

INVESTMENTS IN REPAIR OF OUTDATED METAL FORMING MACHINES AND EVALUATION OF THIS INVESTMENTS

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Abstract: *The production of various details with deformation always wants work, accuracy and expenses. The purpose of these expenses at the beginning of the project also gives hope that these investments will return to us together with profit. In the Balkan countries, as we know, production in metal forming has stagnated. The privatization is not done so well that many metal forming factories have been returned into various supermarkets. The few remaining factories are facing various problems. Among the problems with which most of them are faced is outdated machinery which in developed countries is sophisticated.*

The purpose of this paper is to present the possibility of investment in such machineries by taking as an example a metal forming press as well as evaluating the investment project in manufacturing of these press dies (tools). These evaluation of this investment will be done using IRR method. Application of internal rate return (IRR) method sends us in terms of investment assessment and potential benefit, taking into account all project data of investment.

Key words: *Investment, metal forming machines, repair, evaluation, IRR method*

1. INTRODUCTION

Project evaluation is of particular importance. The use of the appropriate methods of assessment is also of particular importance. From the experience of life we know that private sector projects are always intended to benefit not to overlook the public sector as well. The methods used for the evaluation of private sector projects are numerous but the most widely used method is that of the IRR. Deformation process and project evaluation of this type is what will be analyzed in this paper. Manufacturing of the open die for deformation process of sink barrow as well as the costs will be analyzed using the above mentioned method. The presentation of knowledge for the assessment of the benefit during the production of the sink barrow and the process in general are introduced here.

2. THEORETICAL VIEW

The **internal rate of return (IRR)** is a rate of return used in capital budgeting to measure and compare the profitability of investments [4]. Authors [8] say that Internal Rate of Return is not, as its name suggests, a measure of the return on an investment. Internal rates of return are commonly used to evaluate the investments or projects in this case manufacturing of open die for sink barrow production. The higher a project's internal rate of return, the more desirable it is to undertake the project. Assuming all projects require the same amount of investment, the

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project with the highest IRR would be considered the best and undertaken first. A firm (private sector) should, in theory, undertake all projects or investments available with IRR- s that exceed the cost of capital. Investment may be limited by availability of funds to the firm and by the firm's capacity or ability to manage numerous projects [5]. Internal rate of return is a discounted cash flow rate of return used in capital budgeting to measure and compare the profitability of investments [4].

The main purpose of project is economic analysis to help design and select projects that contribute to the welfare of a country. The tools of economic analysis can help us answer various questions about the project's impact on the entity undertaking the project, on society, on the fisc, and on various stakeholders, and about the project's risks and sustainability [6].

The most popular indicator of the profitability of a project is, without doubt, the Internal Rate of Return [7]. Moreover, if the cash flows are multiples, there are more than one IRR, which makes its use impractical [3].

Burim Fejzaj was born on 01.08.1981. in Istog. Primary school had ended in the birthplace at the elementary school "Ndre Mjeda" in Rakosh. Burim completed secondary school in Istog at SHMT "Mithat Frashëri" in the technical direction of the machinery. He started engineering studies in 2000/2001 at the University of Prishtina - Faculty of Mechanical Engineering which he completed in 2005. Since academic year 2005/06 he has been employed as a professor of machanical field at SHMT "Mithat Frashëri" in Gurrakoc, Istog. Master studies he had enrolled in 2012/2013 at the University of Prishtina "Hasan Prishtina" at the Fakulty of applied science, and finished on 24.07.2014. In the academic year 2017/2018 he has enrolled doctoral studies at the University of Montenegro, Faculty of Machinery - direction - Production Machinery.



He has over a thousand hours of professional training in the field of education and has been the CNC machine trainer in various projects. He possesses good skills for different software and speaks six foreign languages.

2.1. Formulas and calculation

According to the definition of the IRR for somebody to be able to estimate its precise height, as long as we refer to a specific investment project, we should solve the equation [5].

$$NPV = \sum_{t=0}^{t=T} \frac{R_t}{(1+i)^t} - \sum_{t=0}^{t=T} \frac{C_t}{(1+i)^t} \quad (2.1)$$

Where: R_t and C_t - the revenues and costs respectively per year;

T - Investment lifetime;

i - Discount rate.

The period is usually given in years, but the calculation may be made simpler if is calculated using the period in which the majority of the problem is defined (e.g., using months if most of the cash flows occur at monthly intervals) and converted to a yearly period thereafter. Any fixed time can be used in place of the present (e.g., the end of one interval of an annuity); the value obtained is zero if and only if the NPV is zero. The equivalent value can be calculated using any of the three methods mentioned above. The interest rate that is obtained is called IRR. Using the formula for the present value, the IRR is interest i' %, and from which we can take the yield in another form [1].

$$\sum_{k=0}^N R_k(P/F, i', \%, k) = \sum_{k=0}^N E_k(P/F, i', \%, k) \quad (2.2)$$

Where are:

R_k - net revenues or saving for k – years;

E_k – net expenditures including any investment cost for k – years;

P – Present value of money;

F – Future value of money;

k – number of years.

Another way to determine the internal salary for the alternative is to determine i' so its present value is zero. Then the IRR can be determined from the equation.

$$\sum_{k=0}^N R_k(P/F, i', \%, k) - \sum_{k=0}^N E_k(P/F, i', \%, k) = 0 \quad (2.3)$$

R_k - net revenues or saving for k – years;

E_k – net expenditures including any investment cost for k – years.

A current value graph, for an alternative to the investment cost in the present ($k = 0$) and a series of positive cash payments in the period N , in the function of the interest rate of return as headline 1 in which $Pw = 0$ determined i' and then its named internal wage rate for that project.[1]

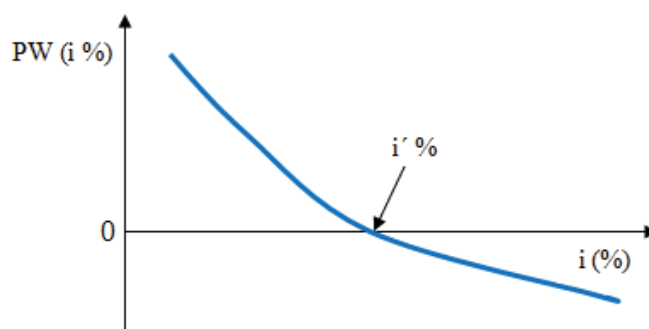


Figure 1. Pw depending on interest rates

The Investment Balance Diagram is another way in which the IRR can be presented.

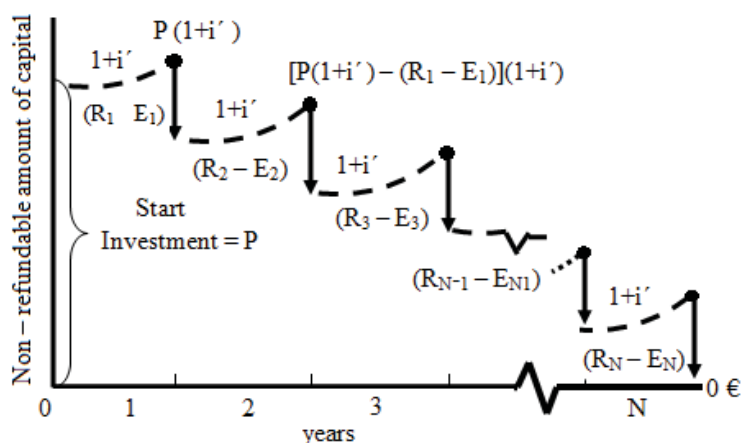


Figure 2. Investment diagram showing the IRR

3. PRACTICAL PRODUCTION PROCESS WITH DEFORMATION OF SINK BARROWS

Deep drawing materials are easily shapeable materials, because of their high ductility. Aluminum alloy materials are classified in the deep drawing materials group because they are easily shapeable. In order to increase the strength, materials are made an alloy by adding some chemical additives [2]. But here it is necessary to achieve the precision of the metal forming details, especially the bigger details.

3.1. Practical conditions of production in factory:

Company name: Interested to invest “**Company A**”

Number of workers – 2, Press machine from 400 tons, Material – plates of metal (ST – 7). The calculation is made to evaluate the accuracy that will be gained with the new tools. Analysis and evaluation will be made only for this purpose and will not include other parameters.



Figure 3. Press and open die tools, final shape

Milan Vukčević was born in 1954. Primary and secondary school he finished in Podgorica. After that, Mechanical faculty – University of Montenegro, as first in class. Master degree he finished at Mechanical faculty – University of Belgrade. PhD thesis he worked at University Lomonosov - Moscow and finished in 1989. University career he began in 1978. He passed through all stages of university career - from assistant to full professor, and The Dean of Mechanical Faculty for two mandates.

His areas of scientific work in his 40 years-long university career are: Applied mechanics, Technology, Engineering economy, Standardization.

He attended the following abroad: 1980/1981, 6 months at institute STANKIN in Moscow; 1982, 2 months at Polytechnic in Lublin- Poland; 1987/ 1988, 14 months at University Lomonosov in Moscow; 1992, 8 months at University in Birmingham – England (Postdoctoral fellowship of European Community).

Professional work: has published 4 books, 6 course textbooks. more then 230 papers at Conferences and Journals in 10 countries. He has worked on more then 20 projects, as manager, or member of a working team.

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3.2. Data of project:

The data for the project should consider these ranked factors.

Duration of project – 4 years, Production for hours 20 pieces – production for day (8 x 20) = 160. Production days (365 – 115) = 250 days, Total production days for 4 years excluding holidays = 1000 days. The purpose of this project is to invest in the manufacturing cost of new tools for sink barrow in order to achieve accuracy and profit.

4. APPLICATION OF (IRR) METHOD IN EVALUATION OF MANUFACTURING PROCESS OF OPEN DIE FOR SINK BARROW IN METAL FORMING

However use of the IRR method is characterized from several problems. Now from the upper date the investment in project is 6500 € and the profit for four years 3367.5 €, and for four years the company will have market value of 1580 €. Annual costs will be 1625 €, the company is willing to play for a project that generates revenue of 11% per years, before tax on profits, on total investment.

<i>Project data</i>	<i>Cost and duration</i>
Investment for project	6500 €
Life time of project	four years
Market value of the project in the end	1580 €
Interest value of incomes for 4 years	3367.458
Annual income	2466.864 €
Annual costs	1625 €

Table1. Project date

4.1. Evaluation process

Project evaluation will be based on the cash flow of money.

$$P_w = 0 = -6500 \text{ €} + (841.864 \text{ €}) (P/A, i'\%, 4) + 1300 \text{ €} (P/F, i'\%, 4), i'\%=?$$

For the investment assessment we will use the 6% variation, which means that the first rate will be 7 % and the second 13%.

For $i' = 7\%$: $P_w = -2443.05 \text{ €}$

For $i' = 13\%$: $P_w = -3026.85 \text{ €}$

Percentage	7%	8%	9%	10%	11%	12%	13%
Pw (€)	-2443.05	-2550.29	-2653.28	-2752.24	-2847.37	-2938.85	-3026.85

Table 2. Eligibility for profit-based assessment

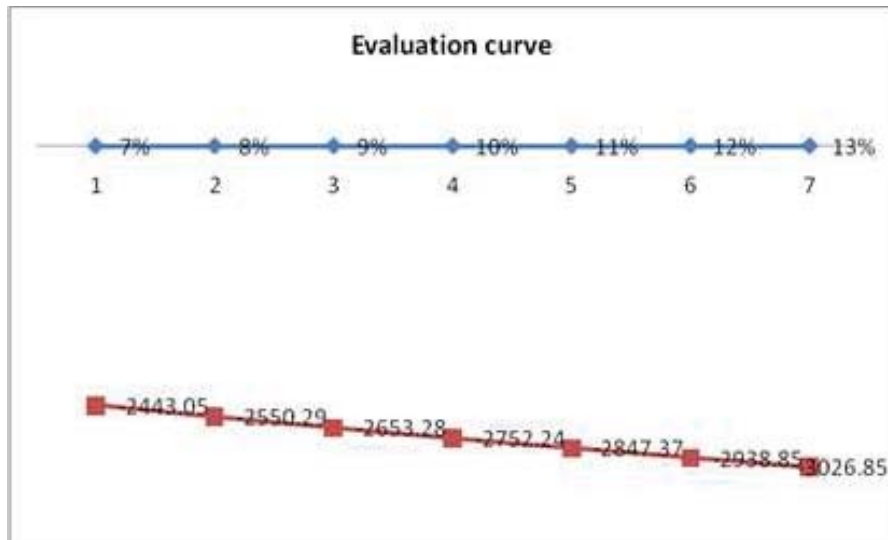


Figure 4. Evaluation curve

The assessment of economic reasonability for machining parts of press machine should be seen in a sphere in which the benefits are to be in longer periods. Project evaluation for more years (10 years) but with the same percentage is presented down.

$$P_w = 0 = -6500 \text{ €} + (1195.624 \text{ €}) (P/A, i', 10) + 650 \text{ €} (P/F, i', 4), i' = ?$$

Percentage	7	8	9	10	11	12	13
Pw (€)	2227.987	1823.808	1447.67	1097.193	770.224	464.822	179.227

For $i' = 7\%$: $P_w = 2227.987 \text{ €}$

For $i' = 13\%$: $P_w = 179.227 \text{ €}$

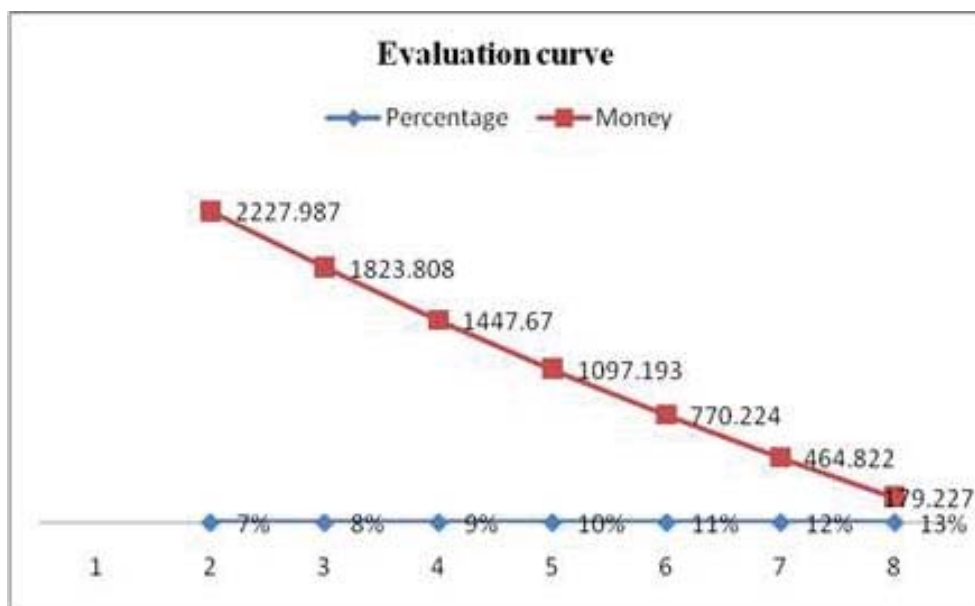


Table 5. Eligibility for profit-based assessment

5. CONCLUSION

The values obtained during the project evaluation for the manufacturing of open dies tool for production of sink barrow give us an important insight understanding. The tools are of particular importance as they revitalize this machine to make a production. The company's investment, which aims at invest money for the four-year period is not economically feasible. It is seen from the diagram that the company for such investment will work with loss so it is not worth investing so much money in order to get it for four years. But if the same project is invested the same amount but lifetime of project is 10 years can be called a good investment and from diagram 5 we can see that investing in such a project would be appropriate for the company as the work would be functional from the other hand there would be no risk even though the profit would be lower. So we can say that such investments in repay of outdated metal forming machines for short periods it is not good but for longer period is appropriate.

6. LITERATURE

- [1] Vukcevic M., Inzinjerska ekonomija, Universitet Crne Gore –Masinski fakultet, Podgorica 2012
- [2] Karali M., Examination of the strength and ductility of aa-1050 material shaped with the multi-stage deep drawing method, DOI: 10.2478/v10172-011-0026-8, volume 56/2011
- [3] Nobrega, Marcos. The limits and the application of Internal Rate of Return (IRR) in the Concessions and Public-Private Partnerships (PPPs) in Brazil (2017).
- [4] Project Economics and Decision Analysis, Volume I: Deterministic Models, M.A.Main, Page 269
- [5] Athanasios Cristodoulou "The internal rate of return problems and manners of solution, school of Foresll and rural Environment, Thessaloniki, Greece 1996
- [6] Pedro Belli. Jock Anderson, Howard Barnum, John Dixon, Jee-Peng Tan" Handbook - economic analysis of investment operations" January, 1999
- [7] Kelleher, John e MacCormack, Justin. Internal Rate of Return: A Cautionary Tale. The McKinsey Quarterly. October 20, 2004.
- [8] Jonatan Langthon, The False Reinvestment Assumption and the Propagation of Incorrect Ideas, 2010

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Present position:
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After graduating he started work at the University of Montenegro - Faculty of Mechanical Engineering 01/09/1992. After taking his Masters degree he was appointed assistant for the subjects: Metal Forming, Quality Control and Mechanical Materials. After taking Ph.D. degree he was appointed assistant professor for the subjects: Metal Forming, New technologies, Projecting of technological processes at Faculty of Mechanical Engineering, and Technique with informatics at philosophical faculty.

His specialty is bulk forming processes and numerical FEM simulations of the next processes like hot and cold forging in open and closed dies, hot and cold extrusion, upsetting.

He has published 57 scientific papers at conferences in country and abroad, and in domestic and foreign magazines. He participated in 7 scientific research and professional projects.

Other skills:

- *Finite Element Method (DEFORM, EESY-FORM, ABACUS)*
- *ProEngineer, AutoCAD, Corel*
- *Turbo Pascal, C++, MATLAB*
- *Microsoft Office: Word, Excel, PowerPoint*