ECONOMIC EVALUATION OF INVESTMENT PROJECT IN THE AREA OF SHEET METAL PROCESSING

The article is oriented on the process modelling in selected company. The aim of the process modelling is a possibility to prevent the formation of future risks as a consequence of a wrong decision concerning a capital project. The analysis of actual state in society with the focus on the means of processing the lamination using computer numeric control technology is also a part of article. Based on the analysis mentioned above, the selection and the definition of the capital project have already been carried out. Final section evaluates the capital project using methodology of economic indicators by means of economic indicators of effectiveness and brings a decision whether to accept or refuse given investment.

Key words: economics, net present value, internal rate of return, payback period, profitability index

INTRODUCTION

There is a wide range of methods that deals with evaluation of investment projects. These methods are able to clearly assess the profitability of investments, if it is necessary. The aim of this article is to evaluate the effectiveness of a particular investment project. This project represents an investment purchase of a new high-pressure water jet. This paper is focused on the area of sheet metal processing using computer numeric control technology, specifically laser cutting and water jet cutting.

METHODOLOGY

In the process of evaluation the investment it is necessary to define criterion according to which the investment will be assessed. The basic and most frequently used aspect for classification of specific methods of evaluating investments include time factor. There are two methods that take into account time value of money: Static methods - these methods do not take into account time factor and its impact on the value of money [1, 2]. They are used in cases where the economic life of investment period is short and the discount rate derived from the capital structure of company is low.

The higher is the discount rate, the more marked is the difference between the future and the present value of money. These methods are used for initial preliminary calculations [1]. The most used indicators are: average annual return, average payback period and percentage yield.

Dynamic methods - These methods take into account time factor and a risk factor. Both of these factors are taken into account by a discount rate. They are used mostly in the case of assessment the longer-term investment, because there is no greater distortion of cash flow and capital expenditure due to time factor [1, 2].

The most used indicators are: net present value, internal rate of return and profitability index [3].

The following stage of paper deals with the analysis of current state of selected company, evaluation and selection methods of processing sheet metals by computer numeric control technology.

EXPERIMENTAL WORK

The main objective of company is the enhancement of company capital in the field of mechanical engineering with the available human resources with application of modern business and technological processes [2].

The priority activity of production program in selected company represents sheet metal processing using CNC technology [2].

Figure 1 Display of laser beam technology
RESULTS AND DISCUSSION

Net present value (NPV) [3]:
For calculation of net present value, it is needed to know following indicators:
- Amortization
  \[ 240,000 \, \text{€} / 6 \text{ years} = 40,000 \, \text{€} \text{ attributes to one year} \]
- Gross profit
  \[ \text{GP} = \text{Sales growth} - \text{the growth of expenses} - \text{amortization} \]
- Income tax
  Calculated as 19 % of gross profit
- After-tax profit (net profit)
  \[ \text{After-tax profit} = \text{Gross profit} - \text{Income tax} \]
- Cash flow (after-tax profit + depreciation)
- Discount for \( i = 10 \% \) (0,1)
- Discounted cash flow (DCF)

\[ \text{NPV} = \sum DCF - CE \text{ (Capital Expenditure) \ (1)} \]

\[ \text{NPV} = 464,868 - 240,000 \]
\[ \text{NPV} = 224,868 \, \text{€} \]

Above mentioned results indicate that the NPV is greater than 0 (224,868 > 0). On the base of NPV indicator the investment should be made because it guarantees required rate of return and increases the value of company.

The internal rate of return (IRR) [4]:
When calculating IRR, it is needed to start from the results listed in Table 1. The required return on investment for the company is 10 %. IRR is calculated using following steps:

Any interest rate that discounts the expected cash flows for each year of life of machine will be chosen. The sum of the discounted cash flows is compared with capital expenditures.

If discounted cash flow will be higher than the capital expenditures for the machine, it is needed to choose another, higher interest rate and the whole calculation will be repeated at a given interest rate. And when the discounted cash flow will be lower than capital expenditure, the calculation with an even lower interest rate will be repeated. The sum of discounted cash income at an interest rate of 50 % is € 189,839 (Table 2), which is less than capital expenditure on machinery (€ 240,000), the same calculation will be repeated with an even low-

Table 1 | Indicators of NPV [€]
<table>
<thead>
<tr>
<th>Indicator</th>
<th>1st year</th>
<th>2nd year</th>
<th>3rd year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales growth</td>
<td>125,000</td>
<td>140,000</td>
<td>170,000</td>
</tr>
<tr>
<td>Cost growth</td>
<td>22,000</td>
<td>25,000</td>
<td>31,000</td>
</tr>
<tr>
<td>Depreciation</td>
<td>40,000</td>
<td>40,000</td>
<td>40,000</td>
</tr>
<tr>
<td>Gross profit</td>
<td>63,000</td>
<td>75,000</td>
<td>99,000</td>
</tr>
<tr>
<td>Income tax</td>
<td>11,970</td>
<td>14,250</td>
<td>18,810</td>
</tr>
<tr>
<td>After tax profit</td>
<td>51,030</td>
<td>60,750</td>
<td>80,190</td>
</tr>
<tr>
<td>Cash income</td>
<td>91,030</td>
<td>100,750</td>
<td>120,190</td>
</tr>
<tr>
<td>Discount (10%)</td>
<td>9,091</td>
<td>0,8264</td>
<td>0,7513</td>
</tr>
<tr>
<td>Discounted cash income (DCI)</td>
<td>82,755</td>
<td>83,260</td>
<td>90,299</td>
</tr>
<tr>
<td>Indicator</td>
<td>4th year</td>
<td>5th year</td>
<td>6th year</td>
</tr>
<tr>
<td>-----------</td>
<td>----------</td>
<td>----------</td>
<td>----------</td>
</tr>
<tr>
<td>Sales growth</td>
<td>195,000</td>
<td>150,000</td>
<td>130,000</td>
</tr>
<tr>
<td>Cost growth</td>
<td>37,000</td>
<td>31,000</td>
<td>27,000</td>
</tr>
<tr>
<td>Depreciation</td>
<td>40,000</td>
<td>40,000</td>
<td>40,000</td>
</tr>
<tr>
<td>Gross profit</td>
<td>118,000</td>
<td>79,000</td>
<td>63,000</td>
</tr>
<tr>
<td>Income tax</td>
<td>22,420</td>
<td>15,010</td>
<td>11,970</td>
</tr>
<tr>
<td>After tax profit</td>
<td>95,580</td>
<td>63,990</td>
<td>51,030</td>
</tr>
<tr>
<td>Cash income</td>
<td>135,580</td>
<td>103,990</td>
<td>91,030</td>
</tr>
<tr>
<td>Discount (10%)</td>
<td>9,630</td>
<td>0,6209</td>
<td>0,5645</td>
</tr>
<tr>
<td>DCI</td>
<td>92,601</td>
<td>64,567</td>
<td>51,386</td>
</tr>
</tbody>
</table>

Table 2 | View of discounted cash income [€] at 50 % interest rate
<table>
<thead>
<tr>
<th>Indicator</th>
<th>Discount (50 %)</th>
<th>Discounted cash income</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st year</td>
<td>0,667</td>
<td>60,690</td>
</tr>
<tr>
<td>2nd year</td>
<td>0,445</td>
<td>44,773</td>
</tr>
<tr>
<td>3rd year</td>
<td>0,296</td>
<td>35,612</td>
</tr>
<tr>
<td>4th year</td>
<td>0,198</td>
<td>26,777</td>
</tr>
<tr>
<td>5th year</td>
<td>0,132</td>
<td>13,695</td>
</tr>
<tr>
<td>6th year</td>
<td>0,088</td>
<td>7,992</td>
</tr>
</tbody>
</table>
er interest rate. When counting the net present value, the values calculated at the rate of 10 % will be used.

Calculation of lower and higher Net present value (NPV), (NPVh) [3]:

\[
\text{Net present value lower } NPV_l = \sum \text{DCF} - \text{CE} \tag{2}
\]

\[
\text{NPV} = 464\,868 - 240\,000 = 224\,868\,€
\]

\[
\text{Net present value higher } NPV_h = \sum \text{DCF} - \text{CE}
\]

\[
\text{NPV} = 189\,539 - 240\,000 = -50\,461\,€
\]

Calculation of discount:

When calculating an interest rate 50 %, the discount is calculated as follows:

\[
\frac{1}{(1 + 0,5)^n} \tag{3}
\]

\(n\) – durability life

Calculation of internal rate of return (IRR):

Using interpolation, the internal rate of return (IRR) will be calculated.

\[
\text{IRR} = 0,1 + \frac{224\,868}{224\,868 - (-50\,461)} \times (0,5 - 0,1)
\]

\[
\text{IRR} = 0,1 + \frac{224\,868}{275\,392} \times (0,4)
\]

\[
\text{IRR} = 0,4267 = 42,67\%
\]

Required rate of return on investment is defined by company. The calculated IRR is 42,67 %, and therefore is valid that the IRR is greater than the required rate of return on investment \(i\) (42,67 % > 10 %). It means, that investment should be made, because it ensures required rate of return and increases the value of company.

The modified internal rate of return (IRRm) [4]:

The modified IRR calculation requires the following steps [4, 5]:

- The calculation of terminal value of project
- Calculation of modified internal rate of return

When calculating the modified IRR, data listed in Table 3 are used.

### Table 3: Reinvested cash flow of the terminal value of project

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Coefficient</th>
<th>Cash flow [€]</th>
<th>Reinvested cash flow [€]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st year</td>
<td>1,61</td>
<td>91 030</td>
<td>146 605</td>
</tr>
<tr>
<td>2nd year</td>
<td>1,46</td>
<td>100 750</td>
<td>147 508</td>
</tr>
<tr>
<td>3rd year</td>
<td>1,33</td>
<td>120 190</td>
<td>159 973</td>
</tr>
<tr>
<td>4th year</td>
<td>1,21</td>
<td>135 580</td>
<td>164 052</td>
</tr>
<tr>
<td>5th year</td>
<td>1,1</td>
<td>103 990</td>
<td>114 389</td>
</tr>
<tr>
<td>6th year</td>
<td>1,0</td>
<td>91 030</td>
<td>91 030</td>
</tr>
</tbody>
</table>

Coefficient

Coefficient is calculated by using the equation:

\[
(1 + 0,1)^n \times t, \text{ where }
\]

\(n\) – durability life,

\(t\) – individual years of durability life

Terminal value of project = \(\sum 823\,557\,€\)

The calculation of modified internal rate of return

\[
\text{IRR}_m = \frac{823\,557\,€}{240\,000} - 1
\]

\[
\text{IRR}_m = 0,3281 = 32,81\%
\]

If the IRR exceeds the required return, the modified IRR is within the limits of required return \((i = 10\%)\) and IRR.

Payback period:

The procedure for calculating the payback period of investment project:

Identify annual after-tax profit and depreciation.

Calculation of total cash flow [5]:

Total cash flow = depreciation + after-tax profit

Calculation of cumulative cash flow (CF):

is set by mutual summation of individual cash flows in particular year (Table 4).

### Table 4: Calculation of cumulative CF

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Cash Flow [€]</th>
<th>Cumulative CF [€]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st year</td>
<td>91 030</td>
<td>91 030</td>
</tr>
<tr>
<td>2nd year</td>
<td>100 750</td>
<td>191 780</td>
</tr>
<tr>
<td>3rd year</td>
<td>120 190</td>
<td>311 970</td>
</tr>
<tr>
<td>4th year</td>
<td>135 580</td>
<td>447 550</td>
</tr>
<tr>
<td>5th year</td>
<td>103 990</td>
<td>551 540</td>
</tr>
<tr>
<td>6th year</td>
<td>91 030</td>
<td>642 570</td>
</tr>
</tbody>
</table>

Determination of the payback period of investment project [6, 7]:

\[
PBP = \left(\frac{\text{CAPEX} - \text{cumulative CF}}{\text{CF}}\right) + t \tag{4}
\]

Where:

CAPEX – capital expenditure,

CF – cash flow

\(t\) - the year in which CF is the closest to the cost of acquisition, but does not exceed it

\[
PBP = \left(\frac{(240\,000) - 191\,780}{120\,190}\right) + 2 = 2,4\,\text{year}
\]

Investment of € 240 000 will return to the company, so the payback period of the investment project is 2,4 year (Figure 3).
Profitability Index:

When calculating the profitability index, the data from Table 5 are used. Also the cash flow, discount (10\%) and discounted cash flow is taking into account. Calculation of Profitability Index:

\[ PI = \frac{464\,868}{240\,000} = 1.94 \]

Table 5 The calculation of depreciation and profit after tax to determine payback period [6]

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Gross profit</th>
<th>Income tax</th>
<th>After-tax profit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st year</td>
<td>63 000</td>
<td>11 970</td>
<td>51 030</td>
</tr>
<tr>
<td>2nd year</td>
<td>75 000</td>
<td>14 250</td>
<td>60 750</td>
</tr>
<tr>
<td>3rd year</td>
<td>99 000</td>
<td>18 810</td>
<td>80 190</td>
</tr>
<tr>
<td>4th year</td>
<td>118 000</td>
<td>22 420</td>
<td>95 580</td>
</tr>
<tr>
<td>5th year</td>
<td>79 000</td>
<td>15 010</td>
<td>63 990</td>
</tr>
<tr>
<td>6th year</td>
<td>63 000</td>
<td>11 970</td>
<td>51 030</td>
</tr>
</tbody>
</table>

Gross profit = sales growth – cost growth – depreciation (calculation is based on data in Table 1)

Income tax = 19\% of gross profit

After tax profit = gross profit – income tax

Calculation shows that the profitability index is 1.94, and it means that profitability index is greater than 1 (1.94 > 1). Company should make an investment (purchase of a new high-pressure water jet), because it ensures the required rate of return and increases the value of company.

CONCLUSIONS

Invested project advantageous for high-pressure water jet (Model SMART Board - JET). The investment was evaluated by using static and dynamic methods of evaluation of investment, specifically: net present value of the investment, internal rate of return, modified internal rate of return, payback period and profitability index.

The results show that the investment is profitable and the company is recommended to make the investment because it guarantees required rate of return, increasing the value of company and there is a presumption that the investment will be economically profitable and successful.

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REFERENCES


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