

## EVALUATION OF AN INVESTMENT PROJECT FOR ROBOTIZATION OF THE METAL-BEARING MATERIAL SAMPLE PREPARATION DEPARTMENT

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### Abstract

It is more and more difficult for companies and firms to survive in the highly competitive environment at the present. This is why they try to find ways to achieve competitive advantages, which is associated with investments in innovative technologies or information technologies. This paper analyse the investment project for robotization of the metal-bearing material sample preparation department. It describes the individual phases of the investment project and associated cash flows and the investment efficiency evaluation methods. The objective of the paper is to evaluate the investment project using appropriate investment evaluation methods for efficient decision-making and project management, which is extremely important for the company. Investment decisions are among the most critical decisions made by the company's management. Inefficient and improperly focused investment may cause serious financial problems or even dissolution of the company.

**Keywords:** Metal-bearing materials; capital expenditure plan; analysis; cash flow

### 1. INTRODUCTION

The fourth industrial revolution already directly affects many production companies and their customers. Those who get ready for the future using the most recent technologies and their interconnection using information technology in a timely manner will secure a competitive advantage, and not only in the medium term. The fundamental role in this respect is played by interconnection of all technical components and production data required for the production process.

The new wave of innovations in the form of industry digitalization provides companies with new opportunities to win a competitive advantage. Only those companies which have an opportunity to analyse and utilize huge amounts of data will be able to secure the critical added value for their customers. The data is transformed into knowledge and business models based on a combination of process and product know-how, data and the application software that uses it. The Industry 4.0 strategy is starting to be applied not only in production, but also in process technologies; for instance, in remote diagnostics or predictive maintenance. It reduces operating costs and expands the offer of products and services. It reduces the time required to place a product on the market and enables bigger differentiation based on the needs of the individual customers. [1]

At present, robotization is often associated with the term Industry 4.0 that is based on digital transformation and automation of industrial production.

The advantages of using automation or robotization in a company stem from the fundamental principles, such as performance, speed, precision, but they can also offer opportunities for more suitable and creative utilization of human resources. Although making decisions about using automatic solutions for individual operations or logistic activities remain basically the question of economic reasons, duration and the rate of investment return, the Czech Republic is an attractive region owing to the historical structure of its industry, economic structure and geographical position. The interest in automation and robotization is starting to gradually move over to small and medium-sized companies. [2]

## 2. COMPANY INVESTMENT PROJECT

The company is aware of the fact that winning a competitive advantage requires innovation in the area of new products, technologies, efficient production, satisfying customers' needs and the flexible placing of products on the market. Only those companies which are able to orientate themselves towards the given issue and specify the departments or activities suitable for automation or robotization will prosper. And this is associated with, for instance, investments in innovative technologies which can bring the required benefit to the company if they succeed.

The company's investment project is about robotization of the metal-bearing material sample preparation department where an automatic milling line, grinding machine and milling cutters are used. The purpose is to interconnect them with handling robots. This mainly concerns machines used to prepare an essential part of the test samples in the quantometry department. The intended investment is the purchase of a new automatic milling line in the amount of CZK 9,000,000 and a robotic handler for the milling cutter in the amount of CZK 2,500,000.

The investment project would result in faster sample preparation, the improved quality of samples and a decrease in costs. Three alternatives were prepared for the investment project's evaluation. **Alternative one** only includes the purchase of the automatic milling line. **Alternative two** takes into account only the purchase of the robotic handler and **alternative three** includes the purchase of both automatic milling line and robotic handler.

The company will fund 40 % of the investment project from its own resources and the remaining 60 % by long-term bank loan for a period of 5 years with an interest rate of 4 %. The life cycle of the automatic milling line and robotic handler has been fixed at 12 years.

### 2.1. Investment Project Cash Flow

The investment project cash flow comprises planned expenses and revenue imposed by the investment project during the course of its implementation, operation or liquidation. [3] The estimate of the future revenue and expenses is the critical element of the entire decision-making procedure concerning the investment. The **expenses** are any and all "costs" incurred at the moment of leaving the bank account or petty cash. The expenses may include: expenses for material required for production, purchase of company equipment, expenses for purchased services (internet, telephone, legal services, etc.), repayments of loan received, personal costs (wages and insurance), indirect costs, promotion expenses, taxes or expenses for repairs completed. The **revenue** is to include the actual revenue not as of the invoice issue date, but as of the day when it is actually credited to the bank account and thus becomes free and usable funds. The revenue may include: revenue from sale of goods and services, sale of (old) company equipment, new load received, accrued interest, tax refund or invested capital. The trend of these factors is hard to predict, and, therefore, it is necessary to involve various sophisticated statistical and econometric methods at this stage. It is obvious that accurately calculated and entered input data is the prerequisite for correct and accurate results.

The **main capital expenditures** of the investment project include the acquisition prices of the automatic milling line and robotic handler, as well as the interest rate on the long-term bank loan, personal costs, inflation and construction works. The **expected cash income** from the investment project includes the value of leasing machinery and premises due to the removal of the old milling line, expenses associated with servicing thereof, the reduction of ½ of the work load per shift, including reduced personal costs.

Investment affects the company's cash flow in the long term, and, therefore, it is required to respect the aspect of time and risk when planning the profit and, subsequently, the cash flow of the investment project. The time and risk are taken into account by the mathematical discounting operation. Discounting means the conversion of planned cash income and cash expenses to their present value. The investment project's expenses are discounted only if they are spent over a period exceeding one year as of the investment project's

commencement. Determination of the company discount rate value represents a significant part of the economic evaluation of the investment project. [4]

## 2.2. Analysis of selected investment indicators

There are a number of methods which can be used for evaluating the investment's efficiency. The basic input parameters characterizing the investments include the starting capital expenditures, cash flow from the investment in the individual years, investment life cycle, and the weighted costs of capital taking into account the risk factor. The methods taking into account the influence of time on the value of money and also the risk as for the interest rate were chosen as follows: net present value, internal rate of return and profitability index.

### Net Present Value

The concept of the net present value is based on the principle of the value of money as it uses the present value factor or discount rate to convert the future revenue and expenses of the project to their present value. The net present value is usually identified as NPV and is expressed by the **equation 1** [5]. **Table 1** shows the net present value of all the alternatives analysed.

$$NPV = \sum_{i=1}^n \left[ \frac{CF_i}{(1+k)^i} \right] - II \quad (1)$$

where:

- NPV net present value,
- II internal investment,
- i individual years of investment.

**Table 1** Net Present Value

Alternatives	Alternative I	Alternative II	Alternative III
NPV	CZK 4,087,773	CZK 7,605,073	CZK 30,884,668

The higher the net present value, the more economically efficient the project is. The analysis indicates that alternative three is beneficial for the company.

### Internal Rate of Return

The internal rate of return (IRR) is the method of evaluating the efficiency of investment projects which considers the cash income from the project's effect and respects the time factor (**equation 2**). The internal rate of return equals the discount rate in a situation when the present value of future income equals the capital investment.

$$IRR = i_n + \frac{NPV_L}{NPV_L + NPV_H} * (i_H - i_L) \quad (2)$$

where:

- IRR internal rate of return,
- $i_L$  lower chosen interest rate,
- $i_H$  higher chosen interest rate,
- $NPV_L$  net present value at lower interest rate,
- $NPV_H$  net present value at higher interest rate.

It is easy to apply the internal rate of return as the criterion for making a decision on accepting or rejecting the project. The company should accept the subject project if its internal rate of return is higher than the discount rate, i.e. the required rate of return on the project. If the internal rate of return on the project is lower than the

discount rate, the project should be rejected. **Table 2** below shows the calculated internal rate of return for all the alternatives analysed.

**Table 2** Internal Rate of Return

Alternatives	Alternative I	Alternative II	Alternative III
IRR	19.66 %	26.63 %	41.46 %

The higher the internal rate of return, the more economically efficient the subject project is. In this case, the analysis indicates that Alternative 3 is beneficial.

### Profitability Index

The profitability index (PI) expresses the present value of future revenue of the project per unit of the investment's expenditures, converted to the present value (**equation 3**). **Table 3** shows the profitability index of all the alternatives analysed.

$$PI = \frac{\sum_{i=1}^n \frac{CF_i}{(1+k)^i}}{K} \quad (3)$$

where:

- PI      profitability index,
- CF<sub>i</sub>    cash flow from investment in individual years of its life cycle,
- k        required revenue,
- K        starting investment expenditure,
- i        individual years of investment.

**Table 3** Profitability Index

Alternatives	Alternative I	Alternative II	Alternative III
PI	1.45	1.86	4.43

The investment is acceptable if the profitability index is higher than or equals 1, which is directly related to the requirement of non-negative NPV. The more the project profitability index exceeds the value of one, the more economically efficient the project is. The analysis indicates that alternative three is beneficial for the company.

### 2.3. Evaluation of Results

The management's decision on accepting or rejecting the investment project is associated with great responsibility towards the company's future development. Prior to making such a decision, it is required to thoroughly assess all aspects of the planned investments; in particular, long-term investments. The major portion thereof in case of the evaluated company comprises investments in the acquisition of the new automatic milling line in the amount of CZK 9,000,000 and a robotic handler for the milling cutter in the amount of CZK 2,500,000.

The objective of this paper was to evaluate the efficiency of the investment project in three alternatives and assess the suitability of applying the individual evaluation methods to analyse the long-term investment plans. In case of the analysed investment project, we can conclude, based on the values calculated above, that Alternative three is the most efficient for the company, i.e. acquisition of the robotic handler and automatic milling line. Nevertheless, all three alternatives are economically acceptable for the company.

### 3. CONCLUSION

New technologies and innovations offer many opportunities to companies. They are slightly different for each business branch, but the important thing is that they can help us be one step ahead of our competitors. If we know the trends and development, we can imagine better what the future will be like and get ready for it before it comes. [6] Many companies respond to events when they occur, but the successful ones respond much earlier before they occur, which significantly diversifies them from their competitors, thus giving them a major edge.

At present, automation and robotization are applicable in various industries. Robotized technological departments or technological complexes are established which consist of several robotized departments. Industrial processes can be robotized only in large-lot productions, as well as in small-lot or single-piece production. We should robotize a process only when it makes sense in technological, technical and financial terms, if it offers advantages, including but not limited to: reduced operating costs, improved quality, better production flexibility, high rate of return on investment.

Information technology is currently considered to be the critical factor affecting economic and social development. [7] Thanks to the dynamics of its development, extent and radius, information technology is essential for contemporary society.

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