrog: TREU, 2006, Quaid Wadia Ahmed Abdo. Innovation Decision-making Process Particularities//International theoretical and practical conference "Science globalization: problems and perspectives", Part 2. – Ufa, 2014. P. 83-85, Basovskii L.E., Basovskaya E.N., Economical Activities Complex Analysis. Manual. – M.: INFRA – 2005. – 366 p. and Lipsits I., V. Kossov. Capital Investment Project: design and analysis methods / Reference manual. – M.: BEK. 1996. – 294 p), and then the ready project estimation. Different definitions of capital investment project exist (E.G. Nepomnyashchii. Investment Economical Evaluation: manual. – Taganrog: TREU, 2003. – 262 p.), which come to complex business problem system solving definition and development (in complete set of required documents execution and system of problem solving development), directing to project capital investment and results receiving (income, profits, social effect).

Three stages of capital investment process exist: pre-investment; investing; produced objects exploitation. UNIDO (Abramov A.E. Financial, economical, investment concern activity analysis basis. – M.: CBIA "Economy and life", 1994 and Finaev V.I. and Quaid Wadia Ahmed Abdo. Capital Investment Project Management While Not Having Enough Input Data// Research collection "Millennium Science and Education", vol. 1, Kislovodsk 2014. P 74-84) defines four stages for the first stage: investment concept search; project pre-preparation; final project preparation and its technical and economic and financial satisfiability estimation; final examination and decision-making. Indeterminateness exists at each listed stages for ways of concern index improvement should be found by investing, business plan development (having not enough full information), final project realization decision taking and best scheme of its financing finding.

Decision-taking while capital investment project analyzing first of all is aiming for expenditure level (investments) detection, potential profits amount (business receipts), period of investments determination (period of time during which the vested project will bring in income) and project cost liquidation.

Capital investment project is a strict sequence of determined problems solving. Each problem is important and aims for common purpose achievement – capital investment project development and estimation.

2. The Used Method

For innovative project in comparison with capital investment one there is a larger number of options for its modifications of all stages of its lifetime is typical.

The difference between capital investment project and innovative one is also in following: after long-term capital investment project selection usually the only one way of its realization is carried out. Innovative project due to its alternativeness, indeterminacy and multi-variant approach during all the stages demands new reevaluation and reconsideration at each checkpoint selected. Innovation prediction is more difficult problem. It is interconnected with quality integral indicator, competitiveness and market adaptation.

During preprocessing step one should give attention to success criteria. For capital investment project success criteria stand for financial success, and for innovative one unexampled novelty, patent purity, license protection, innovation tendency priority, competitiveness of novelty implemented are of the greatest significance. The listed criteria determination and variation are also connected with significant indeterminateness.

Another distinction of innovative project lies in its multicriteriality. Appropriate integral criteria should be found and problems of repeated optimization for innovative project perspective determination should be solved.

Multistage and great amount of work at each stage are common to both capital investment and innovative projects. All these work can be done separately as well as jointly when one or several criteria are reached.

Decision-making in problems investment particularities directs at intended purpose reaching, which is framed (altered) by chosen criteria combination. Having chosen criteria estimations one can prove the decisions made. The classification of criteria for capital investment decision-making is presented in the Figure 1.

Point 1 determines the project aim, directing to certain market part take-over, systematical profit gaining and also decision of main characteristics and parameters of product is made.

Point 2 shows the analysis of marketing information, directing to current sector situating researching, project competitiveness and suppliers and intermediaries market analysis, target market determination. Information about market general demand for analogous product Q_{obu} and declared concern market share allows determining demand for concern Q_{np} product. According to analysis results the decision about market share and demand amount is made.

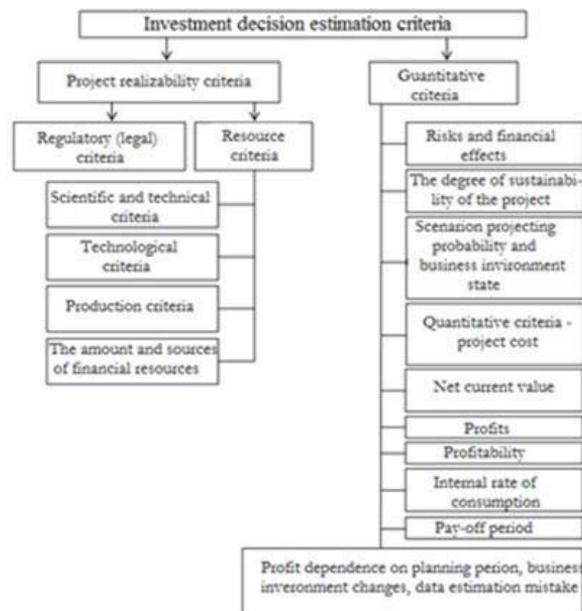


Figure 1 – Capital investment decision-making criteria

Also on given stage execution phase decisions of article production, product P_0 price, ways of product spreading, marketing network, working scheme and production equipment selection is made.

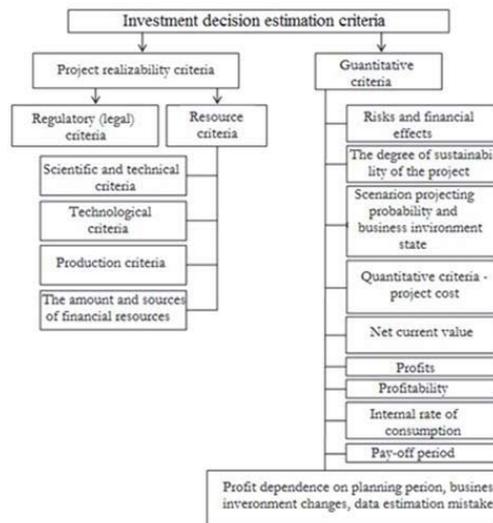


Figure 2 – Capital investment project working-out and estimation algorithm

Point 3 shows project documentation cost estimation, building and construction works (BCW), main fund structure and quantity. Decisions about fixed assets quantity and their parameters are also made.

As a result one gets slab “Veto” producing and selling concern capital investment project input data. Input data are given in table 1. Routine of work is based on flexitime (360 days per year) double-shift uninterrupted operating mode.

Point 4 shows one making decision about concern and industrial estate location, infrastructure particularities, concern expansion possibilities, analyzing lands grand conditions for industrial area.

Point 5 shows the calculations of expenditure rates and main materials cost, and subsidiary materials for technological purses and components cost. For slab “Verdo” production and sale amortized deduction measurement data and exploiting cost standard and main fund support are defined.

Table 1 – Project general input data

No	Input data	Unit of measurement	Value
1	100% capacity shift process equipment productivity	item per 8 hours	600
2	Routine of work:		
	- labour shift number;	item per day	2
	- all labour shifts operating time;	hour per day	16,00
	- workdays number per year	days	360
3	Machine utilization index	-	0,9
4	Period of project realization, BCW included (8 months), equipment setting into operation and adjustment (4 months), production development and production (10 years)	years	11
5	Prime cost of main funds: buildings (27 000); constructions (8 700); process equipment and license technical documentation (30 600); other equipment, communications and computer technology; (3000); utilities equipment (840); power circuits (900); carrier equipment (2310); inventory (390)	rub.	73 740
6	Basic production worker wages fund overhead charges	%	65
7	Concern one article free sale price (rub.)	rub.	350
8	Advertisement cost	%	1,5
9	Materials, components and power supply consumption rate (per one article): wood (0,0204 m ³); cement M500 (15 kg); machine oil (0,05 l); liquid glass (0,2 kg); steel ties(0,44 kg); electric power (1,95 kW/hour); water(0,0125 m ³); compressed air (1,2 m ³)		
10	Profit tax rate		
11	Dividends to founders starting with the second year of project realization	% per year	25

Materials and components consumptions calculation for a given slab issue is made. One also calculates energy power and resources for technological goal in concern article producing cost.

Point 6 and point 7 show the process of decision-making on workers number and wages. Decisions on staff, concern management structure and functions assignment. In the figure 3 the organizational structure of slab "Verto" producing concern is represented.

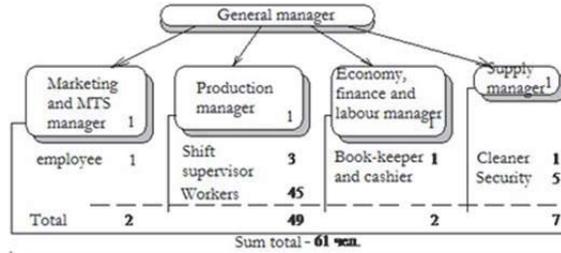


Figure. 3. Concern organizational structure

Decision about level of proficiency and main production workers number for one shift article production and wage system (piece or time-based rate wage plan) is made.

Payroll workers number is determined, calculation main production workers wages are made. Annual wages fund for all concern staff calculations are carried out.

In point 8 there is an algorithm of project realization terms planning. Project realization plan consists of 3 main steps: prepared (invested) step, plant development, reaching the planned production capacity.

While plan developing (reaching the planned production capacity) the graphic of reaching the planned production is being determined. Table 2 shows the graphic of project realization and production plan year by year for developing capital investment project.

Point 9 of the algorithm shows the financial and economic indexes of the project. Calculation of slab and its components (set of steel tie) prime costs is given in table 3.

Table 2 – Project realization graphic and year by year production plan

Project realization stages	Years and stages of project realization												Total	
	1 st year								Full production capacity	2		...		11
	Total	Building 8 months				Plant development 4 months								
		Per months												
	1	2	...	8	9	10	11	12						
Slobs production (thousand items)	68,4				4,0	12,0	20,0	28,8	388,8	...	388,8	3952,8		

Unit investment are formed with main funds initial fixed investments, main funds replacement and circulating capital increase.

Table 3 – Calculation of slab and its components (set of steel tie) prime cost. Full production capacity

	Costs	Sum in rubles	Full prime cost percentage
1	Raw materials and materials	101,21	54,19
2	Energy power and fuel for technological purposes	8,29	4,44
3	Wage base and bonus wage	17,55	
4	Social needs deductions 34%	5,97	
5	Wages with deductions	23,51	12,59
6	Equipment, buildings and constructions maintenance and exploitation	28,19	15,09
7	Office and management personal wages fund with deductions	11,39	6,10
8	Burden costs	11,41	6,11
9	Input costs	183,99	98,52
10	Marketing	2,76	1,48
11	Total cost	186,75	100,00
12	Semi-fixed costs	77,25	41,37
13	Semi-variable costs	109,50	58,63
14	Semi-fixed costs without amortization	56,75	

Capital allowances calculation are carried out and main funds replacement per year of project realization. Main fund replacement depends on real term of main funds existence, amortization quota, produced articles lifetime and concern and firm management policy.

Circulating assets calculation per first year product realization months (plant development) and two first years of the second year (full production capacity) is carried out. Circulating assets can be calculated as a sum of three components:

- materials and component parts supplies (materials and component parts cost per one article multiplied by standard inventory per day and multiplied by average daily article production);
- work-in-progress volume (manufacturing cycle duration multiplied by average daily article production, multiplied by one article prime cost (without amortization) and multiplied by work-in-progress availability ration);
- storages of finished goods (finished goods supply standard per day multiplied by average daily product release and multiplied by one article prime cost without amortization);

Then plan of unit investment per years of project realization with first year among.

Sources of finance are determined, for example founders free clubbed capital or current liabilities (net gain and capital allowances). Matrix array of finance sources is compared in several steps: beforehand (after unit investment determination), finally (after cash flow table for financial planning comparing).

Income tax is determined, net gain report is prepared, production and sale costs, product prime cost during the period of plant development, net gain, production and main funds profitability calculation are provided.

The key condition of project realization is positive value cumulative cash at each step of calculation. If there is a negative balance of cash at some step that means that current project can't be realized notwithstanding integral effectiveness indexes values. Therefore the cash flow calculation for financial planning is performed.

Product net current value calculation within the limits of settlement period is carried out in base price. That meets the "right chose" stage. The discount rate is 5% higher than dividends for possible risks and inflation compensation.

Net current value is calculated. Financial profile is shown in the figure 4

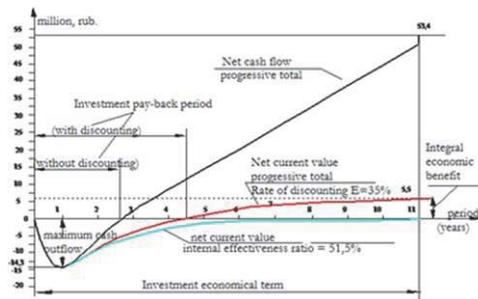


Figure 4 – Project financial profile

Let's determine breakeven point. Graphic breaking-even is shown in the in Figure 5.

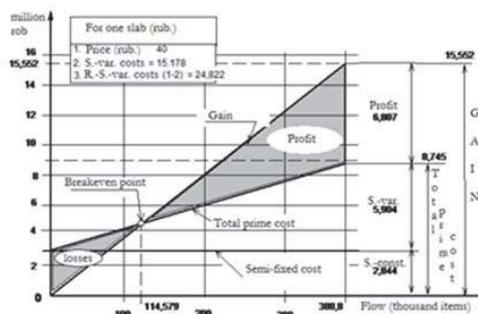


Figure 5 – Graphic of breaking-even of slab production

In the table 4 summary financial and economic indexes are exposed.

Cash flow continuity supports by cumulative cash positive value at each step of calculation.

After investment project development and its financial and economic estimation final decision about its definitive expediency is made (point 10). Now one set about the next step of working out called "the stage of designing".

The given algorithm of capital project realization consists of current tasks sequence. Each task is based on this or that model. Such algorithm can be presented as multistage model, shown in the figure 6.

Table 4 – Summary financial and economic indexes

No	Indexes	Metage	Numerical value
1	Total investment, including: 1.1. Main funds originally fixed investments 1.2. Circulating assets	thousands rub.	84101,7 73740,0 4661,7
2	Maximum cash outflow	thousands rub.	-71493,93
3	Cumulative net cash flow	thousands rub.	464635,13
4	Integral economic benefit (E=0,35)	thousands rub.	90109,11
5	Internal effectiveness ration		49,50%
6	Period of return on investment without discounting	years	2,9
7	Period of return on investment with discounting	years	4,8
8	Breakeven point	thousands articles per year	107,15
9	Financial soundness rate		3,63
10	Main funds profitability (net)	%	41,7

The capital investment project algorithm examined, its financial and economic estimation and the example of its realization show that some indeterminateness in decision-making at various stages of algorithm realization exists. This indeterminateness provokes various mistakes in decision-making at certain stages of algorithm realization as well as in capital investment project in whole. That becomes exactly obvious in the figure 6. Collateral and consistent models application provokes the increase of indeterminateness.

Mistakes will be provoked by price instability, error of method, indeterminateness of market opinion, project life planning and lots of other reasons.

Some steps should be taken for indeterminateness to be removed and for more reliable estimate of investment project results to be proved.

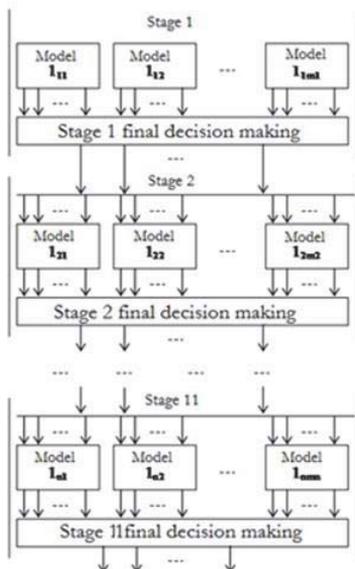


Figure 6 – Multistage model for investment task solving

In multistage modal structure for investment task solutions the process of decision-making is presented. The variant of algorithmic structure for alternatives evaluation is realized in the model. That is realized in each several model of task solution then input data is deficient.

On algorithm investment project development realization analytical calculations were taken into account. Some of these results are presented in the article. It is suggested to supplement analytical models with decision-making models.

At each i ($i = \overline{1, n}$) stage of algorithm collateral application of several models of fuzzy inference is possible. Their summary number stands for m_i . Collateral model application allows getting fuzzy inference results, which become fuzzy input data for following $(i+1)$ stage of multistage model of investment task solving, i.e. decision-making models results at i stage are viewed as linguistic (fuzzy) variable choosing for models of fuzzy inference of $(i+1)$ stage. On the last n stage final decision on investment process final result is being formed.

Similar representation of multistage model for investment task solving completely correspond to investment process as it allows various criteria of task solving manipulating and all variety of input data and invest process variables analyzing.

From well-known decision-making models the model of classification, the model of the calculation of the degree of verity of fuzzy deduction rule and situational model are supposed to be applied (A.N. Borisov, O.A. Krumberg, I.P. Fedorov. Decision-making on Basis of Fuzzy Models: examples of application. – Riga: "Znanie", 1990, - 184 p, Guanrong Chen, Trung Tat Pham. Introduction to Fuzzy Sets, Fuzzy Logic, and Fuzzy Control Systems, 2001, ISBN 0-8493-1658-8 (alk. paper) and V.I. Finaev, Qaid Wadia Ahmed Abdo. Decision-making Strategien Within the Format of Initial Information in the Problems of Investments// World Applied Sciences Journal 26 (11): P.1444 – 1450, 2013). There is no clear conclusion in favor of one or another model. Each modal is apt to inference carrying out basing on expert knowledge. To decrease the degree of indeterminateness it is submitted to apply situational model while decision-making at first (for solution reliability increase) and then (in the case of result ambiguity) apply classification model. One should assign linguistic variable called "real fuzzy situation and reference fuzzy situation grade of membership".

3. Conclusion

This article is written about capital investment project organization. Differences between investment and innovation are examined. Investment decision-making criteria are listed. In the article algorithm of capital investment project development and estimation is supposed. Investment project development is illustrated by the example of slab "Verto" producing and selling concern investment planning. The description of working-out process at successive stages investment project realization is listed. Project input data, slab "Verto" producing concern organization structure, project realization graphic, working scheme are defined and main results of financial and economic indexes calculation are listed. The existence of indeterminateness in at various steps decision-making of algorithm realization is given prove. The multistage model of investment tasks solving is proposed. Application of the models of investment task solving helps decrease the degree of indeterminateness due to expert knowledge of capital investment project organization taking into account.

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