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Investment Projects Evaluation in Decision Making Process*

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Abstract

One of the most important criteria in classifying investment projects is economic dependence between new and existing projects. Economic dependence causes the neccessity of specific information in decision making process. The prerequisite of shaping incremental effects projections is to take opportunity effects, caused by economic dependence, into account. Basic principles of risk estimation that are well known in the field of financial assets, are concerning real investments as well. An enterprise can be viewed as portfolio of investment projects that cannot be perfectly diversified and where market risk is not the most important risk. In the field of real investments, individual risk and added risk to the total risk of enterprise, besides market risk, have to be estimated. This paper explains basic principles of risk estimation in the field of investment projects in the selection of project variants. It researches types of economic dependence among various investment projects and their influence into decision making process.

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1. Introduction

Research of investment projects has many aspects in recent literature. Investment projects are broadly treated in the area of strategic management, project management,

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production and operations management, in the area of management accounting and financial management. This paper observes investment projects from the point of view of financial management and management accounting. The first section of the paper explains basic principles of risk estimation of the investment projects. The second section researches assessment of project proposal by using economic and financial criteria and variations of economically independent and dependent projects.

2. Risk and investment projects estimation

Risk can be defined as knowing future event probability, and uncertainty as unknown probability of future events. Measured uncertainty is a risk. Terms risk and uncertainty are often used as synonyms in economy because there is no possibility in economy of some event repetition in exactly the same circumstances. That means that it is hard to measure risk, and event's probability is a highly subjective estimation. The term risk prevails in portfolio analysis whether in the sense of risk measure (e.g. beta is the risk measure) or in the sense of uncertainty (e.g. "Risk is the chance that some unfavorable event will occur ... or exposure to loss or injury", Brigham, 1989:104). In the capital budgeting the term uncertainty prevails in both senses, (e.g. "techniques of uncertainty measurement", Bierman, Smidt, 1992:387)

Numerous authors dealing with management and organization have developed their own project definitions, which do not vary considerably. A project can be defined as an entity of inter-dependent activities, which is unique and has its purpose and objective. The objective is to carry out the project with minimal costs, within the shortest possible time and applying adequate quality (Rozman, 2000:5). Similarly, the project can also be described as a unique entity of logically interrelated activities that have a common purpose and limited duration (Vila, 1994:189).

Project risk can be defined as the cumulative effect of the chances of uncertain occurrences which will adversely affect project objectives. It is the degree of exposure to negative events and their probable consequences. Project risk is characterized by three factors: risk event, risk probability and the amount at stake.

Different authors classify project risks from many different aspects. Most frequently we encounter the classification of project risk according to its interrelation with the project objectives. We distinguish among (Burk, 1999:19): time-related risks, financial risks and quality risks. Time-related risks are connected with the time objective of the project, trying to avoid the delays. Financial risks refer to the cost objective of the project, trying not to exceed the planned budget. Quality risks are linked with the objective of achieving a suitable performance in the project. It is also possible to divide project risks according to the way they impact project objectives or according to the time sequence of risk recurrence. There are two types of project risks according to these criteria: indirect (subordinate) risks and direct (superior) risks. Indirect risks appear

first and their materialization triggers the occurrence of direct project risks. The relation between indirect and direct risk can be described as a causative-consequential connection. Direct risk is in a way superior to indirect risk, as the latter is actually only the cause for direct, real problems in the project, like delays or cost overruns or inadequate performance. The division of project risks according to the way they impact project objectives is actually an upgrading of risk classification according to its interrelation with project objectives.

Although portfolio of real investments or investment projects in enterprise has some specific characteristics that are different from financial investments portfolio, basic principles of risk estimation developed in the field of financial investments, concern real investments as well. Real investments portfolio cannot be perfectly diversified as financial investments portfolio, and risk measurement in the field of financial investments is simplified because of developed financial markets and institutions that use sophisticated techniques of examination and appreciation of financial assets. Risk measurement in the field of real investments based on predicted cash flow is highly subjective. Also, there is the problem of particular assets parts identification. Real investments portfolio by means of new investments and restructurations creates synergic effects through growing, expansion, complementary resources exploiting etc., which estimation is very complex.

Influence of new investment project addition on total risk and return change depends on many factors, among them the most important are: (1) correlation of new investment with average market return and risk and (2) new investment relation to other enterprise investment projects.

Correlation of new investment with average market return and risk can be viewed in two ways. First of all, basic principle of risk estimation explains that higher correlation means higher risk. On other hand, when the correlation of new investment with average market return and risk is more different than the correlation between existed portfolio of enterprise, then the influence of new investment to total risk and return is higher. On the theoretical assumption that enterprise with its investment or project portfolio realizes the same risk and return as market portfolio, then it would be a perfect correlation between its and market portfolio and a new investment addition would not influence change in total risk and return. In reality, every particular investment portfolio is not perfectly correlated with market portfolio, and addition of new investment that has the same level of correlation doesn't influence total expected risk and return.

From the point of view of risk and expected return of real investments, the main role is played by economic relationship of new project or real investment proposal and portfolio of existed real investments. That relationship is defined by mutual influence on effects of new and existed real investments. From that point of view real investments can be economically independent or dependent. Economic independence means that there is no mutual influence on effects of new and existed

investments. In that case, one considers the total effects of new investment proposal, taking into account opportunity costs, in decision making process.

Economically independent projects may be:

- investment in the same kind of capacity as existing in order to expand existing production,
- introducing the new production that is expected not to influence the existing production or existing market of an enterprise,
- investment in bottleneck capacity in order to expand existing production.

Economic dependence can vary from total prerequisitness, strong and weak complementariness, and then weak and strong substitutability to mutuall exclusiveness. Complementary investment increases outputs or decreases inputs of existing investment. Substitutive investment increases inputs or decreases outputs of existing investment. Inputs are: costs, cash outflows, raw materials etc. Outputs are: revenues, cash inflows, products etc. These relationships are the most important factor in risk estimation. Consideration of economic dependence of investment projects is important from the point of view of risk and expected return. If the proposed project is complement to the existing projects, then its influence to the expected return and risk is very significant. Contrary, by changing the level of relationship through independence and weak and strong substitute relationship that influence becomes less important. In any case, influence of complementary investment to risk of enterprise is higher than the influence of independent or substitutive investment.

Economically dependent projects may be:

- investment in replacement capacity,
- introducing the new production in order to complete existing assortment, counting on existing market or eventually expanded market where new product would be sold accompanied by existing products,
- introducing the new complement activity in order to expand business in the frames of existing production,
- introducing the new production with intention to gradually substitute the existing product from assortment of which life cycle is on the decline.

Generally, acceptability of investment proposal in regard to interrelation between risk and return is realized in cases: (1) if investment proposal increases total return without influence to total risk, (2) if investment proposal decreases total risk without influence to total return and (3) if investment proposal contributes to acceptable relation in change of total risk and return.

In practice required rate of return is often estimated on the basis of stocks or capital return at financial market of particular enterprise that undertakes investment project. This approach uses the enterprise's beta as the real investment's beta. Discount rate for calculation financial criteria of investment project is stocks rate of return. That approach doesn't evaluate particular project's risk, but risk of enterprise that undertakes investment project. Investment decision based upon that approach can accept a high risk project or reject a low risk project depends on its relation to average cost of capital.

Economic independence or dependence must be distinguished from another type of interrelationship, namely statistic independence or dependence. Statistic dependence is said to be present when increase or decrease of the benefits from one project accompanied by an increase or decrease in the benefits of the second are caused by an external event. Such event can influence both of the mutually independent projects in the same way. The example is strong dependence of the highest or the lowest level of purchasing power, when change in the consumers' purchasing power would influence both of the projects equally.

3. Assessment of a project proposal

Assessment of project proposal or variant involves using the economic and financial criteria and decision models. A criterion is an effect of project to the stated goals. Economic criteria are based on accounting information and statements. Financial criteria are based on cash flow information and discount technique. Cash flow information derives from accounting information. Cash flow assessment is derived based on accounting estimation of net income and balance sheet. The following relation expresses the above stated derivation:

$$\Delta CF = \Delta SL + \Delta LL - D + (1+t) * (R-C) - \Delta NCA - IO + A$$

CF = cash flow
SL = short-term liabilities
LL = long-term liabilities
D = dividend
t = tax rate
R = revenues
C = costs
NCA = non-cash short-term assets
IO = invested outlay into long-term assets
A = accumulated depreciation

Both sets of criteria require at the outset information of annual incremental net income as the difference between incremental revenues (cost savings added) and incremental costs (opportunity costs or income lost added). Incremental net income is

relevant because it contributes to the financial result of the enterprise ascribable to the project decision. It is necessary to estimate opportunity costs in order to calculate incremental net income.

Economic criteria are: net income, contribution rate, margins of safety, profitability ratio of the total investment outlay, profitability ratio of the average investment outlay, annual coverage rate of required profitability, expected annual rate of net income related to engaged assets.

Financial criteria are: net present value of the total cash flow, net present value of the cash flow in the operation period, internal rate of return, payback period, quotient of net present value in the operation period and investment outlay, annuity equivalent to the initial investment in payback period.

3.1. Variations of economically independent projects

Economically independent project is taken into consideration separately from existing projects in enterprise. Net income and cash flow of independent project are incremental in their total. There are three variations of independent projects that can be found in practice of an enterprise: project with estimated constant volume of activity, with estimated increasing volume of activity and decreasing volume of activity.

Project with estimated constant volume of activity is the simplest variation that is being shaped when there is no relevant data for estimation of project's life time. In that case it is necessary to limit the estimated period to, at the most, five years, because every forecast for longer period is uncertain. The present value of equipment at the end of estimated period is terminal value of the project and terminal cash flow. Salvage and scrap value at the end of the technical useful time has to be ignored.

The shaping of estimate begins with assessment of revenues, costs and net income. Assessment of revenues is based on the most uncertain components from environment of an enterprise; hence it is most complex. Project capacity is only one of the strongpoints of revenues' projection and others are based on market analysis and forecasting. It is possible to shape information for better insight into project variation using assessment of net income: information about contribution margin, contribution rate, break-even point, margins of safety, points of indifference.

Variation of independent project with estimated increasing volume of activity presumes that project begins operation period with partial utilization of capacity, which is gradually to be increased. This is more realistic presumption than that of constant volume of activity. Accounting projections forecast: (1) optimistic, average and pessimistic starting point of capacity utilization, (2) probability of variations' realization and (3) probability of temporal achievement of the full capacity utilization. Expected initial volume of activity is the product of multiplication of possible volumes and probability of realization. Expected initial volume of activity is also the starting point for risk assessment. The project with higher variance and standard deviation of

expected initial volume of activity is a more risky one. Accounting estimates of project with increasing volume of activity stress two problems in calculation: (1) calculation of depreciation and (2) relationship between net income and cash flow. It is necessary that depreciation projection corresponds the estimated change in capacity utilization. That is a prerequisite of real net income projection. Operating cash flow of project with increasing volume of activity shows that in the period of increasing volume of activity cash flow is overstrained caused by changes in accounts receivable and inventories. Given constant turnover ratio, accounts receivable and inventories become enlarged in period of increasing volume of activity.

In some specific cases, independent project can be estimated with decreasing volume of activity. For example, in pharmaceutics one can estimate market saturation connected with production of new medicament, where the volume of activity will be stabilized after the first phase of present needs satisfaction. Accounting estimates stress the same moments on the analogy of the project with estimated increasing volume of activity.

3.2. Variations of economically dependent projects – substitution relationship

There are two projects in substitution relationship: (1) the project that substitutes existing project, so-called substitutional project and the project to be substituted, so-called substitutive project. The enterprise takes into consideration substitutional project when the existing project's life-cycle is on the decline or if it intends to substitute partly or completely the existing project with a more profitable one. In the first case, the substitutive project has declining profitability. In the second case, the substitutive project has increasing or stagnant profitability. Economic dependence of substitutional project is caused by its influence on the effects of substitutive project. Substitution can be partial or complete. Complete substitution interrupts farther proceeding of substitutive project. Partial substitution reduces possible effects (outputs) of substitutive project. It is important to stress that substitutional project can take over part of fixed costs i.e. overheads of substitutive project. In that case the life of substitutive project is prolonged as long as it obtains positive contribution margin.

Opportunity cost of substitutional project is lost net income as economic category. Lost cash flow is financial category and opportunity net cash flow. Opportunity effects (cost and cash flow) decrease planned economic and financial effects of considered project variations.

Declined volume of activity of substitutive project causes loss of contribution margin. The amount of loss is product of multiplication of contribution margin per unit and lost volume of activity. It is necessary to correct that result for appropriate part of degressive variable overhead costs that will not appear because of declined volume of activity. There are many techniques for separation variable and fixed component of overhead costs from which elementary mathematical methods and regression method are in usage most often. It is necessary to take income tax rate into account. Opportunity costs can be expressed by using relation:

$$OC = (1\text{-}t) * (Sq * CMs - OC * r * Sr)$$

OC = opportunity cost (lost income)
t = tax rate
Sq = lost volume of activity of existing (substitutive) project
CMs = contribution margin per unit of substitutive project
OC = degresive variable overhead cost of substitutive project
r = rate of variable component share in degresive variable cost
Sr = substitution rate

Loss of cash flow is lower then of income loss, given constant turnover ratio. Partial substitution will decrease average inventories and accounts receivable. That can be expressed as follows:

$$OCF = OC - (AR + I) * Sr$$

OCF = opportunity net cash flow (lost net cash flow)
OC = opportunity cost
AR = average accounts receivable of substitutive (existing) project
I = average inventories of substitutive project
Sr = substitution rate

There are three main problems concerning substitutional and substitutive projects:

- Preparing the information base for using the decision model about replacement time, if substitutive project has declining profitability;
- Programming the degree of substitution that influences the opportunity costs, if substitutive project has increasing or stagnant profitability;
- Projecting the redistribution of overhead costs.

a) Replacement time

Replacement model compares annuity equivalent to substitutional project's present value and opportunity cost. Replacement project's opportunity cost is net cash flow that substitutive project can obtain enlarged for loss because of postponing the sale of its scrap value. The first step is creating projection of economic effects as a starting point of substitutive project's net cash flow estimate. It is important to treat the depreciation correspondingly to the estimated level of activity and to take in account tax corrections caused by the difference between projected and tax recognized depreciation. In the year when the beginning of declining phase is diagnosed, net cash flow is calculated as a sum of net income and depreciation, that is enlarged for decline in accounts receivable and inventories caused by decreased volume of activity. It is usual that cash flow in declining phase of substitutive project exceeds net income significantly. Negative net income can be accompanied by positive net

cash flow till the expiration of the project. The enterprise makes replacement decision in the year when net cash flow of substitutional project exceeds net cash flow of substitutive project. Replacement decision is a case of mutually exclusive dependence, since replacement means the full substitution.

b) Substitution degree

Partial substitution is the case when substitutional and substitutive projects can be active at the same time. The project option which improves the present production can be a better and more expensive variation of present basic product (for example, a new type of car) or simplified and cheaper variation of present basic product, that will be within everybody's reach (for example, a new cosmetic). In the first case it is probable that substitutive product has increasing profitability, whereas in the second case the probability of substitutive project having stable profitability is higher. In both cases it is necessary to programme the degree of substitution, that is expected to be higher if substitutive product has stagnant profitability than if it has increasing profitability. Opportunity cost as consequence of substitutive project's reduced volume of output, is irrelevant for accounting. It does not influence the projection of economic and financial effects of substitutional project. It is significant only from the point of view of substitutional project's decision making.

Causes of substitution effect can be internal and external. Internal causes lie in limited capacities and appear as a result of new project's introduction. They are temporary, because the enterprise will install required capacities as soon as possible. Until then it is important to programme substitution in a well-balanced way in order to avoid unutilized capacities. In estimation of internal opportunity effects one needs to define: (1) substitutive project's volume of activity lost and (2) unutilized capacities caused by partial engagement of present capacities with new project.

External causes of substitution effects are unavoidable and dependent on:

- substitutional project's volume of activity influencing the substitutive project's outputs demand;
- relationship between selling price of outputs of substitutional and substitutive projects.

The influence caused by volume of activity can be estimated by presuming the constant and known total demand of kinds of products, being outputs of both projects. On the assumption that total demand will decline, consideration of new project is very risky and can be justified only in the circumstance of extreme competitiveness. On the assumption that total demand will increase, there is no substitution effect. Presuming the constant and known total demand of outputs of both projects, one can estimate substituted volume of activity from the relation:

$$Sq = M\,SVq * SNq$$

Sq = expected substituted volume of activity of existing project

M SVq = market share of outputs of substitutive (existing) project

SNq = planned volume of activity of substitutional project

According to above relation, expected substituted volume of activity of existing project is the product of multiplication of substitutive project's outputs share on market and the planned volume of activity of substitutional project.

Substitution rate is quotient between expected substituted volume and volume of substitutive product. That can be expressed by the relation:

$$Sr = Sq / SVq * 100$$

Sr = substitution rate

SVq = volume of activity of substitutive project

Substitution rate projected in above way takes in consideration the first cause of substitution effect. The second cause is the relationship between selling price of outputs of substitutional and substitutive projects. Influence of that relationship corrects substitution rate depending on price elasticity. If the the demand function of the considered group or kind of product is known, one can calculate the price elasticity for determined price level projected by new project, from the relation:

$$E = b * p / Sf$$

E = elasticity (percent of demand decrease if price increases for one percent)

b = slope of line (coefficient close to "p")

p = price planned by new substitutional project

Sf = demand function

Calculation of substitution rate can be illustrated in example:

Example 1:

Total car demand on considered market is 100,000 units. The enterprise's market share of the existing car is 6%. Projected volume of activity of the new car project is 4,000 units. Expected decline of existing project's outputs is 240 units (4,000 * 6%). Substitution rate caused by volume of activity is 4% (240 / 6,000 * 100). Demand function of cars is: Sf = 120,000 – 1.5p. Price elasticity for price level of 10,000 $ (planned by new project) is:

$$E = (-1.5 * 10{,}000) / (120{,}000 - 1.5 * 10{,}000) = -0.14286$$

Estimated substitution rate of 4% has to be corrected for elasticity at the planned price level:

Sr = 4 – 0.14286 = 3.857

One can conclude that smaller volume of existing car type will be substituted by new one because of negative price elasticity than it would have been only because of increased total volume of activity. As in most cases demand functions are unknown, an enterprise can lay down price elasticity at one's own discretion, by alignment of outputs of considered projects into several price groups. The example for such estimation is shown in table 1.:

Table 1: Basis for own estimation of price elasticity

Price class	Quantity realized at the market	Average price
I	10	20
II	15	12
III	35	9
IV	40	6
TOTAL	100	

As the planned price of new project's output is 10,000 $, it belongs to the third price class. In that class compared with fourth class, price increase is 50% (9,000/6,000=1.5) and quantity decline is 12.5% (35,000/40,000-1=-0.125). Elasticity can be estimated to –0.25% (-12.5/50=-0.25). That means that price increase for 1% (at average level of 9,000$) causes demand decrease for 0.25%. Estimated elasticity on above way can be taken as corrective of substitution rate.

The presented projection of substitution rate can take in consideration other factors that influence the demand elasticity. That can be: consumers' income effect, expectation of future prices change, existing of good product's substitutes on the market etc. Volume of activity and price elasticity are the most important factors that are sufficient to be considered for practical estimate's needs.

c) Overhead costs

Projects of which life cycle is on the decline often attain negative income for several years before expiration. The same result can be obtained by projects for assortment complement. Such projects do not justify themselves economically or financially and there are only marketing reasons for their running. They have negative income accompanied by positive or negative cash flow, depending on overhead. Probability of positive cash flow attainment is higher if depreciation takes a bigger part in overhead costs. The project is justified if it contributes to covering of unavoidable

fixed costs, but in context of existing or introducing another one, that will take over uncovered part of fixed costs. In the case of substitutional project it is necessary to take redistribution of overhead in estimate of incremental effect.

In table 2. is shown example of estimate of economic flow and cash flow have to be allocated to substitutional project:

Table 2: Estimate of economic and cash flow have to be allocated to substitutional project (annual)

Estimate items	Amount
1. Planned contribution margin of existing project	40,000
2. Planned depreciation of existing project	50,000
3. Planned overhead of existing project	70,000
4. Planned income of existing project (1-2-3)	-80,000
5. Tax saving on negative income (35% of ord.num.4)	28,000
6. Planned net cash flow of existing project (1-3)	-30,000
7. Economic flow (net income) has to be allocated to substitutitutional project (-4-5)	52,000
8. Cash flow has to be allocated to substitutional project (-6-5)	2,000

The example shows that existing project attains positive contribution margin and negative income and cash flow in the considered year. If overhead is lower than contribution margin, the project would attain positive cash flow and there would be no need for cash flow allocation. Negative economic and cash flow in the example have to decline for tax saving. Negative income of existing project or lower income of substitutional project after allocation causes tax save. If tax saving is higher than negative cash flow of existing project, there would also be no need for cash flow allocation. Calculated annual amounts necessary for allocation (if they are positive) decrease estimated economic and financial incremental effects of substitutional project.

One can say that substitutional project saves existing project, i.e. contribution margin of existing project. Usefulness of substitutional project is the ratio between average net income i.e. net cash flow of substitutional project and economic i.e. cash flow of existing project which have to be allocated to the substitutional project. It can be one of criteria for making decision about substitutional project. Economic i.e. financial usefulness can be expressed as follows:

$$Ue = \phi NI / ANI$$

$$Uf = \phi CF / ACF$$

Ue = ratio of economic usefulness

Uf = ratio of financial usefulness

ϕNi = average incremental net income of substitutional project

ANI = net income has to be allocated to substitutional project

ϕCF = average incremental cash flow of substitutional project

ACF = cash flow has to be allocated to substitutional project

The above ratios show how many times economic and financial flows which have to be allocated are contained in incremental effects of substitutional project. When amounts for allocation are very high, these ratios can be crucial for making decision about substitutional project. In that case redistribution of overhead costs is the reason for introducing of substitutional project.

3.3. Variations of economically dependent projects – complement relationship

Complement projects present a kind of economic dependence when introducing of new project increases outputs (cash inflows) or decreases inputs (cash outflows) of existing project. The project that complements the existing project is complemental project and existing project is complemented project. Complemental project is highly risky because it moves in the same direction as the existing complemented project. Risk is on the decrease if complemental project has reserve possibility of usage. Such possibility causes opportunity cost.

There are four main problems concerning complemental projects:

- Optimization of inputs or outputs of complemental project when it engages the same capacities as the existing project, or enterprise introduce complemental and complemented project at the same time;
- Risk estimation of complemental project;
- Opportunity cost estimation if complemental project has reserve possibility of usage;
- Overhead estimate of complemental project.

a) Optimization of inputs or outputs

When complemental project engages the same capacities as the existing project, or complement projects are introduced at the same time, it is necessary to optimize their outputs. In that case, object is to maximize total contribution margin. When complemental project uses the same resources as the existing project, the object is to minimize direct, variable costs per unit. One can solve the problem with one objective function and more constraints by using of mathematical programming. In most cases, it would be linear programming, because object and constraints can be expressed as linear equations. Contrary, if it is not possible, one can use nonlinear programming or other solving methods of programming problems.

b) Risk estimation

High correlation between complement projects means that every change in volume of activity of existing project causes proportional change in volume of activity of complemental project. That means a high degree of economic dependence and risk. Risk estimation is of utmost importance for such projects.

In the case of capital investments or investment projects there are three relevant types of risk: stand-alone risk, market risk and within-firm total risk.

Stand-alone risk is project's own risk disregarding the facts that the project is but one asset within the firm's portfolio of assets and that the firm in question is but one stock in most investors' stock portfolios. A project's stand-alone risk is measured by the variability of the project's expected returns. It is of great importance because it is much easier to estimate than other types of risk and it is highly correlated with other types of risk. The starting point for analyzing a project's stand alone risk involves determining the uncertainty inherent in the project's cash flow. Convenient techniques for assessing a project's stand-alone risk or variability of expected return are: (1) sensitivity analysis, (2) scenario analysis and (3) Monte Carlo simulation. (Brigham, 1989:409-435) In sensitivity analysis key variables are changed and the resulting changes in the rate of return or any other criteria are observed. Scenario analysis compares several forecasted cases, usually worst, best and base case, and estimates expected rate of return or any other criterion under the presumed probability of particular scenario. Monte Carlo simulation is computer technique where distributions of probability of key variables are at the outset and distribution of particular criterion is at the close. Coefficient of variation is the standard deviation divided by the expected return. The product of multiplication of coefficient of variation and expected average rate of return is a part of premium for stand-alone risk. For example, if expected average rate of return is 18%, coefficient of variation is 20%, than stand-alone part of risk premium is 3.6% (18*20%), that would be added to the risk-free rate of return.

Market risk is another part of risk premium that is measured by the project's beta coefficient. There are two approaches for projects' or real investments' beta measuring. The first approach supposes that project's market risk is equal to risk of enterprise where the main activity or product is the content of considered project. The average of these kinds of enterprises' betas is project's beta. The second approach estimates accounting beta as relationship between enterprise's gross profitability and average market rate of return. It is useful for small and medium enterprises and in the circumstances of undeveloped financial market. In the case of complemental project, known rates of return of complemented project could be useful for beta estimation. A part of total risk premium caused by market risk is product of multiplication of beta and difference between expected average market rate of return and risk-free rate of return.

The last part of risk premium within-firm total risk is measured by a project's effect on the firm's earnings variability. New project influences the total return and risk of enterprises. New project is acceptable from the point of view of risk-return interrelationship when: (1) project increases total expected return with no influence on the total risk; (2) project decreases total risk with no change in total expected return and (3) project contributes to acceptable relation in changes of total return and total risk. Acceptable relation is realized inside of marginal utility slope. When marginal utility slope is unknown, what is in most cases, then added profitability of new project to the total profitability of enterprise can be the measure of added risk i.e. within-firm total risk. If shaped profitability of complemental project is less than total profitability of enterprise, it can be presumed that such project has not within-firm total risk.

c) Reserve possibility of usage

Complemental projects with reserve possibility of usage are: (1) project with reserve possibility of outputs' usage, (2) project of own inputs' production with reserve possibility of buying and (3) project of outputs' further processing with reserve possibility of selling. Such complemental projects are less risky than those without reserve possibility of usage. The emphasis of accounting estimates is opportunity effects valuation.

There are two types of opportunity effects in the case of project with reserve possibility of outputs' usage, depending on fact whether reserve variant would realize higher income than planned complemental project or would not. If reserve variant would realize higher income, opportunity effect is opportunity cost as unrealized income, reduced by tax salvage. Opportunity cost is deductive item of estimated economic and financial effects of complemental project in order to shape incremental effects. If reserve variant would realize lower income, opportunity effect is opportunity earnings as unrealized loss of income. Opportunity earnings are reduced for added tax outlay and these are additional item of estimated economic and financial effects.

In the case of project of own inputs' production with reserve possibility of buying, opportunity earnings appear as avoided cost that would realize reserve variant of buying. In the case of project of outputs' further processing with reserve possibility of selling, opportunity cost appears as lost income that would realize reserve variant of selling. Both opportunity effects have to be corrected for tax influence as added tax outlay: in the first case, it decreases opportunity effect; in the second case, it increases opportunity effect. Incremental economic flow (inceremental net income) of project of own inputs' production is the sum total of net income and opportunity earnings. Incremental cash flow of project of own inputs' production is the sum total of net cash flow and opportunity earnings. Incremental economic flow of farther processing project is difference of net income and opportunity cost. Incremental cash flow of farther processing project is difference of net cash flow and opportunity cost.

It is useful to calculate indifferent volume of activity in order to risk assessment of such specific complemental projects with reserve possibility of usage. It is the level of activity that gains equal net income for complemental project and reserve variant of usage. When complemental project produces level of activity, not much higher than it is indifferent volume of activity, one can conclude that it is a risky project.

d) Overhead estimate

Complemental project as supplement of existing production does not influence the existing overhead significantly. Classic methods of full costing calculate overhead rates in order to add overhead cost to direct, variable cost. Allocation bases are usually types of direct cost. Valuation of complemental product can be based on: (1) existing overhead rates and (2) changed overhead rates. The first solution means that complemental projects causes overhead costs in total sum of its direct cost multiplied with overhead rate. It is opposite to the essence of degressive overhead and it overvalues that cost. The second solution means that insignificant higher overheads are allocated on the basis of increasing direct costs. Therefore overhead rates become lower and existing products become underestimated.

Modern costing systems as Activity Based Costing[3] provides a more reliable basis for assigning non-manufacturing overheads to products. It defines categories of activity in overhead departments, which on the one hand are recognizable to overhead department managers but, on the other hand, are driven by factors (cost drivers or indicators) which are characteristic of products and other cost objects. This has allowed a much higher proportion of total company cost to be allocated to products more strictly according to causation.

The idea behind ABC is that cost objects, which can be products, services, jobs, units, batches, customers, or anything the management accountant is trying to cost, consume activities. In turn, activities consume resources. Activity drivers measure the activities consumed, and resource drivers measure the resources consumed. If drivers are correctly defined, then existing cost per unit of activity, as temporary cost object, will be appropriate base to approximate overhead caused by new complemental product. Total overhead cost is the sum of product of multiplication of cost per indicator's unit and number of activity's units caused by complemental product. ABC achieves constant value of cost indicators per unit and incremental estimating of volume of added activities. That means that overhead cost is estimated on the basis of added activities required by new product and that existing products do not change their value.

[3] Activity Based costing (ABC) is broadly treated in recent literature; for example: J.G.Burch: *Cost and Management Accounting. A Modern Approach*, West Publishing Company, St.Paul, 1994; C.Berliner, J.A.Brimson: *Cost Management for Todayś Advanced Manufacturing*, Harvard Business School Press, Boston, 1988; G.Cokins: *Activity Based Cost Management*, Irwin, Chicago, 1996; C.Drury: *Management Accounting for Business Decisions,* International Thomson Business Press, London, 1997., e.t.c.

4. Conclusion

The decision making process about projects variants involves using the economic and financial criteria and decision models. At the outset the criteria require information of annual incremental net income as the difference between incremental revenues (cost savings added) and incremental costs (opportunity costs or income lost added). Incremental net income is relevant because it contributes to the financial result of the enterprise ascribable to the project decision.

Risk measurement can be satisfactory, if the base, economic and financial effects of real investment, are appropriately estimated. Incremental and opportunity effects regarding economic dependence of real investment are the key element in shaping economic and cash flow, and stand alone risk estimation. Within-firm total risk depends on project profitability and size. Assessment of market risk is the most uncertain, but its importance in real investments area is presumed to be less than individual and within-firm total risk component.

Investment economic relationships can be arrayed from mutually stipulated relationship where existing project cannot survive without new project, to the mutually exclusive relationship where potential benefits to be derived from existing investment will completely disappear if the new project is accepted and vice versa. Mutually stipulated relationship is the extreme of the complement project, whereas mutual exclusive relationship is the extreme of the substitute project. Economic independence lies between complement and substitute economic dependence. That means that independent project has no influence on inputs or outputs of existing projects.

In the case of independent projects it is necessary to distinguish: the project with estimated constant volume of activity, with estimated increasing volume of activity and decreasing volume of activity. Besides the main accounting information, net income and net cash flow, accounting process has to provide significant information concerning decision about the best project variation and information for better insight into project variation using assessment of net income.

In the case of substutional project it is necessary to provide accounting information about opportunity costs and opportunity net cash flow that decrease planned economic and financial effects of considered project variations. It is relevant to: (1) prepare the information base for using the decision model about replacement time, if substitutive project has declining profitability; (2) programme the degree of substitution that influences the opportunity costs, if substitutive project has increasing or stagnant profitability and (3) estimate the redistribution of overhead costs.

Complemental project stresses the need for shaping some specific information: (1) information about optimum of inputs or outputs of complemental project when it engages the same capacities as the existing project, or when enterprise introduces complemental and complemented project at the same time; (2) information about risk

of complemental project; (3) information about opportunity cost if complemental project has reserve possibility of usage; and (4) information about overhead costs of complemental project. Providing needed information is the prerequisite for succesful decision-making process and choice of the best project's variant.

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Procjena investicijskih projekata u procesu odlučivanja

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Sažetak

Jedan od najvažnijih kriterija u klasifikaciji investicijskih projekata je ekonomska ovisnost između novog i postojećih projekata u poduzeću. Ona uzrokuje potrebu za specifičnim informacijama u procesu odlučivanja. Preduvjet projekcije inkrementalnih efekata projektne varijante je procjena oportunitetnih efekata uzrokovanih ekonomskom ovisnošću. Temeljni principi procjene rizika nastali u području financijskih investicija odnose se i na realne investicije, odnosno investicijske projekte. Poduzeće se može promatrati kao portfelj investicijskih projekata koji ne može biti perfektno diverzificiran i kod kojeg tržišni rizik nije najvažniji. U području investicijskih projekata procjenjuju se individualni rizici i rizici koje novi projekti dodaju ukupnom riziku poduzeća. U ovom radu se objašnjavaju osnovni principi procjene rizika investicijskih projekata u fazi planiranja, odnosno selekcije projektnih varijanti. Istražuju se vrste ekonomske ovisnosti među investicijskim projektima i njihov utjecaj na proces odlučivanja.

JEL klasifikacija: *G31, M49, O22*

Ključne riječi: *neovisan projekt, dopunjujući (komplementarni) projektni odnos, zamjenjujući (supstitutivni) projektni odnos, dodatni (inkrementalni) efekti, projektni rizici*

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