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INVESTMENT PROPOSAL EVALUATION

ZHODNOCENÍ EKONOMICKÉ EFEKTIVNOSTI PODNIKOVÉ INVESTICE

DIPLOMOVÁ PRÁCE
MASTER'S THESIS

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In the Czech language:

Zhodnocení ekonomické efektivnosti podnikové investice

Instruction for writing:

Introduction
Targets and Methodology
Theoretical Background
Analysis of the Current Statement
Investment Project Proposal
Conclusion
References
Appendices

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List of literature:

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ABSTRAKT

Tato diplomová práce je zaměřena na zhodnocení ekonomické efektivnosti dvou konkrétních návrhů k investici na základě příslušných metod vhodných k hodnocení efektivnosti investic. První část práce obsahuje teoretický základ potřebný k hodnocení efektivnosti investic. Druhá, analytická část je zaměřena na aplikování metod na dané investiční projekty. Ve třetí části, na základě těchto metod, je navrženo přijetí jednoho ze z těchto investičních projektů spolu s přihlédnutím k riziku investice.

ABSTRACT

This master's thesis is focused on an evaluation of economic effectiveness of two particular investment proposals based on appropriate methods for evaluation of investment efficiency. First part of the thesis contains a theoretical basis needed for the evaluation of investment efficiency. Second part (analytical) is aimed to application of methods to the investment projects. In the third part, based on these methods, it is suggested to undertake one of these investment projects with an investment risk which is taken into account.

KLÍČOVÁ SLOVA

Investice, projekt, efektivnost, hodnocení, diskontní míra

KEY WORDS

Investment, project, efficiency, evaluation, discount rate

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Brno, 31st August 2015 ....

Bc. Ondřej Figala

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CONTENT

1 INTRODUCTION

Investment is an essential part of every company which tends to become or sustain competitive and necessary for further development of a particular company. Such investment may be purchase of long-term tangible asset (buildings, machines), long-term intangible asset (patents, copyrights) or financial investment as a purchase of securities for instance (13).

The core principle of the investment is the fact that investment is postponed consumption of an item or asset which is purchased with a hope that it will appreciate or generate income during the lifetime of investment. The lifetime of investment or investment project has to be at least one year in order to be classified as an investment. If the lifetime does not exceed one year, it is classified as an operation cost (8,19).

The acceptance or rejection of particular investment is not simple task for the company. Not only for the reason that the lifetime of the investment exceeds one year, often exceeds several years or even decade and therefore the future development is uncertain, but also external factors that influence the investment ought to be considered. Therefore, with uncertain future development of the investment and due to (un)expected external factors which might jeopardize the project, the investment decision-making is difficult task for the management of the company.

The topic "Investment proposal evaluation" for this master's thesis is current; selected company still considers the investment and the topic has been also chosen for the reason that such topic is seen as significantly interesting for the author of this thesis and at the same time CEO of the company is a good friend.

2 PURPOSE AND OBJECTIVES

The company DV Polanka nad Odrou is engaged predominantly in agriculture. For such business activities related to agriculture are nowadays necessary agricultural machines which help to improve the efficiency of an agricultural production in general. It is obvious that every machine has its own lifetime and when the machine reaches it, it will be replaced or just discarded when there is no need of replacement. DV Polanka nad Odrou owns an agriculture machine – combine harvester which reaches its lifetime. Therefore there is need for replacement of this kind of combine harvester. The company has received an offer to purchase a refurbished combine harvester of similar type but newer model. Second option for the company is a purchase of offered combine harvester, but new one.

The main objective of this diploma thesis is therefore evaluation of efficiency of two investment projects, purchase of refurbished combine harvester and purchase of new combine harvester, from which one will be recommended to company to undertake.

Partial objectives, in order for the main objective to be met, are:

- Elaboration of a theoretical background
- Data acquisition needed for appropriate methods of evaluation of an investment efficiency; Net present value (NPV), internal rate of return (IRR), profitability index (PI) and payback period (PP)
- Estimation of capital expenses, operating costs, estimation of cash flows and valuation of weighted average cost of capital
- Application of NPV, IRR, PI and PP
- Formulation of proposal
- Discussion and conclusion

3 RESEARCH DESIGN

The first step of this thesis is the process of theoretical background necessary for the further analyses of the investments.

The knowledge of theoretical basis is exploited for the acquisition of data necessary for proper evaluation of investment efficiency, such as initial investment as capital expenditures, estimation of operating costs related to a particular investment option, estimation of future cash flows which are resulting from both investment options and valuation of weighted average cost of capital as a quantity which determines the discount rate needed for the calculation where is necessary to account for the time factor.

The part of analysis also includes the brief introduction of DV Polanka nad Odrou followed by description of an investment plan.

In the next chapter "Evaluation of efficiency of investment options" methods to evaluate investment efficiency are applied with use of capital expenditures, future cash flows and discount rate where is an efficiency of both investment options examined.

Results of analyses mentioned above form the basis for the proposal where is accounted for the risk factor extra and the proposal part of the thesis also includes the suggestion which investment project ought to be accepted based on the economic efficiency.

4 THEORETICAL APPROACHES

4.1 Investment

Benjamin Graham, pioneer in the field of securities and lector of many successful investors tried in a book Security Analysis to define an investment. According to Benjamin Graham an investment is such operation which after a thorough analysis promises a security of an input and adequate return. This definition is more appropriate for investments on stock markets but basically the principle is the same for project investments. (8)

From the macroeconomic point of view investments are understood as capital assets that consist of goods which are not assigned for immediate consumption but are used in production process of consumer goods or other capital goods (18).

From the business perspective investments are expended resources which will bring in the future cash inflow during longer period of time (typically more than one year). Investments can be classified as (19,20):

1. Capital expenditure on purchase of intangible asset (know how, purchase of software, licences)
2. Capital expenditure on purchase of tangible asset (buildings, lands, production machines, artworks)
3. Capital expenditure on purchase of financial long-term asset (securities) (19,20)

Investments are significant and indispensable element of every company which tend to support its development and to sustain competitive on the market. For investments or investment projects in the context of business a term capital budgeting is used (13).

4.2 Capital budgeting

One of the most important decisions made by company management are capital budgeting decisions. Selection of investments in real assets which will increase the value of the company is the main objective of these decisions. These investments are positive for the company if they are worth more than they cost. The importance of those decisions made on investments is not only for the reason that they increase the value of the company. They represent a substantial capital expenditure for the company and once the investments are made, they are not easily to be reversed. For all those reasons capital budgeting plays a significant role in company's success (13).

4.3 Investment project

4.3.1 Classification of investment projects

Investment project could be classified according to several different aspects. Among the basic aspects belong: relation with development of company, factual content, degree of correlation of projects, conventionality of cash flows and project size (7).

1) Relation with development of company

According to this aspect, projects can be classified as:

- Developing, focused on expansion; projects primarily to increase the volume of production, introduction of new products or services, market penetration, et cetera. Benefits of these projects are reflected generally in growth of sales.
- Renewal; here are included projects of replacement or modernization of production equipment which are enforced by the physical condition of the equipment for the reason that the equipment is close to reach the end of its lifetime.

- Mandatory; projects whose targets are not economic effects, but to reach the harmony with existing laws, regulations, rules modifying certain areas of business activities. These projects are usually focused on environmental protection, increase of work safety, improvement of work environment (7,13,17).

2) Factual content

Introduction of new products, technology respectively; projects focused on new products and/or technologies, which are new for certain company but they already exist on the market. Part of these projects is generally new production equipment investment (7).

Research and development of new products and technologies; these projects are often more risky and are difficult to evaluate correctly (these projects cannot be weighed independently but with all related projects with a use of result of research and development) (7).

Innovation of information systems, introduction of information technology respectively; these projects are also difficult to evaluate in terms of its economic efficiency due to difficulty of quantification of their benefits (7).

Increase of work safety; these projects are usually mandatory while its economic efficiency evaluation is difficult as well (7).

Reduce the negative impact on environment; as well as innovation of information systems and projects to increase of work safety, projects to reduce the negative impact on environment are difficult to evaluate in terms of its economic efficiency due to difficulty of quantification of real benefits (7).

3) Degree of correlation of projects

Mutually exclusive projects; two or more projects in this category are mutually exclusive, which means that implementation of both is not possible. Such examples of two mutually exclusive projects could be project focused on production of the same product but by a different technology, or projects using the same technology, but differ in the input resources (7,13).

Fully dependent projects; fully dependent project are usually part of larger project which is composed of partial projects. For the reason that all partial projects are fully dependent and part of larger project, it is necessary to complete all of them. If a partial project is not implemented, whole project is considered as not fulfilled. It is obvious that all dependent projects cannot be evaluated separately. It is needed to evaluate them together (7).

Complementary projects; Complementary projects are projects which have positive impact on another/other project/s. It is obvious that complementary projects cannot be evaluated separately but with regard to following one/s (7).

Economically dependent projects; economically dependent projects are projects which are subject to substitute effect which means that implementation of one project may have negative impact on another/other project/s. Generally such projects might be introduction of new model or type of a product which has similar functions for the customer. Typical example is introduction of new model of smartphone. Such step might influence (negatively) sales of the smartphone predecessor (7).

Stochastically dependent projects; decrease (increase) of costs or cash inflow of one project influences decrease (increase) of costs or cash inflow of the second project. Alternatively increase (decrease) of costs or cash inflow of one project influences decrease (increase) of costs or cash inflow of second project. This situation is typical for projects focused on products for the same market or customers, projects using the same distribution channel (7).

4) Conventionality of cash flows

According to conventionality, cash flows differ:

- <u>Conventional cash flows</u>; in these projects are negative cash flow in the first phase of project – the initial investment and positive cash flows in the period of lifetime of the project. This is demonstrated by thefollowing schemes (7,17):

--+++++ , -0++++ , -+++++

- <u>Unconventional cash flows</u>; negative/positive symbol of cash flow in this project is changing more often. Such example might be a project where are high closing costs (oil extraction) or high (unexpected) costs during the lifetime of the project. The cash flow of unconventional cash flows is demonstrated by the schemes below (7,17):

--+++- , -+-+++ , -0+-++

5) Size of the project

The distinguishing factor is usually capital costs needed to implement the project/s. Therefore according to the size, projects are classified (7):

- Large projects
- Middle projects
- Small projects

This classification is very relevant and depends on the size of the company. Project with the same capital costs one million € might be for one company considered as a small but on the other hand, for another company as a large project. Therefore more accurate classification is where the decision about the acceptance of certain project is made:

- Top management of the company – important and large projects (strategic);
- Middle management or particular division of company – middle projects (operational, tactical) (7).

4.3.2 Process of preparation and project implementation

1) Pre-investment phase

Preparation in this phase plays key role as the selection of the right project is prerequisite for successful project implementation. All information and findings gathered in the pre-investment phase are highly important for the decision making and future project development. Thorough and correct analysis ought to prevent selection of incorrect project and therefore may prevent future losses arising from such project implementation. Pre-investment phase consists of identification of opportunity, tentative choice of project and economic and technical study elaboration (12,19).

2) Investment phase

The second phase of investment project is the investment phase, in other words project preparation and project implementation. This phase consists of two stages, project design specification and implementation phase. In the implementation phase are reflected all shortcomings and imperfections from the previous phase which might considerably complicate and extend the investment phase. On the other hand, well processed economic and technical analyses facilitate the investment phase (12,1).

3) Operation phase

Operation phase of the investment project begins with the test mode which is followed by the regular mode. This phase consists of control and maintenance which helps to maintain the condition of the unit during its lifetime (12,1).

4.4 Evaluation of investment efficiency

An investment for company predominantly represents purchasing an asset in a hope of future benefit. Therefore while evaluating the investment efficiency input resources (predominantly financial) are compared with returns which a particular project has brought during its lifetime. Such evaluation is not just comparison of two factors, initial investment and the return. It is necessary to take into account other factors which influence the evaluation of investment project (18):

- Return
- Safety (Risk)
- Liquidity (18)

This can be demonstrated on a triangle which illustrates the dependence of the factors mentioned above:

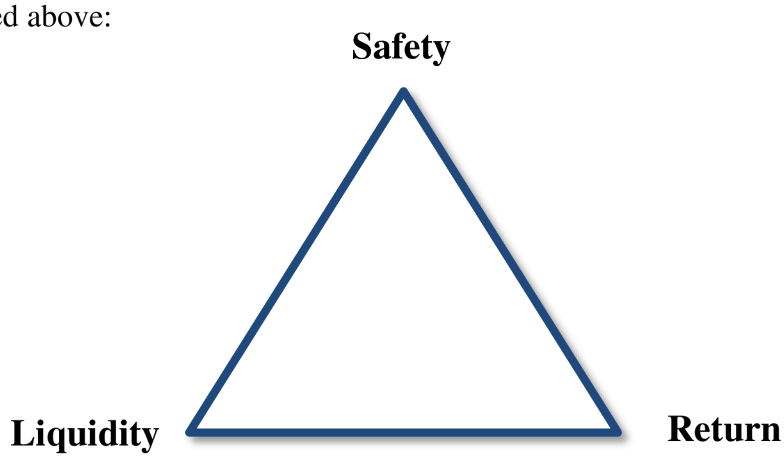

Figure 1: Safety-Liquidity-Return Triangle (Source: 18)

From the previous scheme it is obvious that all three factors are contradictory. Every company would be pleased to invest in project which fulfils all three factors, high return, high liquidity and low risk at the same time. But such projects are entirely rare. As all the factors are contradictory, investments with high return generally bring high risk. Vice versa, project which is risk free and high liquid, brings no return from the project. Therefore it is desirable not to insist on one factor but to find out the optimum composition of them (18).

To evaluate investment efficiency are required (13,18):

- Determination of costs of the project (capital expenditures),
- Estimation of future cash flows,
- Weighted cost of capital or the required return of the investment,
- Calculation of discounted cash flows and their comparison with capital expenditures

4.4.1 Capital expenditures

Capital expenditures consist only of relevant expenditures; which means capital expenditures which are directly related to investment project. Sunk costs cannot be included, but on the other hand opportunity costs should be. Determinations of capital expenditures of machines or production equipment are exact; these expenditures consist of purchase price plus transportation costs plus installation costs including project expenditures and preparatory documentation expenditures. Capital expenditures consist of purchase price of asset, increase of net working capital which can be calculated as an increase of current assets minus increase of short-term liabilities. Included are also expenditures related to sale or liquidation of an asset which is about to be replaced. It is common that the time of construction or installation exceeds several months or years. In that case it is desired to use discount rate (18).

Capital expenditures therefore can be expressed (18,19):

$$K = I + O - P \pm D$$

where:

K …………… Capital expenditure

I ……………. Expenditure which is related to purchase of asset

O ………..…….. Expenditure on increment of net working capital

P …………… Cash inflow related to sale or liquidation of asset which is about to be replaced

D …………… Tax effect (18,19)

4.4.2 Future cash flows

Determination of future cash flow is more difficult than determination of capital expenditures. Cash flows will probably be generated for longer period of time than the initial phase of the project. Therefore many factors might influence the cash flow, such as time factor or macroeconomic factor –inflation for instance. Deflection between the estimated cash flows and the real cash flows may significantly increase the return of the project (6).

Future cash flows of investment project include (19):

- Depreciation
- Net working capital
- Earnings after tax
- Income from the sold long-term asset

Future cash flows can be illustrated as (19):

$$P = Z + A \pm O + P_M \pm D$$

where:

P ……………	Total annual cash inflow
Z …..………	Annual increment of earnings after tax which is related to investment
A …………..	Annual investment depreciations
O……………	Change in short-term assets
P_M…..………	Income from the sold long-term asset
D…..………	Tax effect (19).

4.4.3 Weighted average cost of capital (WACC)

The term "Cost of capital" is perceived as company's costs to obtain a certain components of capital. Cost of capital represents minimal required rate of return (internal rate of return) of capital. Costs of each component are different and develop in time. Cost of capital can be understood from two perspectives, from the perspective of investor and from the perspective of certain company (4,12).

From the company's point of view is cost of capital a price of capital obtained for a further development of the company. From the investor's point of view is cost of capital requirement of return which has to be reached by a company to ensure that the value for investor will not be decreased. This means, it is an internal rate of return when the market value of certain asset equals present value of cash flows which the asset generates (4,17).

Generally cost of capital depends on the risk of particular assets. It consists of risk-free rate R_F and the market risk premium R_P. This is demonstrated on the following graph:

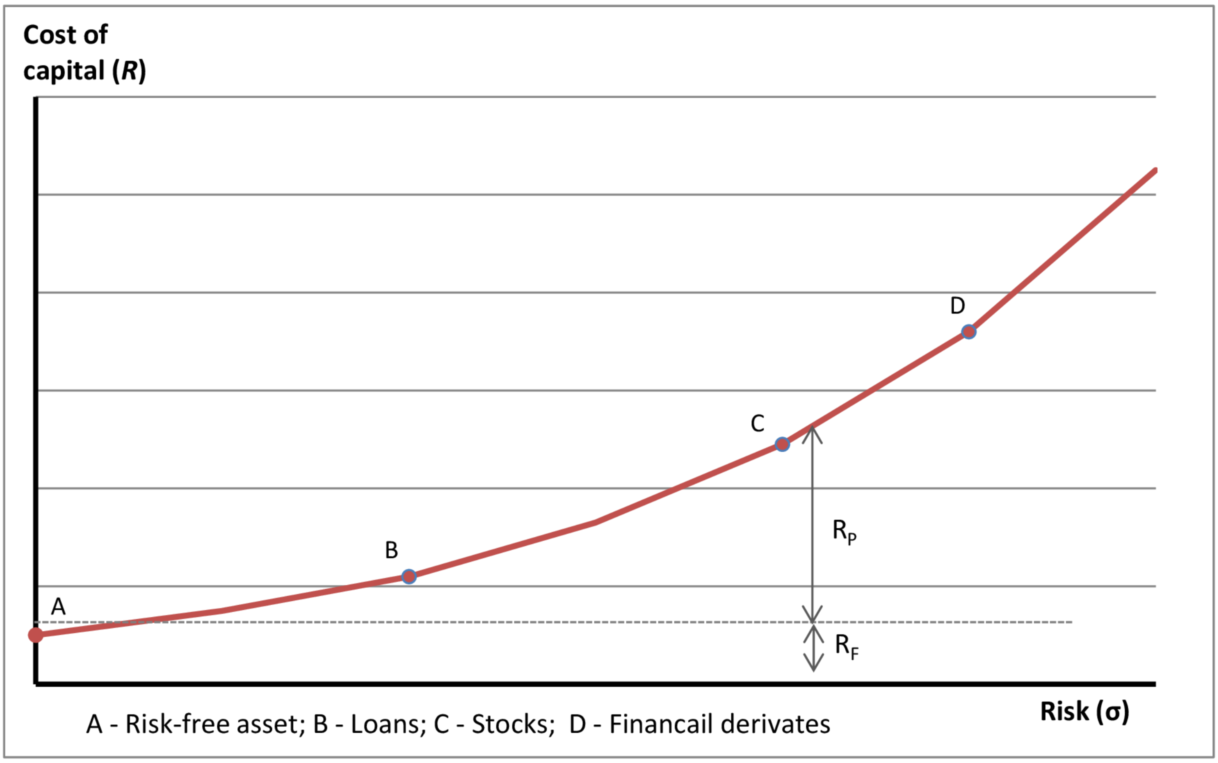

Figure 2: Correlation between cost of capital and risk (Source: 4)

Cost of capital is very important for many financial decisions, such as optimisation of capital structure, investment decisions, estimation of value of company, etc. (4).

Weighted average cost of capital $WACC$ can be calculated by the following formula (17):

$$WACC = R_E \frac{E}{V} + R_D \frac{D}{V}(1 - T_C)$$

where:	T_C………..….	Corporate tax rate
	E ….………..	Market value of the company's equity
	D …………..	Market value of the company's debt
	R_D………….	The cost of debt
	R_E….……….	The cost of equity
	$V = E + D$	(17).

The WACC formula theoretically seems to be easy to calculate, but practically the estimation of certain parameters is not a simple task. Weighted average cost of capital therefore consists of two components, the cost of equity part and the cost of debt part. It is necessary to quantify based on market prices. Using only booking value of both components of capital may negatively influence the estimation of a market value (4).

The estimation of the cost equity R_E is a difficult task. The reason is that it is hardly to measure the return which investors require from their company's equity investments. Four main approaches discuss the estimation of the cost of equity (4):

- The capital asset pricing model
- The arbitrage pricing model
- Dividend growth model approach
- INFA rating model (4).

1. The capital asset pricing model

The capital asset pricing model (CAPM) represents the market approach of estimation of the cost of equity and it is worldwide often used way how to estimate discount rates for market valuation of the company (15).

The CAPM formula is (13,17):

$$R_E = R_F + \beta_E(R_M - R_F)$$

where: R_E............................ Expected return

R_F............................ Risk-free rate of return

β_E............................ Amount of systematic risk

R_M............................ Expected return on the market

$R_M - R_F$.................... Market risk premium (13,17)

2. The arbitrage pricing model

The arbitrage pricing model APM is alternative model for asset valuation. It is market approach of estimation of the cost of equity. This model is multifactorial for the reason that it takes into account more risk factors which could be macroeconomic (GDP, inflation, etc.) or microeconomic (indebtedness, liquidity, size of the company, etc.) (4,15).

The formula of APM is:

$$R_E = R_F + \sum_j \beta_{Ej} \left(R_J - R_F\right)$$

where: R_E............................ Expected return

R_F............................ Risk-free rate of return

β_{Ej}............................ Coefficient of the sensitivity of additional return on equity

$\left(R_J - R_F\right)$.................. Market risk premium (4).

3. The dividend growth model

Dividend growth model is used for valuation of shares when the market value of share is given by the present value of future dividends of the share in particular years. Under the assumption that the dividend of the company growths at a constant rate g and the price of the share is P_0, the formula can be expressed (4,17):

$$P_0 = \frac{D_0 * (1+g)}{R_E - g} = \frac{D_1}{R_E - g}$$

Where the D_0 is the paid dividend, g is the expected dividend growth in next years. Therefore D_1 is projected dividend in next year which equals to $D_0 * (1+g) = D_1$. The formula can be rearranged to solve it for R_E (17):

$$R_E = \frac{D_1}{P_0} + g$$

For the reason that shareholders require return on the share R_E; this can be interpreted as the cost of equity (17).

4. The INFA rating model

The INFA rating model was created for the reason that previous model is not suitable for companies whose shares are not publicly tradable or not joint-stock company. Another reason for creation of the model is the fact that coefficient beta for small and medium companies is not easy to estimate. In fact INFA model calculates alternatively the weighted cost of capital as a sum of certain risk factors. $WACC$ for companies which are no indebted (according to INFA model) consists of (4,7):

$$WACC_U = R_F + R_{POD} + R_{FINSTAB} + R_{LA}$$

where: R_F………………………..….... Risk-free rate of return

R_{POD}…..…………..……… Business risk

$R_{FINSTAB}$………………… Financial stability risk

R_{LA}……………………….. Company size risk (11).

The limitation is clear. Capital structure of main part of companies is composed of equity capital and debt including bank loans and/or bonds. Therefore the formula is extended (4):

$$WACC = WACC_U\left(1 - \frac{BU + OBL}{A}t\right)$$

where: $WACC$………………… Weighted average cost of capital

$WACC_U$………………… Weighted average cost of capital for companies with no long-term debt

BU………………… Bank loans

OBL………………… Bonds

A………………… Assets

t………………… Corporate tax rate

Calculation of individual components of $WACC_U$ are (4):

- **Determination of risk-free rate of return (R_F)**

Risk-free rate of return is determined as a return on 10-years government bonds. See table 1- Return on 10-years government bonds.

Table 1: Return on 10-years government bonds (Source: 11)

	1st quarter	Half of year	1st-3rd quarter	1st-4th quarter
2009	4,55%	4,90%	4,92%	4,67%
2010	3,95%	3,92%	3,78%	3,71%
2011	3,86%	3,79%	3,51%	3,79%
2012	3,02%	2,87%	2,55%	2,31%
2013	1,98%	1,93%	2,27%	2,26%
2014	2,30%	2,03%	1,81%	1,58%

- **Determination of financial stability risk ($R_{FINSTAB}$)**

Determination of financial stability risk indicates the market liquidity of company, in other words, for company the ability to cover short-term liabilities. Company's liquidity L can be expressed (11):

$$L = CR\ (Current\ Ratio) = \frac{Current\ Assets}{Current\ Liabilities}$$

Then:

If $L \leq 1$ then $R_{FINSTAB} = 10{,}00\%$

If $L \geq 2{,}5$ then $R_{FINSTAB} = 0{,}00\%$

If $1 < L < 2{,}5$ then $R_{FINSTAB} = 0{,}1\frac{(2{,}5-L)^2}{(2{,}5-1)^2}$

- **Determination of company size risk (R_{LA})**

Company size risk is determined as a sum of bonds, bank loans and equity UZ (free loans are not included). Therefore (11):

If $UZ \leq 100M\ \ CZK$ then $R_{LA} = 5{,}00\%$

If $UZ \geq 3B\ CZK$ then $R_{LA} = 0{,}00\%$

If $100M\ CZK \leq UZ \leq 3B\ CZK$ then $R_{LA} = \frac{(3-UZ)^2}{168{,}2}$ (UZ in billion)

- **Determination of business risk (R_{POD})**

Business risk indicator is linked to Return on Assets ratio and its sufficient range. The requirement is (4,11):

$$\frac{EBIT}{A} \geq \frac{UZ}{A} * \frac{U}{BU + OBL}$$

$$X1 = \frac{UZ}{A} * \frac{U}{BU + OBL}$$

where:	$EBIT$ …………………	Earnings before interests and taxes
	A ………………………	Assets
	BU………………………	Bank loans
	OBL…………………	Bonds
	U……………………...	Interests
	$X1$………………………	Comparative variable
	UZ …………………	Equity + $BU + OBL$ (4,11).

If $\frac{EBIT}{A} \geq X1$ then $R_{POD} =$ minimal value in a particular business sector (see Appendix 1)

If $\frac{EBIT}{A} \leq 0$ then $R_{POD} = 10{,}00\%$

If $0 < \frac{EBIT}{A} < X1$ then $R_{POD} = 0{,}1 \frac{(X1 - \frac{EBIT}{A})^2}{X1^2}$

- **Determination of capital structure risk $R_{FINSTRU}$**

Financial risk structure risk indicator is a difference of R_E and $WACC$ (11).

$$R_{FINSTRU} = R_E - WACC$$

It is necessary to limit the value of $R_{FINSTRU}$ to:

If $R_E = WACC$ then $R_{FINSTRU} = 0{,}00\%$

If the result of $R_{FINSTRU} > 10{,}00\%$ then is necessary to limit the value of $R_{FINSTRU}$ to 10,00% (11).

4.4.4 Estimation of discounted cash flows

In contrast to initial capital expenditures, which regularly takes up to one year in time (if exceeds, there is necessary to use a discount rate), cash inflow resulting from the investment is expected within next few years. To calculate and evaluate investment properly, it is desirable to take into account time factor which causes that future value of money is lower than its present value. This means that value of money is changing in time. For that reason future value needs to be converted to the same basis which is usually the year of the initial investment. Future value is therefore converted to present one. Coefficient for conversion is used weighted average cost of capital which can be calculated from previous chapter. The formula of discounted cash flow is (18):

$$PVCF = \frac{CF_1}{1+i} + \frac{CF_2}{(1+i)^2} + \cdots + \frac{CF_n}{(1+i)^n} = \sum_{t=1}^{n} \frac{CF_t}{(1+i)^t}$$

where: $PVCF$.................. Present value of cash flow in time t

CF_t........................ Expected cash flow in time t

i.............................. Capital cost of investment ($WACC$ of company)

t.............................. Time 1 to n(in years)

n.............................. Expected lifetime of investment project (in years) (18)

4.5 Methods of evaluation of investment efficiency

There exist several methods in theory and practice of financial management how to evaluate the efficiency of investment. With a respect to a time factor; if certain method of evaluation of investment efficiency takes into account time factor, they can be classified (19):

- Static (ignore the time factor)
- Dynamic (take into account the time factor) (19)

Static methods are recommended to use only when the time factor does not significantly influence the investment decision. For example if the investment project is a purchase of tangible with short lifetime (one or two years maximum). Abstraction of time factor is not proper but generally does not significantly influence the evaluation. In this context the level of discount rate is important. The lower the discount rate is, the less important is the time factor. These cases with short lifetime and very low discount rate occur sporadically therefore the application of static methods is very limited. But paradoxically in practice these methods are often used especially for their simplicity (19).

Dynamic methods of evaluation of investment efficiency ought to be used for projects where time factor plays significant role, therefore in projects with a longer initial investment phase and/or their lifetime (14,15).

Taking into account the time factor notably influence the decisions while evaluating the investment efficiency. It projects into cash flow resulting from the investment and into capital expenditures as well. If the time dimensions are not respected in calculation of investment efficiency, the valuation of efficiency of investment project is often distorted notably and therefore may cause that incorrect decision is made (19).

Mostly in theory and practice are used following methods of evaluation of investment efficiency:

1. Annual cost
2. Discounted cost
3. Net present value
4. Profitability index
5. Internal rate of return
6. Average rate of return
7. Payback period (19).

Further amount of methods evaluating the investment efficiency exists, for example modified net present value, discounted payback period, et cetera. These are usually derivative from above mentioned basic ones (19).

4.5.1 Annual costs

Within this method of evaluation of investment efficiency are compared average annual costs of two or more comparable investment project which means an amount of their production. The option with lower average annual costs is preferable (19).

Average annual costs can be calculated as:

$$R = O + i * J + V$$

where: R …………………..…. Annual average costs
O …..………………... Annual depreciation
i …………………… Minimal profitability
J …………………… Investment costs
V …………………….. Additional annual operating costs (19).

It might happen that valuation of two investment projects based on the annual average cost method would result the same. Therefore it is difficult to decide which project is more suitable. For that reason more accurate calculation which takes into account decreasing connectedness of capital is following formula (19):

$$R = \frac{J * i(1+i)^n}{(1+i)^n - 1} + V$$

where: R..................... Annual average costs

n..................... Number of years

i..................... Interest rate coefficient

J..................... Investment costs

V..................... Additional annual operating costs (19).

4.5.2 Discounted costs

Discounted costs method is based on the same principle as the annual costs method. Instead of comparison of average annual costs of each option are compared sum of all costs related to investment projects implementations during their lifetime. More favourable is the option with lower discounted costs (19).

The formula for discounted costs of investment projects can be expressed:

$$D = J + V_d$$

where: D..................... Discounted costs of investment project

J..................... Investment cost

V_d..................... Discounted annual operating costs (Total costs-depreciation) (19).

In fact this method is based on the same principle as the method of annual costs. Instead of annual costs, this method compares a sum of all costs related to investment project implementation throughout the lifetime. For the reason that costs occurred in different years, it is necessary to modify them to be added together (due to time factor), they need to be discounted (19).

The formula mentioned above does not take into account that the asset may be sold at the end of its lifetime. Therefore if it expected to sell the asset for the price L, obviously the discounted costs need to be decreased by the discounted selling price of the asset (19).

For this reason discounted costs of investment project can be expressed (19):

$$D = J + V_d - L$$

where: D…………………… Discounted costs of investment project
J…………………… Investment cost
V_d…………………… Discounted annual operating costs (Total costs-depreciation)
L…………………… Discounted selling price of the asset (19).

4.5.3 Net present value

Net present value (NPV) is a dynamic method of evaluation of investment efficiency. It can be defined as a difference between discounted cash flows resulting from the investment and capital expenditure. If the capital expenditure is being performed for longer period of time, the net present value is difference between discounted cash flows and discounted capital expenditures (19). Mathematically the net present value can be expressed:

a) $$NPV = \frac{CF_1}{1+i} + \frac{CF_2}{(1+i)^2} + \cdots + \frac{CF_n}{(1+i)^n} - INV$$

where: NPV…………………… Net present value
CF_t…………………… Expected cash flow in time t
i…………………… Capital cost of investment ($WACC$ of company)
INV…………………… Initial investment (capital expenditure)
n…………………… Expected lifetime of investment project (in years) (6,18)

b) $NPV = \sum_{t=1}^{n} \frac{CF_t}{(1+i)^t} - INV$

where:
NPV .... Net present value
CF_t .... Expected cash flow in time t
i .... Capital cost of investment ($WACC$ of company)
t .... Time 1 to n (in years)
n .... Expected lifetime of investment project (in years)
INV .... Initial investment (capital expenditure) (6,18)

Formula b) is simplification of formula a). In mentioned formula it is expected that the capital expenditure is performed immediately. If the capital expenditure is being performed in longer period of time, it is necessary to modify not only cash flows, but capital expenditures as well. The model of net present value is therefore (19):

$$NPV = \sum_{t=1}^{n} \frac{CF_t}{(1+i)^{t+v}} - \sum_{u=1}^{v} \frac{CF_u}{(1+i)^u}$$

where:
NPV .... Net present value
CF_t .... Expected cash flow in time t
i .... Capital cost of investment ($WACC$ of company)
t .... Time 1 to n (in years)
n .... Expected lifetime of investment project (in years)
CF_u .... Capital expenditure as cash outflow in time u
u .... Time 1 to v (in years)
v .... Time of investment project implementation (in years) (19)

This can be illustrated on the timeline:

Interpretation of net present value result:

a) If the $NPV < 0$, discounted cash flow is lower than the capital expenditure. Therefore such investment project is unacceptable for company for the reason that the rate of return of the project is lower than required and thus would decrease the market value of the company (19).
b) If the $NPV = 0$, such investment project is for company indifferent. Discounted cash flow equals capital expenditure. Project does not decrease nor increase the market value of the company (19).
c) If the $NPV > 0$, discounted cash flow is higher than the capital expenditure. Such project ought to be accepted by the company for the reason that rate of return is higher than required and it increases the market value of the company (19).

4.5.4 Profitability index

Profitability index is defined as a quotient of present value of cash flow and capital expenditure:

$$PI = \frac{PVCF}{INV}$$

where: PI.......................... Profitability index
$PVCF$...................... Present value of cash flow
INV........................ Capital expenditure (18)

If index $PI > 1$, the investment project can be accepted. The profitability index can be used for comparison of options; from two options is preferable the one with higher value of the profitability index (18).

4.5.5 Internal rate of return

Internal rate of return (IRR) method is dynamic method of evaluation of investment efficiency based on concept of present value of cash flow and very closely related to NPV in that both involve discounting the cash flows, thus both account for the time value of money. When the NPV is used to evaluate the investment project, the discount rate is the rate of return required by the investors for investments with similar risk at discount rate which is determined by the company's cost of capital. The internal rate of return is based on prerequisite that project's present value of a cash inflows equal to the project's present value of cash outflows (18):

PV (Project's future cash inflows) = PV (Cost of the project) (13,18)

The IRR concept is based on finding the rate of return associated with the project, so therefore it can be determined whether the rate of return of the project is higher or lower than the project's cost of capital (13).

This in other words mean net present value of the project equals zero (18):

$$INV = \sum_{t=1}^{n} \frac{CF_t}{(1 + IRR)^t}$$

$$NPV = \sum_{t=1}^{n} \frac{CF_t}{(1 + IRR)^t} - INV = 0$$

If the project implementation takes a longer period of time, there is necessary to use the discount rate for capital expenditure (18,19):

$$\sum_{t=1}^{n} \frac{CF_t}{(1 + IRR)^{t+v}} = \sum_{u=1}^{v} \frac{CF_u}{(1 + IRR)^u}$$

$$NPV = \sum_{t=1}^{n} \frac{CF_t}{(1 + IRR)^{t+v}} - \sum_{u=1}^{v} \frac{CF_u}{(1 + IRR)^u} = 0$$

where: NPV .... Net present value

CF_t .... Expected cash flow in time t

IRR	Internal rate of return
t	Time 1 to n (in years)
n	Expected lifetime of investment project (in years)
CF_u	Capital expenditure as cash outflow in time u
u	Time 1 to v (in years)
v	Time of investment project implementation (in years)
INV	Initial investment - capital expenditure (13,19).

Because of the close relation of NPV method and IRR method both give the same answer- if the project should be accepted or rejected. After all, both methods are based on whether the return of the project exceeds the cost of capital and whether the project adds value to the company. Generally when comparing two projects the one with higher IRR is preferable for company (13,14).

The estimation of internal rate of return is relatively challenging task. Literature mentions two approaches how to calculate the IRR:

a) **Trial-and-error method**. The IRRcan be computed by the trial-and-error method using the substitution of various values for IRR. The process is continued until the IRR value is found that makes above mentioned formula equal zero. Computing the internal rate of return by this method is relatively time consuming (13,14).
b) **Iterative method based on linear interpolation.** Computing the IRR by this method is faster than the trial-and-error method. It consists of four steps:
    1. Randomly is selected discount rate by which the future cash flows are discounted.
    2. To sum up discounted cash flows and to compare the sum with the capital expenditure.
    3. If the discounted cash flows are higher than the capital expenditure the discount rate needs to be increased and step 1 and 2 followed again. And

vice versa. If the discounted cash flows are lower than the capital expenditure, the discount rate needs to be decreased and steps 1 and 2 followed as well.

4. Required IRR is calculated by a linear interpolation (19,21). The formula is (19):

$$IRR = i_a + \frac{PV_a(i_b - i_a)}{PV_a - PV_b}$$

where: IRR ………………………….. Internal rate of return

i_a ………………………….. Lower discount rate

i_b ………………………….. Higher discount rate

PV_a ………………………….. Present value at i_a

PV_b ………………………….. Present value at i_b (19,21).

Limitations of the IRR:

a) Nonconventional cash flows. The most important problem with IRR is the fact that it might assume more than one value. If during the lifetime the positive/negative symbol in cash flow changes just once (capital expenses in the phase of project implementation and positive cash inflow during the lifetime of investment) then only one value of the IRR exists and therefore the decision is clear. On the other hand if throughout the lifetime of investment project are cash flows nonconventional, an amount of values of IRRmay be the same as changes in negative/positive symbol in cash flows. For example if the project is significantly extended. The example is illustrated on the Figure 3 (13,17,19):

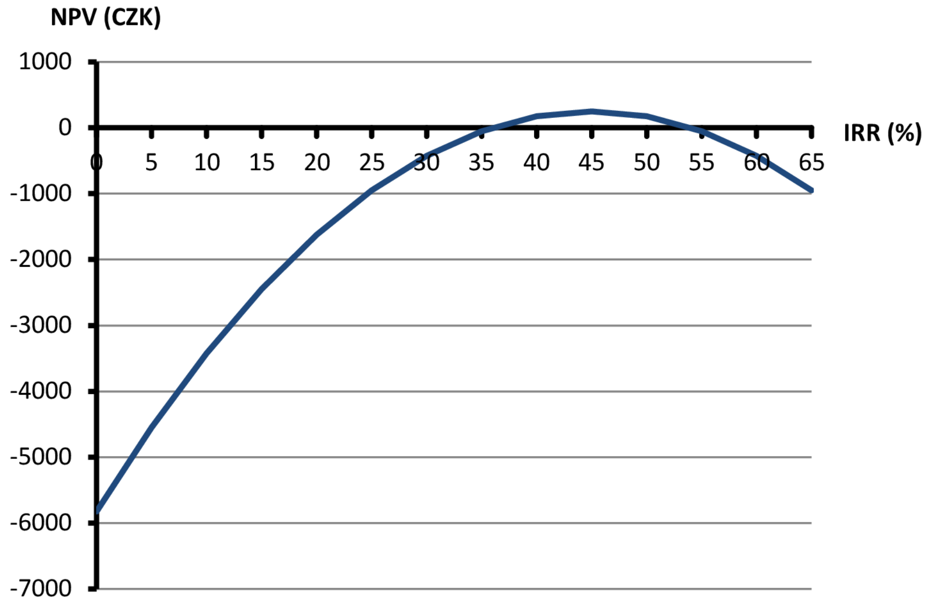

Figure 3: IRR in project with multiple rates of return (Source: 17)

From the Figure 3 above is clear that IRR assumes two values. At the discount rate of 35% and 55%. The answer of question which one is correct is both and none. In this situation the IRR rule breaks down completely. For example if required minimum return is 20%, both of them are greater than 20% therefore it seems that the investment ought to be accepted. However how the Figure 3 demonstrates, the NPV is negative at any discount rate less than 35%, so it is not a good investment. The critical thing is that IRR assumes positive values in the interval of $(35\%; 55\%)$. In this case the IRR method does not provide unambiguous answer; therefore the method in this case is inappropriate (13,17).

b) Mutually exclusive investments. Another situation in which the IRR may lead to incorrect decision is when the projects are mutually exclusive, meaning that accepting one means rejecting the other. Figure 4 illustrates an example of two mutually exclusive investments. From the figure is clear that:

i. Selection of project based on internal rate of return is constant; 25 percent is always higher than 22 percent, project A is then superior to project B (17).

ii. Selection of project based on net present value is not constant; depends on the rate of return. If the return is lower than the crossover point (10 percent) the project B is superior to the project A even it has higher IRR and if the return exceeds 10 percent, the project A is superior to project B (13,17,19).

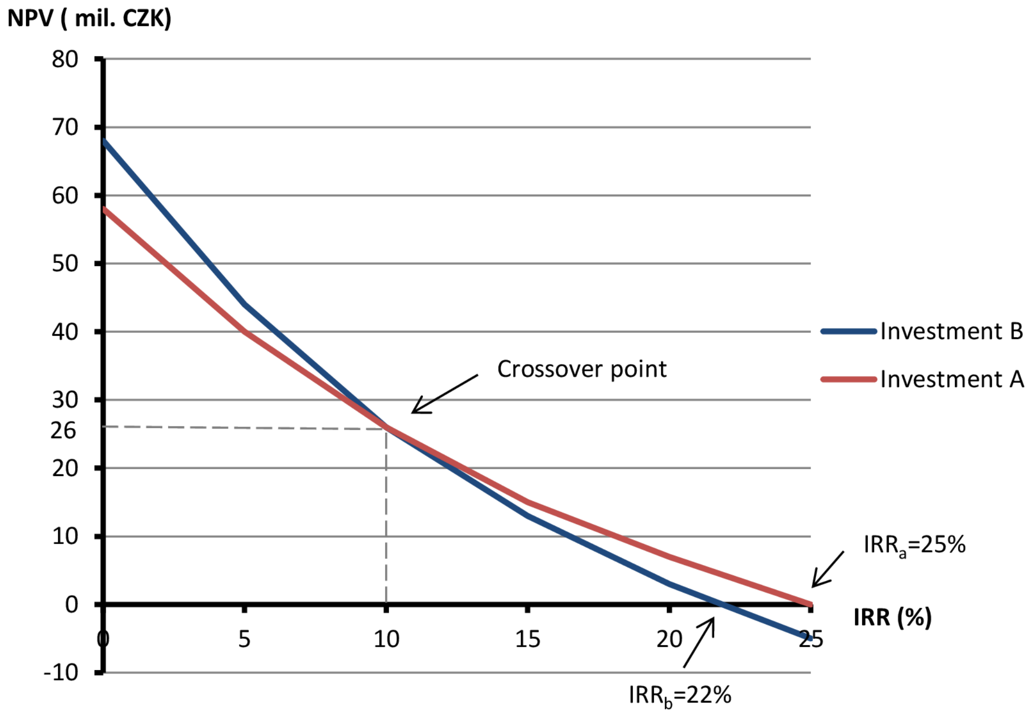

Figure 4: 2 mutually exclusive investment projects (Source: 17)

As illustrated on the figure above, NPV and IRR provides different results of which project is more favourable to accept. Therefore the IRR method is not appropriate to use for mutually exclusive investment projects (17,18).

4.5.6 Return on investment

Return on investment is a static method for the fact that it does not account for the time factor. Nevertheless this method is very popular and often used, predominantly for its simplicity and for the fact that is easy to understand (18,19).

The formula for return on investment is:

$$ROI = \frac{EAT}{INV}$$

where: ROI .... Return on investment

EAT .... Earnings after tax

INV .... Initial investment (18).

For the reason that in the formula is used EAT, projects with different lifetime, different investment costs and production volume can be compared (18).

4.5.7 Payback period

Payback period is defined as a period of time (years, months or days) when future net cash flows equal initial investment, capital expenditure, respectively. As well as the return on investment or annual cost, the payback period is static method (14,18).

An evaluated project is accepted if its payback period is below specific threshold. Negative aspect of this method is the fact that it ignores time value of money and does not take into account the risk of project; the quicker the cash flow covers the initial capital expenditure, the less risky is the project (13).

If the cash inflow in each year is the same during the lifetime of project, then the payback period is quotient of capital expenditure and annual cash inflow:

$$PB = \frac{INV}{CF_a}$$

where: PB .... Payback period

INV .... Initial investment

CF_a .... Annual cash flow (13,18).

If the cash flow is different is particular years, then the payback period is calculated by cumulating of cash flow from the first year, until the cumulated cash flow equals the capital expenditure (6,18).

It is obvious that the payback period has to be shorter than the lifetime of investment project. The shorter the payback period is, the more favourable the investment is (18).

4.6 Investment risk, return

Risk is very significant factor which influences almost every business decisions. Implementation of new technologies, investment into research and development, expansion into market, acquisitions, foreign direct investments, and large investment projects, et cetera. These are examples of business activities where future result are uncertain meaning that real results may differentiate from the planned or expected ones (positively or negatively) (1,6,18).

From the investment point of view may be the correct estimation of future cash flows or capital expenditures the critical element of project success or failure. Practically, predominant part of business investment project's cash flows is connected with uncertainty. Therefore, as future cash flows are expected and predicted and their estimation is based on the probability in order to evaluate investment projects properly, it is necessary to account for the uncertainty (risk) of future cash flows (18,19).

From the historical aspect only the negative site of the risk is perceived; from this perspective the risk is understood as (18,19):

- Probability of emergence of loss;
- Probability of occasion occurrence which jeopardise the reach of objectives of individual, company or project;
- Probability of negative divergence between expected results and real results of individual, investment project or company (18,19).

Such categorisation is appropriate when the risk has only the negative aspect (pure risk). Contemporary approach accounts for the negative and even the positive aspect of risk (business risk). Therefore business risk includes (18):

- Variance of possible results of certain processes or activities;
- Possibility of positive or negative divergence between the planned or expected results and the real ones;
- Probability of different results than expected or planned (18).

The following scheme illustrates which factors influence the project results:

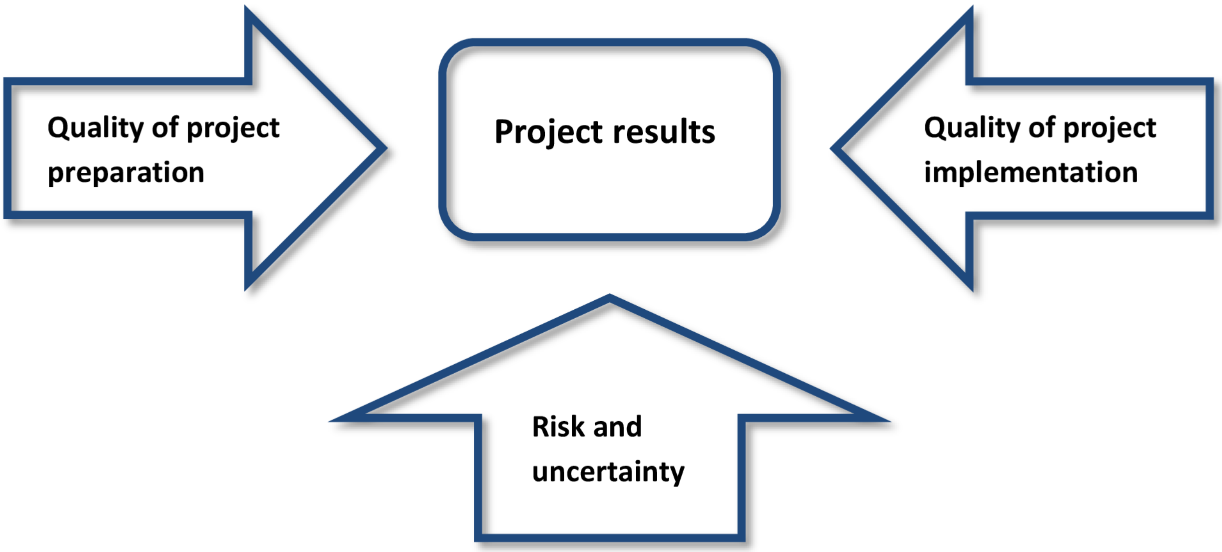

Figure 5: Factors that influence project results (Source: 18)

From the perspective of risk and uncertainty is therefore necessary that all factors mentioned in the Figure 5 need to be taken into account and integrated in the initial phase of the investment. Quality project preparation, its evaluation and selection then require (18):

- Identification of risk and uncertainty factors which influence the project result (its success or failure);
- To assess an impacts of these factors on the project results; to determine the probability and greatness of the risk and to assess its acceptance or rejection;
- To consider possible preventive measures in order to decrease the impact of the risk (18).

Return is closely related to risk. Generally it is valid that the greater return is expected the greater the risk is. It is clear that companies or investors are search for investment project where the greatness of the risk is lower than the greatness of the required return. For instance, if the company invest into government bonds, the divergence between the expected and required return would be probably close to zero. Risk connected to this investment would be therefore minimal (1,17,19).

It is necessary to differentiate two types of return (19):

a) Expected return
b) Required return

Expected return is return which is supposed to happen by an investor from the deposit (for instance dividends or growth of shares) (19).

Required return is return which is required by an investor to compensate the postponed consumption and undergoing the risk (19).

If the expected return is exact or higher, such investment is acceptable for investor. Required return implicitly includes the investment risk consideration. Required return can be divided into several components (19):

$$Required\ return = risk\ free\ rate\ of\ return + inflation\ premium + risk\ premium \text{ (19)}$$

As the risk-free investment is considered government bonds, which calculate with inflation, therefore:

$$Required\ return = interest\ rate\ of\ govenrment\ bonds + risk\ premium \text{ (15,18)}$$

Financial experts state that required return of each financial investment is significantly influenced by the return, which has been reached at securities in the past for a longer period of time. Such statement is supported by the Table 2, which documents a development of average return on various securities in USA since 1926 to 1988 (19):

Table 2: Development of average return on various securities in USA since 1926 to 1988 (Source: 19)

Type of security	Avg. annual return (nominal) in %	Avg. annual return (real) %	Risk premium in %
Treasury bills	3,6	0,4	0
Long-term government bonds	4,7	1,5	1,1
Long-term corporate bonds	5,3	2,1	1,7
Ordinary shares	12,1	8,9	8,5

The probability of expected cash flows can be expressed:

- Objective; based on historical data of cash flows (predominantly at repeated projects). It is expected that high variable past cash flows will be high variable in the future (19).
- Subjective; based on the expert estimate with respect to possible differentiating factors (price, costs, inflation, etc.). This approach is necessary for new projects, where historical data are inaccurate and cannot be used (19).

As mentioned above, the risk can be characterized as a phenomenon which causes that capital expenditures and/or cash flows will be different than expected. The risk can be more accurately expressed by a probability that a certain possibility of cash flow (capital expenditure) occurs. Unit of probability is percentage and it is evident that the sum of probabilities has to equal 100%, one, respectively. The link between cash flow and the risk can be expressed as follows (18,19):

$$CF = \sum_{i=1}^{n} CF_i * p_i$$

where: CF .... Expected cash flow

CF_i .... Cash flow which occurs with probability p_i

p_i .... Probability of occurrence of CF_i

n .... Amount of possible occurrences of CF_i (18)

If the probability of risk, based on subjective or objective method, has been determined, it is necessary that such probability of risk needs to be reflected in the particular evaluation of investment efficiency. Main approaches how to account for the risk while evaluating investment efficiency (19):

- Modification of discount rate
- Determination of risk classes (19).

Modification of discount rate is based on principle that if higher risk of the project is expected, the higher discount rate is selected for determining the net present value. As a result of increase of the discount rate, the lower are discounted value of cash flows resulting from the investment and therefore the whole net present value is decreased. The modified formula of net present value can be expressed as follows (19):

$$NPV_r = \sum_{t=1}^{n} \frac{CF_t}{(1 + i_r)^t} - INV$$

where: NPV_r .... Net present value that accounts for the risk

i_r .... Discount rate that accounts for the risk (19).

Other variables are same as for calculation of net present value.

Determination of risk classes is not based on the exact calculation of the risk using statistical methods but on the experiences of investment managers. In this method is the discounted rate modified as well (18,19).

Table 3: Risk classes (Sources: 16,19)

Type of investment	**Verbal estimation of risk**	**ΔDiscount rate**
Replacement of machine/s	None	+0%
Introduction of new machine/s	Moderate	+1%
Extension of current production	Average	+2%
Introduction of new products into current markets	Medium-high	+4%
Introduction of new products into new markets	High	+8%
Introduction of new products into new foreign market	Very high	+12%
Research and development	Supreme	+17%

4.7 Investment financing

Generally the investment financing can be characterized as a process of obtaining source/s of finance (and its/their optimum structure) necessary to cover the particular investment (21). Sources of finance can be classified as:

- Internal financing – (depreciation, retained profit)
- External financing – (bonds, bank loans, venture capital, government grant) (21).

Company's investment projects are predominantly long-term therefore these investment projects ought to be financed by the long-term sources of finance (19).

The most widespread method of financing of investment project, if the company is not able to cover it by itself or to spread the risk, are bank loans or leasing. On the other hand, contemporary method of investment project financing is venture capital suitable for certain types of investment (15).

5 PROBLEM ANALYSIS

This chapter of thesis is focused on an evaluation of two particular investment decisions from which one will be recommended to the company. Analysis consists of brief company introduction, description of an investment plan and analysis of an investment plan.

5.1 Brief company introduction

Name of the company:	Družstvo vlastníků Polanka nad Odrou (DV Polanka nad Odrou)
Legal form:	Družstvo
Headquarter:	K Vydralinám 114/5, Polanka nad Odrou, Ostrava, Czech Republic
Main line of business:	Agriculture production including sale unprocessed agriculture products

The company operates on the market over two decades with a focus on agriculture production in the original meaning. The production consists of cow milk, pork meat, cereal products, and oilseed rape. The company predominantly operates within the village which is a part of Ostrava city, in Polanka nad Odrou. Besides the turbulent public opinions on the role of the agriculture in the Czech Republic, the company predominantly focuses on the production of healthy products. Attention of the company is focused on modernization and an increase of the competitiveness of the production activities. On the other hand, company does not omit to respect the harmony between company's business activities and the nature (5).

5.2 Description of an investment plan

Besides the animal husbandry, other company's activities growing are agriculture crops. For these business activities are obviously necessary harvesting and processing machines when the crops are ready to be harvested. Every machine has limited lifetime period in which it can be used for its purpose. At the end of its lifetime, especially in case heavy machines, the costs needed for repairs and maintenance is slightly exponentially growing.

The company owns three combine harvesters from which one is reaching the end of its lifetime. Therefore, the combine harvester needs to be replaced by a follower. Company has an option to buy a new machine, which costs 8M CZK or the second option is that on the market appeared an opportunity to buy the same model but this will not be new, but refurbished. The price of the refurbished is significantly lower than the purchase of new machine, 5,5M CZK. As the price is distinctly lower, the purchase has certain negative aspects. First, as the company would buy the new combine harvester, the length of the warranty quarantined by a manufacturer is 5-year. The refurbished combine harvester is covered only by a 3-year warranty which might seem as a moderate difference, but post-warranty repairs of heavy machines are tremendously expensive. Second, the refurbished combine harvester has been already used; therefore its lifetime is considerably shorter in comparison to the new combine harvester.

For purposes of this thesis is an investment project of the purchase of the new combine harvester marked as a **Project A** and the investment project of the purchase of the refurbished combine harvester marked as a **Project B.**

5.3 Analysis of an investment plan

This part contains estimation or valuation of all necessary information required for appropriate evaluation of investment efficiency. Therefore partial parts of the chapter are Capital expenditures, Operating costs, Valuation of weighted average cost of capital and estimation of cash flows.

5.3.1 Capital expenditures

Capital expenditures represent all expenses related to initial investment. Initial investment in this context is meant by a purchase of new agriculture machine or the refurbished one. No additional expenses are expected and the transportation costs are included in the purchase price. The prices of options are as follows:

$$P_A = 8{,}000{,}000\ CZK$$

$$P_B = 5{,}500{,}000\ CZK$$

Each combine harvester would replace the older one which is to be sold due to fact that it reaches the end of its lifetime; therefore capital expenditures will be decreased by cash inflow resulting from the sale. As the purchased combine harvester replaces the older one, there is necessary to subtract the cash inflow (resulting from the sale of the old combine harvester) from the capital expenditure. To the calculation of capital expenditure it is necessary to add a tax which needs to be paid from the sold combine harvester.

It is important to mention that renewal projects require only small or none increment of net working capital (19).

Capital expenditures are then:

$$K_A = 8{,}000{,}000 - 2{,}500{,}000 + 475{,}000 = 5{,}975{,}000\ CZK$$

$$K_B = 5{,}500{,}000 - 2{,}500{,}000 + 475{,}000 = 3{,}475{,}000\ CZK$$

In this case are 8M CZK purchase price of the new combine harvester (option A); 5,5M CZK purchase price of the refurbished combine harvester (option B); 2,5M CZK is the selling price of the combine harvester which is to be replaced and 0,475M CZK tax.

5.3.2 Operating costs

Besides the calculation of the capital expenditures it is necessary to estimate the change of operating costs. These include the change in fuel (positive or negative) and the change in repairs and maintenance (positive or negative). The estimated development of mentioned operating costs is recorded in Table 4 for the Project A and Table 5 for the Project B.

Table 4: Operating costs for Project A (Source: own processing)

Year	ΔFuel	ΔRepairs costs	ΔMaintenance costs	ΔOperating costs
1	-28000	-900000	-107000	-1035000
2	-28000	-900000	-98000	-1026000
3	-28000	-900000	-90000	-1018000
4	-28000	-900000	-83000	-1011000
5	-28000	-900000	-77000	-1005000
6	-28000	-135000	-72000	-235000
7	-28000	-128000	-68000	-224000
8	-28000	-120000	-65000	-213000
9	-28000	-112000	-62000	-202000
10	-28000	-98000	-60000	-186000
11	-28000	-95000	-58000	-181000
12	-28000	-92000	-57000	-177000
13	-28000	-90000	-56000	-174000
14	-28000	-88000	-56000	-172000
15	-28000	-86000	-55000	-169000
16	-28000	-86000	-55000	-169000

Table 5: Operating costs for Project B (Source: own processing)

Year	ΔFuel	ΔRepair costs	ΔMaintenance costs	ΔOperating costs
1	-28000	-700000	-83000	-811000
2	-28000	-700000	-77000	-805000
3	-28000	-700000	-72000	-800000
4	-28000	-90000	-68000	-186000
5	-28000	-88000	-65000	-181000
6	-28000	-85000	-62000	-175000
7	-28000	-82000	-60000	-170000
8	-28000	-80000	-58000	-166000
9	-28000	-78000	-57000	-163000
10	-28000	-75000	-56000	-159000
11	-28000	-73000	-55000	-156000

In the columns "ΔFuel", "ΔRepair costs" and "ΔMaintenance costs" are negative symbols for the reason that both projects generate savings. In the first five rows of Project A and in the first two rows in the Project B is reflected warranty (5-year for new combine harvester and 3-year for refurbished combine harvester) which significantly lower the repair costs and therefore operating costs as well.

Apart from the estimation of operating costs it is necessary to include the depreciation.

Table 6: Total costs for Project A (Source: own processing)

Year	ΔOperating costs	Depreciation	ΔTotal costs
1	-1035000	500000	**-535000**
2	-1026000	500000	**-526000**

3	-1018000	500000	**-518000**
4	-1011000	500000	**-511000**
5	-1005000	500000	**-505000**
6	-235000	500000	**265000**
7	-224000	500000	**276000**
8	-213000	500000	**287000**
9	-202000	500000	**298000**
10	-186000	500000	**314000**
11	-181000	500000	**319000**
12	-177000	500000	**323000**
13	-174000	500000	**326000**
14	-172000	500000	**328000**
15	-169000	500000	**331000**
16	-169000	500000	**331000**

Table 7: Total costs for Project B (Source: own processing)

Year	ΔOperating costs	Depreciation	ΔTotal costs
1	-811000	500000	-311000
2	-805000	500000	-305000
3	-800000	500000	-300000
4	-186000	500000	314000
5	-181000	500000	319000
6	-175000	500000	325000
7	-170000	500000	330000
8	-166000	500000	334000
9	-163000	500000	337000
10	-159000	500000	341000
11	-156000	500000	344000

5.3.3 Estimation of cash flows

In this chapter are estimated all relevant cash flows which are related to the particular investment during their lifetime (For the Project A is the lifetime expected 16 years and for the Project B 11 years). These include annual increment of earnings after tax related to project, increment of depreciation, cash inflow resulting from the sale of combine harvester which is to be replaced and tax effect. Generally is taken into account the change of working capital. But for the reason that both renewal projects would not increase nor decrease the working capital, this value is irrelevant. As mentioned in previous chapter.

In both sales is not expected increase of sales related to realisation of any project. Therefore, as it is not calculated with the increase of sales, but on the other hand it is expected the save on operating costs in both projects. The calculation of ΔEarnings after tax is illustrated on the Table 8 for Project A and Table 9 for Project B.

Table 8: Plan of revenues for Project A (Source: own processing)

Year	**Sale of machine**	**Purchase of new machine**	**ΔOperating costs**	**Depreciation**	**ΔEarnings before tax**	**ΔEarnings after tax**
0	2 500 000	8 000 000	0	0	-5 975 000	**-5 975 000**
1	0	0	-1 035 000	500 000	535 000	**433 350**
2	0	0	-1 026 000	500 000	526 000	**426 060**
3	0	0	-1 018 000	500 000	518 000	**419 580**
4	0	0	-1 011 000	500 000	511 000	**413 910**
5	0	0	-1 005 000	500 000	505 000	**409 050**
6	0	0	-235 000	500 000	-265 000	**-265 000**
7	0	0	-224 000	500 000	-276 000	**-276 000**
8	0	0	-213 000	500 000	-287 000	**-287 000**

9	0	0	-202 000	500 000	-298 000	**-298 000**
10	0	0	-186 000	500 000	-314 000	**-314 000**
11	0	0	-181 000	500 000	-319 000	**-319 000**
12	0	0	-177 000	500 000	-323 000	**-323 000**
13	0	0	-174 000	500 000	-326 000	**-326 000**
14	0	0	-172 000	500 000	-328 000	**-328 000**
15	0	0	-169 000	500 000	-331 000	**-331 000**
16	3 500 000	0	-169 000	500 000	3 169 000	**2 566 890**

Table 9: Plan of revenues for Project B (Source: own processing)

Year	**Sale of machine**	**Purchase of new machine**	**ΔOperating costs**	**Depreciation**	**ΔEarnings before tax**	**ΔEarnings after tax**
0	2 500 000	5 500 000	0	0	-3 475 000	**-3 475 000**
1	0	0	-811 000	500 000	311 000	**251 910**
2	0	0	-805 000	500 000	305 000	**247 050**
3	0	0	-800 000	500 000	300 000	**243 000**
4	0	0	-186 000	500 000	-314 000	**-314 000**
5	0	0	-181 000	500 000	-319 000	**-319 000**
6	0	0	-175 000	500 000	-325 000	**-325 000**
7	0	0	-170 000	500 000	-330 000	**-330 000**
8	0	0	-166 000	500 000	-334 000	**-334 000**
9	0	0	-163 000	500 000	-337 000	**-337 000**
10	0	0	-159 000	500 000	-341 000	**-341 000**
11	3 200 000	0	-156 000	500 000	2 856 000	**2 313 360**

In both projects are earnings before tax reduced by 19%, which is in the Czech Republic in 2015 current rate of corporate tax. For the uncertain development of this rate of tax is calculated with the 19% in each year of the lifetime of Project A and Project B.

In the last year is expected to sell the combine harvester for estimated price 3,5M CZK. This sale will increase earnings significantly. As the price of new combine harvester is 8M CZK and depreciation is linear, it is calculated annual depreciation 0,5M CZK. The price of refurbished is 5,5M CZK. Therefore using the linear depreciation within 11 years, the annual depreciation equals 0,5M CZK as well. For the reason that the old combine harvester is fully depreciated at the purchase of new combine harvester or the refurbished one, in the column "Depreciation" is stated only annual depreciation of new combine harvester, refurbished combine harvester, respectively.

Cash flows in particular years are expressed in the Table 10 for the Project A and in the Table 11 for the Project B.

Table 10: Expected cash flow for Project A (Source: own processing)

Year	**ΔEarnings after tax**	**Depreciation**	**Cash flow**
0	-5 975 000	0	**-5 975 000**
1	433 350	500 000	**933 350**
2	426 060	500 000	**926 060**
3	419 580	500 000	**919 580**
4	413 910	500 000	**913 910**
5	409 050	500 000	**909 050**
6	-265 000	500 000	**235 000**
7	-276 000	500 000	**224 000**
8	-287 000	500 000	**213 000**
9	-298 000	500 000	**202 000**

10	-314 000	500 000	**186 000**
11	-319 000	500 000	**181 000**
12	-323 000	500 000	**177 000**
13	-326 000	500 000	**174 000**
14	-328 000	500 000	**172 000**
15	-331 000	500 000	**169 000**
16	2 566 890	500 000	**3 066 890**

Table 11: Expected cash flow for Project B (Source: own processing)

Year	**ΔEarnings after tax**	**Depreciation**	**Cash flow**
0	-3 475 000	0	**-3 475 000**
1	251 910	500 000	**751 910**
2	247 050	500 000	**747 050**
3	243 000	500 000	**743 000**
4	-314 000	500 000	**186 000**
5	-319 000	500 000	**181 000**
6	-325 000	500 000	**175 000**
7	-330 000	500 000	**170 000**
8	-334 000	500 000	**166 000**
9	-337 000	500 000	**163 000**
10	-341 000	500 000	**159 000**
11	2 313 360	500 000	**2 813 360**

5.3.4 Valuation of WACC

The cost of capital which is used by the company has been determined to 6%. This value is compared with the value of weighted average cost of capital calculated based on the INFA rating model. This model is used by Ministry of industry and trade of Czech Republic (11). Calculation has been conducted according the INFA rating model in chapter Weighed average cost of capital:

$$WACC_U = R_F + R_{POD} + R_{FINSTAB} + R_{LA}$$

Risk free rate of return (R_F) equals rate of return of 10-years government bonds. For the year of 2014 this rate is $R_F = 1{,}58\%$. Business risk R_{POD} for the company equals the minimum value for the particular sector for the reason that fraction $\frac{EBIT}{Assets}$ is greater than the variable X1. Therefore value of business risk R_{POD} equals $2{,}06\%$ (see Appendix 1). Determination of financial stability risk $R_{FINSTAB}$ is based on the current ratio CR of the company.

$$CR = \frac{Current\ Assets}{Current\ Liabilities}$$

In this case:

$$CR = \frac{89{,}7M}{9{,}1M} = 9{,}8$$

As the $CR = 9{,}8$, which corresponds to condition $CR \geq 2{,}5$, the $R_{FINSTAB} = 0{,}00\%$.

As the value of UZ (sum of bonds, bank loans and equity) is 168M, the determination of company size risk R_{LA} equals:

$$R_{LA} = \frac{(3 - UZ)^2}{168{,}2}$$

In this case:

$$R_{LA} = \frac{(3 - 0{,}17)^2}{168{,}2} = 4{,}76\%$$

For the reason that company has no bonds or bank loans, the formula is sufficient. To check that the formula for $WACC_U$ equals $WACC$:

$$WACC = WACC_U\left(1-\frac{BU+OBL}{A}t\right)$$

$$WACC = WACC_U\left(1-\frac{0}{A}t\right)$$

The fraction $\frac{0}{A}$ equals zero; then the entire expression in brackets equals 1, which is multiplied by $WACC_U$; therefore:

$$WACC = WACC_U = R_F + R_{POD} + R_{FINSTAB} + R_{LA}$$

In this case final value of $WACC$ is:

$$WACC = 1{,}58\% + 2{,}06\% + 4{,}76\%$$

$$\underline{WACC = 8{,}4\%}$$

5.4 Evaluation of efficiency of investment options

In this chapter is evaluated efficiency of investment Project A and investment Project B based on chosen methods.

5.4.1 Payback method

The first method which is applied for evaluation is traditional method which is historically often used predominantly for its simplicity and easy-to-understand factor. The payback period is defined as the number of years/months which take the cash flows to cover the project's initial investment. An evaluated project is accepted if tis payback period is below specific threshold. Negative aspect of this method is the fact that it ignores the time factor and does not account for the project's risk; the more quickly the cash flow covers the initial investment, the less risky is the project (13).

Due to unequal cash flow in each year it is necessary to calculate the payback with the "Cumulated cash flow" column both for Project A and Project B.

Table 12: Payback method for Project A (Source: own processing)

Year	Cash flow	Cumulated cash flow
0	-5975000	**-5975000**
1	933350	**-5041650**
2	926060	**-4115590**
3	919580	**-3196010**
4	913910	**-2282100**
5	909050	**-1373050**
6	235000	**-1138050**
7	224000	**-914050**
8	213000	**-701050**
9	202000	**-499050**
10	186000	**-313050**
11	181000	**-132050**
12	177000	**44950**

13	174000	**218950**
14	172000	**390950**
15	169000	**559950**
16	3066890	**3626840**

The payback period for the project is placed in the 12th year. The formula to calculate the payback period more accurately:

$$Payback\ period\ (PB) = Years\ before\ the\ cost\ recovery + \frac{Remaining\ cost\ to\ recover}{Cash\ flow\ during\ the\ year}$$

(13)

In the case of Project A:

$$PB_A = 11 + \frac{132050}{177000} = 11\ years\ and\ 9\ months$$

The period when the project's cash flow equals the initial investment for the Project A is 11 years and 9 months.

Table 13: Payback method for Project B (Source: own processing)

Year	Cash flow	Cumulated cash flow
0	-3475000	**-3475000**
1	751910	**-2723090**
2	747050	**-1976040**
3	743000	**-1233040**
4	186000	**-1047040**
5	181000	**-866040**
6	175000	**-691040**
7	170000	**-521040**
8	166000	**-355040**
9	163000	**-192040**
10	159000	**-33040**
11	2813360	**2780320**

The cash flow in Project B in 11th year is significantly influenced by the cash income resulting from the sold combine harvester. As the payback period is placed in the 11th year, such inflow negatively influences the result of payback period for the reason that it is generated at the very end of the year. Therefore, to calculate the payback period of the Project B properly, in Table 14 is the cash inflow of the sold combine harvester is extracted.

Table 14: Payback method for Project B – modified (Source: own processing)

Year	**Cash flow**	**Cumulated cash flow**
0	-3475000	**-3475000**
1	751910	**-2723090**
2	747050	**-1976040**
3	743000	**-1233040**
4	186000	**-1047040**
5	181000	**-866040**
6	175000	**-691040**
7	170000	**-521040**
8	166000	**-355040**
9	163000	**-192040**
10	159000	**-33040**
11	156000	**122960**

After the extraction of the consideration of sale of the combine harvester at the end of 11th year, the payback period of the Project B is calculated:

$$PB_B = 10 + \frac{33040}{156000} = 10\ years, 2\ months\ and\ 16\ days$$

In comparison of Project A and Project B according the payback method is the Project B preferable as its payback period is shorter.

This type of payback method how to evaluate investment efficiency ignores the time value of money completely. For that reason, the discounted payback method has been invented as it accounts for the cost of capital by which future cash flows are discounted.

Table 15: Discounted payback method for Project A at 8,4% (Source: own processing)

Year	Cash flow	Discounted cash flow (8,4%)	Cumulated discounted cash flow
0	-5 975 000	-5 975 000	**-5 975 000**
1	933 350	861 024	**-5 113 976**
2	926 060	788 099	**-4 325 877**
3	919 580	721 941	**-3 603 936**
4	913 910	661 891	**-2 942 046**
5	909 050	607 353	**-2 334 692**
6	235 000	144 841	**-2 189 851**
7	224 000	127 363	**-2 062 488**
8	213 000	111 724	**-1 950 765**
9	202 000	97 743	**-1 853 021**
10	186 000	83 027	**-1 769 994**
11	181 000	74 534	**-1 695 460**
12	177 000	67 239	**-1 628 221**
13	174 000	60 977	**-1 567 243**
14	172 000	55 606	**-1 511 638**
15	169 000	50 402	**-1 461 236**
16	3 066 890	843 781	**-617 455**

The Table 15 indicates that, using the discounted payback method, the Project A is unacceptable as the cumulated discounted cash flow does not equal zero in any year. Even in the 16th year when the cash inflow is increased by the sale of the combine harvester. Therefore, such project ought to be rejected according the discounted payback method.

Table 16: Discounted payback method for Project A at 6% (Source: own processing)

Year	Cash flow	Discounted cash flow (6%)	Cumulated discounted cash flow
0	-5 975 000	-5 975 000	**-5 975 000**
1	933 350	880 519	**-5 094 481**
2	926 060	824 190	**-4 270 291**
3	919 580	772 097	**-3 498 194**
4	913 910	723 902	**-2 774 292**
5	909 050	679 295	**-2 094 997**
6	235 000	165 666	**-1 929 331**
7	224 000	148 973	**-1 780 358**
8	213 000	133 639	**-1 646 719**
9	202 000	119 563	**-1 527 156**
10	186 000	103 861	**-1 423 294**
11	181 000	95 349	**-1 327 946**
12	177 000	87 964	**-1 239 982**
13	174 000	81 578	**-1 158 404**
14	172 000	76 076	**-1 082 328**
15	169 000	70 518	**-1 011 811**
16	3 066 890	1 207 270	**195 459**

The discounted cash flow in the Table 16 has been calculated based on the cost of capital which is currently used by the company, thus with 6%. In this case the payback period is placed in the 16th year. The sale of the combine harvester at the end of the 16th year influences the payback period, but in this case not significantly for the reason that the remaining cost to recover in the Table 13 equals to 1,2% of the cash flow in the 11th year. In contrast, in the Table 16, the remaining cost to recover equals approximately 5/6 of the cash flow in 16 year. Therefore the impact of the sale of the combine harvester in Project A in the 16th year is moderate on the payback period.

The payback period of the Project A discounted by 6% is:

$$PB_A = 15 + \frac{1011811}{1207270} = 15\ years\ and\ 10\ months.$$

In the case of Project B:

Table 17: Discounted payback method for Project B at 8,4% (Source: own processing)

Year	Cash flow	Discounted cash flow (8,4%)	Cumulated discounted cash flow
0	-3 475 000	-3 475 000	**-3 475 000**
1	751 910	693 644	**-2 781 356**
2	747 050	635 757	**-2 145 599**
3	743 000	583 312	**-1 562 287**
4	186 000	134 709	**-1 427 578**
5	181 000	120 929	**-1 306 649**
6	175 000	107 860	**-1 198 788**
7	170 000	96 659	**-1 102 129**
8	166 000	87 071	**-1 015 058**
9	163 000	78 872	**-936 186**
10	159 000	70 975	**-865 211**
11	2 813 360	1 158 519	**293 308**

The cumulated cash flow discounted by 8,4% of the Project B equals zero in the last, 11th year. Using the equation for calculation of payback period:

$$PB_B = 10 + \frac{865211}{1158519} = 10\ years\ and\ 9\ months$$

To be strict, the sale of the combine harvester will be conducted at the end of the 11th year; therefore the payback period ought to be exactly 11 years.

Table 18: Discounted payback method for Project B at 6% (Source: own processing)

Year	**Cash flow**	**Discounted cash flow (6%)**	**Cumulated discounted cash flow**
0	-3 475 000	-3 475 000	**-3 475 000**
1	751 910	709 349	**-2 765 651**
2	747 050	664 872	**-2 100 779**
3	743 000	623 837	**-1 476 942**
4	186 000	147 329	**-1 329 613**
5	181 000	135 254	**-1 194 359**
6	175 000	123 368	**-1 070 991**
7	170 000	113 060	**-957 931**
8	166 000	104 150	**-853 781**
9	163 000	96 479	**-757 301**
10	159 000	88 785	**-668 516**
11	2 813 360	1 482 043	**813 527**

The same case with the cumulated cash flow discounted by the 6% in Project B; where the main part of the cash flow of 11th year is cash inflow resulting from the sale of combine harvester and this cash inflow represents considerable part of the cost which remains to recover. To be strict again, the payback period of the Project B, using discount rate 6%, is 11 years.

5.4.2 Net present value

Net present value is dynamic method of evaluation of investment efficiency. NPV method is more accurate and appropriate for such evaluation due the fact that it accounts for the factor of time. Therefore, due to mentioned facts and as it gives more accurate results; it is predominant method for evaluation of investment project used by management.

In this case the importance of time factor is more significant for the reason that it is expected that both project exceed decade (Project A-16 years, Project B-11 years). All cash flows resulting from those projects need to be discounted. The discount rate is used as a cost of capital determined in the chapter Valuation of WACC. As the capital expenditure is performed immediately and in the very initial phase, there is no need to be discounted.

The general formula of NPV:

$$NPV = \sum_{t=1}^{n} \frac{CF_t}{(1+i)^t} - INV$$

Net present value for the project A at discount rate 8,4% is therefore:

$$NPV_A = \frac{933350}{1,084} + \frac{926060}{1,084^2} + \frac{919580}{1,084^3} + \frac{913910}{1,084^4} + \frac{909050}{1,084^5} + \frac{235000}{1,084^6} + \frac{224000}{1,084^7} + \frac{213000}{1,084^8} + \frac{202000}{1,084^9} + \frac{186000}{1,084^{10}} + \frac{181000}{1,084^{11}} + \frac{177000}{1,084^{12}} + \frac{174000}{1,084^{13}} + \frac{172000}{1,084^{14}} + \frac{169000}{1,084^{15}} + \frac{3066890}{1,084^{16}} - 5975000$$

$\underline{NPV_A = -617454{,}74\ CZK}$

NPV for the Project A at 6%:

$\underline{NPV_A = 195459{,}23\ CZK}$

Net present value for the Project B at 8,4%:

$$NPV_B = \frac{751910}{1{,}084} + \frac{747050}{1{,}084^2} + \frac{743000}{1{,}084^3} + \frac{186000}{1{,}084^4} + \frac{181000}{1{,}084^5} + \frac{175000}{1{,}084^6} + \frac{170000}{1{,}084^7} + \frac{166000}{1{,}084^8} + \frac{163000}{1{,}084^9} + \frac{159000}{1{,}084^{10}} + \frac{2813360}{1{,}084^{11}} - 3475000$$

$\underline{NPV_B = 293308{,}21\ CZK}$

NPV for the Project B at 6%:

$\underline{NPV_B = 813527{,}60\ CZK}$

Based on the Net present value method at discount rate 8,4% and 6% as well is Project B more beneficial for the company for the reason that it provides greater (and positive in case of 6% discount rate) return and in both cases increases the market value of the company more than the Project A.

5.4.3 Internal rate of return

According to the net present value method, the Project B seems to be superior to Project A. Besides the very close relation between net present value and internal rate of return method, the IRR value might indicate different priority between projects than the net present value method does. The internal rate of return represents the rate of return of particular project required by investors with similar risk at the discount rate determined by the cost of capital of company. Such project ought be accepted or rejected based on the condition if its value of IRR exceeds the discount rate. If the condition is met, the project is beneficial for the company. In comparison with two particular projects it is valid that one with higher value of IRR is more preferable for the reason that it brings higher rate of return.

The internal rate of return is based on condition that project's present value of cash inflows equal to the project's present value of cash outflows; in other words the net present value equals zero:

$$INV = \sum_{t=1}^{n} \frac{CF_t}{(1 + IRR)^t}$$

$$NPV = \sum_{t=1}^{n} \frac{CF_t}{(1 + IRR)^t} - INV = 0$$

As the capital expenditures are performed immediately, there is no need to discount the initial investment.

There is a prerequisite of conventionality of cash flows (mentioned in the chapter 4.5.5 Internal rate of return in order to calculate the IRR properly. The negative/positive symbol in cash flows during the lifetime in both projects changes once (capital expenditures-negative symbol; positive cash inflow during the lifetime of project). Cash flow is then conventional, the IRR assumes exactly one value and the internal rate of return method is therefore suitable.

There is a need of two net present values which are determined by particular discount rates in order to use the iterative calculation.

Therefore, the application for projects A with a discount rate $i_1 = 8{,}4\ \%$:

$$NPV_{8{,}4\%} = \frac{933350}{1{,}084} + \frac{926060}{1{,}084^2} + \frac{919580}{1{,}084^3} + \frac{913910}{1{,}084^4} + \frac{909050}{1{,}084^5} + \frac{235000}{1{,}084^6} + \frac{224000}{1{,}084^7} + \frac{213000}{1{,}084^8} + \frac{202000}{1{,}084^9} + \frac{186000}{1{,}084^{10}} + \frac{181000}{1{,}084^{11}} + \frac{177000}{1{,}084^{12}} + \frac{174000}{1{,}084^{13}} + \frac{172000}{1{,}084^{14}} + \frac{169000}{1{,}084^{15}} + \frac{3066890}{1{,}084^{16}} - 5975000$$

$$NPV_{8{,}4\%} = -617454{,}74\ CZK$$

At the discount rate $i_2 = 6\ \%$

$$NPV_{6\%} = \frac{933350}{1{,}06} + \frac{926060}{1{,}06^2} + \frac{919580}{1{,}06^3} + \frac{913910}{1{,}06^4} + \frac{909050}{1{,}06^5} + \frac{235000}{1{,}06^6} + \frac{224000}{1{,}06^7} + \frac{213000}{1{,}06^8} + \frac{202000}{1{,}06^9} + \frac{186000}{1{,}06^{10}} + \frac{181000}{1{,}06^{11}} + \frac{177000}{1{,}06^{12}} + \frac{174000}{1{,}06^{13}} + \frac{172000}{1{,}06^{14}} + \frac{169000}{1{,}06^{15}} + \frac{3066890}{1{,}06^{16}} - 5975000$$

$NPV_{6\%} = 195459{,}23\ CZK$

The formula of IRR based on linear interpolation is as follows:

$$IRR_A = i_a + \frac{NPV_a(i_b - i_a)}{NPV_a - NPV_b}$$

As the i_a is the lower discount rate and i_b the discount rate higher, $i_a = 6\ \%$ and $i_b = 8{,}4\ \%$. Therefore, $NPV_a = 195459{,}23\ CZK$ and $NPV_b = -617454{,}74\ CZK$.

$$IRR_A = 6 + \frac{195459{,}23 * (8{,}4 - 6)}{195459{,}23 - (-617454{,}74)}$$

$\underline{IRR_A = 6{,}58\%}$

For project B:

$i_3 = 8{,}4\ \%$

$$NPV_{8,4\%} = \frac{751910}{1{,}084} + \frac{747050}{1{,}084^2} + \frac{743000}{1{,}084^3} + \frac{186000}{1{,}084^4} + \frac{181000}{1{,}084^5} + \frac{175000}{1{,}084^6} + \frac{170000}{1{,}084^7} + \frac{166000}{1{,}084^8} + \frac{163000}{1{,}084^9} + \frac{159000}{1{,}084^{10}} + \frac{2813360}{1{,}084^{11}} - 3475000$$

$NPV_{8,4\%} = 293308{,}21\ CZK$

$i_4 = 6\ \%$

$$NPV_{6\%} = \frac{751910}{1{,}06} + \frac{747050}{1{,}06^2} + \frac{743000}{1{,}06^3} + \frac{186000}{1{,}06^4} + \frac{181000}{1{,}06^5} + \frac{175000}{1{,}06^6} + \frac{170000}{1{,}06^7} + \frac{166000}{1{,}06^8} + \frac{163000}{1{,}06^9} + \frac{159000}{1{,}06^{10}} + \frac{2813360}{1{,}06^{11}} - 3475000$$

$NPV_{6\%} = 813526{,}60\ CZK$

In this case is $i_a = 6\ \%$ and $i_b = 8{,}4\ \%$. Therefore, $NPV_a = 813526{,}60\ CZK$ and $NPV_b = 293308{,}21\ CZK$.

$$IRR_B = 6 + \frac{813562{,}60 * (8{,}4 - 6)}{813562{,}60 - 293308{,}21}$$

$\underline{IRR_B = 9{,}75\ \%}$

The internal rate of return calculated based on the iterative method is for the Project A 6,58% and 9,75% for the Project B. As the calculated company's cost of capital is determined at the rate of 8,4%, the project is automatically rejected for the reason that its internal rate of return is lower than the cost of capital. Therefore, such project would decrease the market value of the company. The rejection of the Project B has been confirmed by the internal rate of return method as is net present value at discount rate 8,4% is lower than project B and negative as well. The value of IRR of the Project B is superior to IRR of the Project A and at the same time exceeds the value of required return- cost of capital. Such project ought to be accepted as it increases the market value of the company. For the discount rate of 6% is the net present value of the Project A positive, even its IRR is higher than the company's cost of capital, but the preference of projects is unchanged.

5.4.4 Profitability index

The profitability index method PI measures the proportion between sum of discounted cash flow resulting from the investment during its lifetime and the capital expenditure. For the project measured by the profitability index is valid that the value of profitability index has to be at least one in order for the project to be considered as beneficial. The higher the index is, the more beneficial is the particular project. If the profitability index assumes value lower than one, such investment project should not be accepted.

For the project A is the profitability index as follows:

$$PI_A = \frac{PVCF}{INV}$$

$$PI_A = \frac{5357545}{5975000}$$

$$\underline{PI_A = 0{,}90}$$

With the discount rate 8,4% is not the Project A beneficial for the company, therefore should not be acceptable based on profitability index method. The potential automatic rejection might be changed with the discount rate of 6%:

$$PI_A = \frac{6170459}{5975000}$$

$$\underline{PI_A = 1{,}03}$$

The Project A at the discount rate 6% is beneficial for the company if it is evaluated independently. While two projects are evaluated, the profitability index of the Project A must be compared with the Project B's profitability index.

The application of PI method for the Project B at discount rate 8,4%:

$$PI_B = \frac{3768308}{3475000}$$

$$\underline{PI_B = 1{,}08}$$

Project B's PI at discount rate 6%:

$$PI_B = \frac{4288527}{3475000}$$

$$\underline{PI_B = 1{,}23}$$

As both values of $PI$of Project B are higher than respective values of the project A, the Project B is more beneficial for the company in comparison to Project A. Therefore this project ought to be accepted according the profitability index method.

6 PROPOSALS – INVESTMENT RISK EVALUATION

Until this moment, the risk itself has not been considered. Partially, the risk is implicitly included in the discount rate. For certain kinds of investment it is necessary to numerically determine the risk and reflect it in the investment evaluation.

As mention in the chapter 4.6 Investment risk, return the risk can be estimated according the risk classes. These distinguish certain kinds of investments and assign them a certain amount of risk premium. This is illustrated in the following table:

Table 19: Risk classes (Sources: 4,19)

Type of investment	**Verbal estimation of risk**	**ΔDiscount rate**
Replacement of machine/s	None	+0%
Introduction of new machine/s	Moderate	+1%
Extension of current production	Average	+2%
Introduction of new products into current markets	Medium-high	+4%
Introduction of new products into new markets	High	+8%
Introduction of new products into new foreign market	Very high	+12%
Research and development	Supreme	+17%

The purchased agriculture combine harvester will fulfil the same function as the one which is to be replaced. On the other hand, the new purchased combine harvester is different model and partially certain things and secondary functions are different as the combine harvester which is to be replaced has been used over the decade and certain things are innovated. As this is neither a typical risk-free replacement nor the introduction of completely new and unknown machine, it is calculated with the "Δdiscount rate" as the risk premium of 0,5%. Tables 20, 21, 22 and 23 display discount rates of both projects with and without considered risk premium.

Table 20: Discounted cash flow (8,4%) with considered risk premium 0,5% for Project A (Source: own processing)

Year	**Discounted cash flow (8,4%)**	**Discounted cash flow (8,4%+0,5%)**
0	-5 975 000	-5 975 000
1	861 024	857 071
2	788 099	780 878
3	721 941	712 042
4	661 891	649 818
5	607 353	593 538
6	144 841	140 897
7	127 363	123 325
8	111 724	107 685
9	97 743	93 778
10	83 027	79 293
11	74 534	70 855
12	67 239	63 627
13	60 977	57 436
14	55 606	52 136
15	50 402	47 040
16	843 781	783 885

Table 21: Discounted cash flow (6%) with considered risk premium 0,5% for Project A (Source: own processing)

Year	Discounted cash flow (6%)	Discounted cash flow (6%+0,5%)
0	-5 975 000	-5 975 000
1	880 519	876 385
2	824 190	816 469
3	772 097	761 273
4	723 902	710 403
5	679 295	663 498
6	165 666	161 054
7	148 973	144 145
8	133 639	128 701
9	119 563	114 605
10	103 861	99 087
11	95 349	90 538
12	87 964	83 134
13	81 578	76 737
14	76 076	71 225
15	70 518	65 712
16	1 207 270	1 119 707

Table 22: Discounted cash flow (8,4%) with considered risk premium 0,5% for Project B (Source: own processing)

Year	Discounted cash flow (8,4%)	Discounted cash flow (8,4%+0,5%)
0	-3 475 000	-3 475 000
1	693 644	690 459
2	635 757	629 932
3	583 312	575 314

4	134 709	132 252
5	120 929	118 179
6	107 860	104 923
7	96 659	93 595
8	87 071	83 924
9	78 872	75 672
10	70 975	67 783
11	1 158 519	1 101 333

Table 23: Discounted cash flow (6%) with considered risk premium 0,5% for Project B (Source: own processing)

Year	**Discounted cash flow (6%)**	**Discounted cash flow (6%+0,5%)**
0	-3 475 000	-3 475 000
1	709 349	706 019
2	664 872	658 644
3	623 837	615 092
4	147 329	144 582
5	135 254	132 108
6	123 368	119 933
7	113 060	109 396
8	104 150	100 302
9	96 479	92 479
10	88 785	84 703
11	1 482 043	1 407 277

The modification of discount rates influences the evaluations of investment projects. The only method on which the consideration of risk premium has no impact is the classical payback method, which does not account for time value of money. On the other hand, the modified discounted payback method does. In the case of Project A calculated with discount rate 8,4% plus risk premium 0,5%, the cumulated discounted cash flow does not cover the initial investment within its lifetime. The payback period of the Project A calculated with the discount rate 6% plus 0,5% equals 15 years 11 months and 28 days but the sale of combine harvester is performed at the very end of the 16th year. Therefore, to be strict, the payback period of Project A discounted by 6,5% is exactly 11 years. The situation is illustrated on two following tables:

Table 24: Discounted payback method (8,4%) with considered risk premium 0,5% for Project A (Source: own processing)

Year	**Discounted cash flow (8,4%+0,5%)**	**Cumulated discounted cash flow**
0	-5 975 000	**-5 975 000**
1	857 071	**-5 117 929**
2	780 878	**-4 337 051**
3	712 042	**-3 625 009**
4	649 818	**-2 975 190**
5	593 538	**-2 381 652**
6	140 897	**-2 240 756**
7	123 325	**-2 117 430**
8	107 685	**-2 009 745**
9	93 778	**-1 915 967**
10	79 293	**-1 836 674**
11	70 855	**-1 765 819**
12	63 627	**-1 702 192**
13	57 436	**-1 644 756**
14	52 136	**-1 592 620**
15	47 040	**-1 545 580**
16	783 885	**-761 695**

Table 25: Discounted payback method (6%) with considered risk premium 0,5% for Project A (Source: own processing)

Year	Discounted cash flow (6%+0,5%)	Cumulated discounted cash flow
0	-5 975 000	**-5 975 000**
1	876 385	**-5 098 615**
2	816 469	**-4 282 146**
3	761 273	**-3 520 872**
4	710 403	**-2 810 469**
5	663 498	**-2 146 971**
6	161 054	**-1 985 917**
7	144 145	**-1 841 772**
8	128 701	**-1 713 070**
9	114 605	**-1 598 465**
10	99 087	**-1 499 378**
11	90 538	**-1 408 840**
12	83 134	**-1 325 706**
13	76 737	**-1 248 969**
14	71 225	**-1 177 744**
15	65 712	**-1 112 032**
16	1 119 707	**7 675**

In case of Project B, the payback period discounted by 8,9% and 6,5% equals 11 years for the same reason mentioned in the previous paragraph. The cash flow in last 11th year reduced by the extracted cash inflow resulting the sale of the machine would not cover the capital expenditures. In other words the cumulated cash flow does not equal zero in the last year until the combine harvester is sold at the end of the year.

Table 26: Discounted payback method (8,4%) with considered risk premium 0,5% for Project B (Source: own processing)

Year	Discounted cash flow (8,4%+0,5%)	Cumulated discounted cash flow
0	-3 475 000	**-3 475 000**
1	690 459	**-2 784 541**
2	629 932	**-2 154 609**
3	575 314	**-1 579 294**
4	132 252	**-1 447 042**
5	118 179	**-1 328 864**
6	104 923	**-1 223 941**
7	93 595	**-1 130 346**
8	83 924	**-1 046 422**
9	75 672	**-970 749**
10	67 783	**-902 967**
11	1 101 333	**198 366**

Table 27: Discounted payback method (6%) with considered risk premium 0,5% for Project B (Source: own processing)

Year	Discounted cash flow (6%+0,5%)	Cumulated discounted cash flow
0	-3 475 000	**-3 475 000**
1	706 019	**-2 768 981**
2	658 644	**-2 110 338**
3	615 092	**-1 495 246**
4	144 582	**-1 350 664**
5	132 108	**-1 218 555**
6	119 933	**-1 098 622**
7	109 396	**-989 226**
8	100 302	**-888 923**

9	92 479	**-796 445**
10	84 703	**-711 741**
11	1 407 277	**695 536**

Based on the net present value method, the Project A is not beneficial for the company, as it decreases the market value of the company by 761695,34 CZK while considering the risk premium 0,5% at discount rate 8,4%, 8,9% respectively. In other words, the NPV for the Project A at discount rate 8,9% (8,4%+0,5%) equals -761695,34 CZK. NPV for the Project A at discount rate 6,5% (6%+0,5%) would still increase the market value of the company, in this case only by 7675,24 CZK. In contrast, the Project A would significantly increase the market value of the company, even with considered market premium 0,5%, by 198366,09 CZK at discount rate 8,9% and by 695535,78 CZK. In both cases the Project A is more beneficial for the company as its NPVs are greater than in comparison to Project B.

As the risk premium is considered, the lower is the internal rate of return of particular project. In case of Project A the IRR is decreased by 0,56%. Therefore the IRR for the Project A with considered 0,5% of risk premium equals 6,02%. In case of Project B, the IRR equals 9,36% which is lower than original IRR by 0,39%.

The risk premium negatively influences the value of the profitability index. Therefore in all cases the value of PI is decreased. For the Project A with discount rate 8,9% (8,4%+0,5%) and 6,,5% (6%+0,5%) $PI = 0{,}87$ and 1,001 respectively. In case of Project B the PI with discount rate 8,9% (8,4%+0,5%) and 6,5% (6%+0,5%) equals $1{,}06$ and 1,20 respectively.

Even with the considered risk premium 0,5%, the Project B, according chosen methods of evaluation of investment efficiency, is superior for the company to Project A. Based on this fact, the Project B is recommended to undertake by the company.

7 CONCLUSION

This thesis was focused on evaluation of efficiency of two particular investment projects from which one is recommended to company to undertake. First option of investment project which company may undertake is purchase of new agricultural machine – combine harvester, marked in the thesis as a Project A. Second option is a purchase of refurbished combine harvester, marked in the thesis as a Project B.

For evaluation of investment efficiency of both options are used methods which account for the cash flow for the reason that the validity of those methods is greater than other approaches of evaluation. For this reason are not used cost methods as they are inappropriate approaches for this kind of investment.

Both options are evaluated based on appropriate static and dynamic methods. For every evaluation are accounted two discount rates. First discount rate is calculated based on the INFA rating model, used by the Ministry of Industry and Trade of the Czech Republic (8,4%) and second discount rate which is currently used in the company (6%). It is obvious that company's capital is seen more risky measured by the INFA rating model than by the company itself. For this reason are seen results of both investment projects measured by investment efficiency methods with discount rate of 8,4% less beneficial than the measurement of particular investment with the discount rate currently used by the company, 6%.

First method applied for evaluation of projects is payback method. Classic payback method does not account for time factor and project's risk. Therefore there is no need of discount rate and classic payback method gives exactly one result for Project A and one result for Project B. Time, when the cash flows cover the initial investment, the payback period, for Project A is calculated at 11 years and 9 months. The recovery of initial investment of project B is shorter; the payback period for the Project B is calculated at 10 years, 2 months and 16 days. According the classic payback method is the project B more beneficial in comparison to Project A. On the other hand, although this method is simple and easy to understand, it ignores the time factor and the verdict cannot be conclusively given.

As the classic payback method ignores the time factor, the modified payback method, discounted payback method, respectively is used. Discounted payback method is based on the same principle as the classic payback method with the difference that cash flows are every year discounted. Using the discount rate 8,4% at the Project A, the payback period exceeds the lifetime of the project, as the cumulated discounted cash flows does not equal zero in any year. On the other hand, the payback period for the Project B at the discount rate 8,4% equals 10 years and 9 months, which is shorter period of time than lifetime of the Project A. With used discount rate of 8,4% the Project A is superior to Project B and therefore this project is recommended to accept. Project A with the discount rate of 6% indicates that payback period is reached within the lifetime of the project. Time when the discounted cash flows of the Project B equal the initial investment is calculated at 15 years and 10 months. Even the recovery is finally within the lifetime of the project, in comparison to Project B calculated at the same discount rate, 6%, the payback period of Project B is still shorter and superior to Project A. According to discounted payback method the Project B is superior in both calculated discount rates (8,4% and 6%) and such project is recommended to be accepted.

Using the net present value method of evaluation of investment efficiency, the Project A at discount rate of 8,4% indicates negative value, meaning that accepting such investment would decrease the market value of the company. In contrast, net present value of Project B, evaluated based on the same discount rate, is 293308,21 CZK. Net present value of Project A calculated with 6% cost of capital assumes positive value (195459,23 CZK), but as expected, the net present value of Project B increases as well (813527,60 CZK) and exceed the value of Project A. Therefore, the Project B is superior to Project A and it is recommended to be accepted according to net present value.

The method of internal rate of return at Project A indicates that independent acceptance of the value of Project B's IRR depends on the selected company's cost of capital. If the selected discount rate would be selected by a company 6%, the IRR of the Project B (6,58%) exceeds this value and therefore independently such project may be accepted. On the other hand, the IRR of Project A is calculated at 9,75% and is more beneficial based on the internal rate of return. The internal rate of return should not be exclusive method while evaluating investment as it determines only the rate of return. Therefore taking into account results of previous evaluations of both projects it can be stated that Project B is superior to Project A.

Profitability index measures the proportion between the sum of discounted cash flow and initial investment. In both cases of evaluation (using the discount rate 6% and 8,4%) the Project B is superior to Project A and confirmed the complex advantageousness of the Project B and such investment project is recommended to undertake.

It is also proposed to the company to take into consideration specific risk which influences the evaluation of investment efficiency and at the same time might not be included in the discount rate. Such risk has been estimated based on the table 19: Risk classes. In both projects, as the purchase of combine harvester is neither a replacement of the same type of agriculture machine nor introduction of completely new one, the estimation of value of the risk is +0,5%. The consideration of risk premium 0,5% influenced results of particular evaluations. The net present value of the Project A with the discount rate 8,9%, considering the risk premium, equals -761695,34 CZK, while the NPV for the Project B calculated with the same discount rate equals 198366,09 CZK. Project A's net present value in the case of 6,5% discount rate would increase the market value of the company by the 7675,24 CZK, but on the other hand, the Project B would increase significantly higher, by 695535,78 CZK.

The internal rate of return has been obviously decreased. The IRR of the Project A with modified discount rate equals 6,02% and 9,36% in the case of Project B.

Last method which has been influenced by the modification of discount rate by the risk premium is profitability index. This changed to 0,87 in the case of Project A with discount rate 8,9% and 1,001 with discount rate 6,5%. The profitability index of the Project B has been decreased as well; to 1,06 and 1,20 with discount rate 8,9% and 6,5%, respectively.

Based on complex evaluation of investment efficiency that comprises appropriate evaluation methods is the Project B, the purchase of the refurbished agricultural machine (combine harvester), more beneficial for the company DV Polanka nad Odrou than the purchase of the same of type of machine, but new; marked in the thesis as a Project A. For such reason, that this thesis provides a complex evaluation of investment efficiency of both methods, the purchase of refurbished combine harvester is recommended by the author of this thesis for the price 5,5M CZK. Such amount would be financed from own sources as the company operates in moderate low risk industry and has enough reserves for financing this type of investment.

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12 APPENDICES

Appendix 1: Recommended minimal values of R_{POD} (Source: 11)

NACE	Název	1.Q.13	1.Pol.13	1.-3.Q.13	1.-4.Q.13	1.Q.14	1.Pol.14	1.-3.Q.14	1.-4.Q.14
A	**ZEMĚDĚLSTVÍ, LESNICTVÍ A RYBÁŘSTVÍ**	**2,04%**	**2,04%**	**2,05%**	**2,05%**	**2,04%**	**2,05%**	**2,06%**	**2,06%**
05	Těžba a úprava černého a hnědého uhlí	2,00%	2,00%	2,00%	2,00%	2,00%	2,00%	2,00%	2,00%
06	Těžba ropy a zemního plynu	2,00%	2,11%	2,10%	2,09%	3,00%	2,11%	3,00%	3,00%
07	Těžba a úprava rud	2,01%	2,05%	2,07%	2,12%	2,12%	2,12%	2,12%	2,12%
08	Ostatní těžba a dobývání	3,00%	3,00%	3,00%	3,00%	3,00%	3,00%	3,00%	3,00%
09	Podpůrné činnosti při těžbě	3,00%	3,00%	3,00%	3,00%	3,00%	3,00%	3,00%	3,00%
B	**TĚŽBA A DOBÝVÁNÍ**	**2,02%**	**2,07%**	**2,09%**	**2,09%**	**2,08%**	**2,10%**	**2,19%**	**2,19%**
10	Výroba potravinářských výrobků	2,28%	2,34%	2,32%	2,48%	2,40%	2,43%	2,43%	5,21%
11	Výroba nápojů	2,32%	2,52%	5,76%	2,28%	2,18%	2,63%	2,43%	2,35%
12	Výroba tabákových výrobků	2,00%	2,00%	2,00%	2,00%	2,00%	2,00%	2,00%	2,00%
13	Výroba textilií	3,00%	3,00%	3,00%	2,54%	2,65%	2,78%	2,62%	2,65%
14	Výroba oděvů	3,00%	3,00%	3,00%	3,00%	3,00%	3,00%	3,00%	3,00%
15	Výroba usní a souvisejících výrobků	3,00%	3,00%	3,00%	3,00%	3,00%	3,00%	3,00%	3,00%
16	Zpracování dřeva, výroba dřevěných, korkových, proutěných a slaměnýc	3,00%	3,00%	3,00%	3,00%	3,00%	3,00%	3,15%	3,00%
17	Výroba papíru a výrobků z papíru	2,64%	2,32%	2,28%	2,31%	2,60%	2,28%	2,30%	2,27%
18	Tisk a rozmnožování nahraných nosičů	3,00%	3,00%	3,00%	3,00%	3,00%	3,00%	3,00%	3,00%
19	Výroba koksu a rafinovaných ropných produktů	2,00%	2,00%	2,00%	2,00%	3,00%	2,00%	2,00%	3,00%
20	Výroba chemických látek a chemických přípravků	2,71%	2,65%	2,88%	2,80%	2,76%	2,71%	2,63%	2,75%
21	Výroba základních farmaceutických výrobků a farmaceutických přípravk	2,61%	2,24%	2,24%	2,19%	2,98%	3,02%	2,22%	2,20%
22	Výroba pryžových a plastových výrobků	2,28%	2,58%	2,33%	2,46%	2,38%	2,44%	2,44%	2,68%
23	Výroba ostatních nekovových minerálních výrobků	3,03%	2,74%	3,64%	3,10%	2,66%	2,69%	2,80%	2,68%
24	Výroba základních kovů, hutní zpracování kovů; slévárenství	2,37%	2,38%	2,28%	3,15%	2,33%	2,41%	2,20%	2,20%
25	Výroba kovových konstrukcí a kovodělných výrobků, kromě strojů a zaříz	3,00%	3,00%	3,03%	3,31%	3,01%	3,03%	3,10%	3,19%
26	Výroba počítačů, elektronických a optických přístrojů a zařízení	2,91%	3,00%	2,86%	2,92%	3,20%	4,54%	2,33%	2,31%
27	Výroba elektrických zařízení	2,77%	2,90%	2,87%	2,65%	2,73%	2,75%	2,98%	2,70%
28	Výroba strojů a zařízení j. n.	2,69%	2,64%	2,63%	2,63%	2,83%	2,76%	2,65%	2,72%
29	Výroba motorových vozidel (kromě motocyklů), přívěsů a návěsů	2,26%	4,52%	2,25%	2,24%	2,32%	2,40%	2,34%	2,37%
30	Výroba ostatních dopravních prostředků a zařízení	3,08%	2,39%	2,39%	2,39%	2,80%	2,75%	2,71%	4,04%
31	Výroba nábytku	3,00%	3,00%	3,51%	3,00%	3,00%	3,00%	3,00%	3,00%
32	Ostatní zpracovatelský průmysl	2,45%	2,45%	2,42%	2,46%	2,41%	2,36%	2,30%	2,39%
33	Opravy a instalace strojů a zařízení	2,52%	2,48%	2,65%	2,42%	2,38%	2,40%	2,45%	2,55%
C	**ZPRACOVATELSKÝ PRŮMYSL**	**2,50%**	**3,17%**	**2,59%**	**2,53%**	**2,57%**	**2,64%**	**2,48%**	**2,64%**
D	**VÝROBA A ROZVOD ELEKTŘINY, PLYNU, TEPLA A KLIMATIZOVANE**	**2,14%**	**2,05%**	**2,05%**	**2,03%**	**2,08%**	**2,09%**	**2,17%**	**2,21%**
36	Shromažďování, úprava a rozvod vody	2,55%	3,00%	3,00%	3,00%	2,39%	2,55%	2,54%	3,00%
37	Cinnosti související s odpadními vodami	3,00%	3,00%	3,00%	3,00%	3,00%	3,00%	3,00%	3,00%
38	Shromažďování, sběr a odstraňování odpadů, úprava odpadů k dalšímu v	3,00%	3,00%	3,00%	3,01%	3,00%	3,00%	3,00%	3,00%
39	Sanace a jiné činnosti související s odpady	3,00%	3,00%	3,00%	3,01%	3,00%	3,00%	3,00%	3,00%
E	**ZÁSOBOVÁNÍ VODOU; ČINNOSTI SOUVISEJÍCÍ S ODPADNÍMI VODA**	**2,65%**	**3,00%**	**3,00%**	**3,00%**	**2,55%**	**2,68%**	**2,67%**	**3,00%**
	Průmysl (B+C+D+E)	**2,30%**	**2,57%**	**2,32%**	**2,28%**	**2,33%**	**2,41%**	**2,39%**	**2,53%**
41	Výstavba budov	3,25%	3,25%	3,74%	4,42%	2,21%	2,27%	2,25%	2,46%
42	Inženýrské stavitelství	2,28%	3,25%	3,33%	2,47%	2,27%	2,60%	2,40%	2,46%
43	Specializované stavební činnosti	3,00%	3,00%	3,00%	3,00%	3,00%	3,00%	3,00%	3,00%
F	**STAVEBNICTVÍ**	**2,52%**	**3,24%**	**3,41%**	**2,91%**	**2,26%**	**2,42%**	**2,38%**	**2,49%**
45	Velkoobchod, maloobchod a opravy motorových vozidel	4,16%	3,63%	3,67%	3,00%	4,06%	3,75%	3,47%	3,20%
46	Velkoobchod, kromě motorových vozidel	2,86%	3,08%	2,81%	2,66%	2,80%	2,68%	2,54%	2,50%
47	Maloobchod, kromě motorových vozidel	2,52%	2,42%	2,51%	2,44%	2,91%	2,84%	2,47%	2,69%
G	**VELKOOBCHOD A MALOOBCHOD; OPRAVY A ÚDRŽBA MOTOROV**	**2,89%**	**2,91%**	**2,79%**	**2,62%**	**2,92%**	**2,83%**	**2,58%**	**2,63%**
49	Pozemní a potrubní doprava	2,06%	2,07%	2,09%	2,08%	2,11%	2,14%	2,55%	2,49%
50	Vodní doprava	3,00%	3,00%	3,00%	3,00%	3,00%	3,00%	3,00%	3,00%
51	Letecká doprava	3,00%	3,00%	3,00%	3,00%	3,00%	3,00%	3,00%	3,00%
52	Skladování a vedlejší činnosti v dopravě	2,19%	2,24%	2,12%	2,21%	2,19%	2,23%	2,14%	2,11%
53	Poštovní a kurýrní činnosti	3,00%	3,00%	3,00%	3,00%	3,00%	3,00%	3,00%	3,00%
H	**DOPRAVA A SKLADOVÁNÍ**	**2,13%**	**2,15%**	**2,13%**	**2,15%**	**2,15%**	**2,19%**	**2,27%**	**2,22%**
55	Ubytování	3,00%	3,00%	3,00%	3,00%	3,00%	3,00%	3,00%	3,00%
56	Stravování a pohostinství	3,00%	3,00%	3,00%	3,00%	3,00%	3,00%	3,00%	3,00%
I	**UBYTOVÁNÍ, STRAVOVÁNÍ A POHOSTINSTVÍ**	**3,00%**	**3,00%**	**3,00%**	**3,00%**	**3,00%**	**3,00%**	**3,00%**	**3,00%**
58	Vydavatelské činnosti	3,00%	3,00%	3,00%	3,00%	3,00%	3,00%	3,00%	3,00%
59	Činnosti v oblasti filmů, videozáznamů a televizních programů, pořizování	3,00%	3,00%	3,00%	3,00%	3,00%	3,00%	3,00%	3,00%
60	Tvorba programů a vysílání	3,00%	3,00%	3,00%	3,00%	3,00%	3,00%	4,99%	3,00%
61	Telekomunikační činnosti	2,01%	2,01%	2,01%	2,00%	2,00%	2,00%	2,00%	2,00%
62	Činnosti v oblasti informačních technologií	2,59%	3,00%	3,00%	3,00%	2,45%	3,00%	2,54%	2,53%
63	Informační činnosti	3,00%	3,00%	3,00%	3,00%	3,00%	3,00%	3,00%	3,00%
J	**INFORMAČNÍ A KOMUNIKAČNÍ ČINNOSTI**	**2,27%**	**2,13%**	**2,13%**	**2,13%**	**2,24%**	**2,33%**	**2,35%**	**2,29%**
L	**ČINNOSTI V OBLASTI NEMOVITOSTÍ**	**3,02%**	**3,09%**	**3,02%**	**3,48%**	**2,87%**	**3,19%**	**2,90%**	**2,75%**
M	**PROFESNÍ, VĚDECKÉ A TECHNICKÉ ČINNOSTI**	**6,67%**	**7,18%**	**7,52%**	**7,89%**	**8,56%**	**7,37%**	**7,74%**	**7,81%**
N	**ADMINISTRATIVNÍ A PODPŮRNÉ ČINNOSTI**	**2,36%**	**2,23%**	**2,45%**	**2,22%**	**2,47%**	**2,28%**	**2,54%**	**2,52%**
	Vybrané služby (G až N bez K)	**2,61%**	**2,64%**	**2,72%**	**2,74%**	**2,90%**	**2,83%**	**2,91%**	**2,77%**
	Ostatní služby (P až S)	**4,08%**	**3,37%**	**3,32%**	**2,84%**	**3,08%**	**3,21%**	**2,91%**	**2,87%**
	Nefinanční podniky (bez K)	**2,35%**	**2,57%**	**2,41%**	**2,38%**	**2,40%**	**2,46%**	**2,47%**	**2,55%**