



<sup>1</sup>Brigitta ZSÓTÉR, <sup>2</sup>IstvánTÚRI

# ECONOMICAL CALCULATIONS RELATED TO A SMOKING TECHNOLOGY INVESTMENT OF A PORK PROCESSING PLANT

<sup>1-2</sup>University of Szeged, Faculty of Engineering, 7 Mars square, 6724, Szeged, HUNGARY

**Abstract:** Nowadays, pig farming, pork production and processing are in a more and more problematic situation. Considering it, it is getting more and more demanding for an entrepreneur to start and run a pork processing plant in a way to stay economical. The smoking system is a very important part of a plant like this, which has effect not only on the taste and smell of the processed meat but also on its lasting, too. In our research, we completed the economical calculations of a smoking system like this, calculating the payback time, the discounted payback time, the net present value, the internal interest rate and the profitability index. We examined them at the output levels of 20, 40, 60, 80 and 100%. After the completion of these calculations, it can be concluded that the investment can be considered as profitable from the level of 60%.

**Keywords:** investment, payback time, discounted payback time, present net value, internal interest rate, profitability index

## 1. INTRODUCTION

Meat consumption of the world has increased twice as much as the population in the last 50 years. It means that it grew from the former 65 million tons to 300 million tons. Growth in population, urbanization, development of both the food-processing and service sectors indicate the further rise in meat consumption [1]. Pork production has increased by 2% as annual average since 1990. 37% of the present global meat production is pork, 35% is poultry, 5% is sheep, while 23% is beef [1].

The mentioned plant would primarily process pigs, the activity of which can be divided into two parts. These are the slaughter of pigs and then processing the raw materials.

Preservation procedures are practical procedures by the use of which food deterioration can be prevented. Taking it from another aspect, they hinder and prevent harmful changes which would lead to the quality deterioration of food [2].

One of the oldest ways of preservation of meat products is smoking. Apart from longer shelf life and reaching the health quality, formation of sensory quality (smoked taste, friability, colour) is an important factor when applying smoking [2].

Enterprises have to improve continuously in order to survive in the constantly changing market environment [8]. The necessity of buying a smoking system directly results from the foundation of the food-processing plant. This plant demands such a system so that it can provide a wider range of products for consumers.

We assume that on the basis of the given tender the investment will be economical. By means of the economical calculations related to the smoking technological device chosen by the entrepreneur, it can be seen whether it will be worth realizing the investment or not, so to ascertain the relevance of our hypothesis we will complete these calculations.

## 2. MATERIALS AND METHODS

The question is frequently there for the enterprises where to invest their capital. The investment is an economical activity the profit of which pays off indirectly, only in the future [3]. It has two types. One of them is the investment, while the other is the financial investment [3].





Decisions on investment are long-run decisions, they influence the company and its life essentially, they induce significant expending. Their profitability and risk cannot be evaluated accurately. A wrong investment decision can endanger the market position of a company or it can even be fatal to it [4].

Most decisions on investment are based on financial calculations which can be simpler or more sophisticated. However, regarding any financial calculation, we have to assume the following in every case:

- ≡ cash in-, and outflows happen always at a certain time, typically at the end of the year.
- ≡ the devices are immediately got into operation.
- ≡ the risk of all future cash flows is commensurable [5].

By means of investment calculations the projects can be assessed according to the company goals. Only the goals which can be expressed in money can be considered in a calculation like this [5].

Calculations on project investments can be carried out in two aspects. In case of static calculations it is not important when and how big cash flows are formed during the operational time, so they do not take the time value of cash in consideration. Nowadays, this calculation method is used only in dynamic calculations, as an additional auxiliary calculation. The most well-known of these static calculations is the payback time [5].

Payback time is a period of time which lasts from the initial investment cash outflow until the sum of the periodical cash inflows reaches the break-even point with the initial outflow. Or, if we explain it more simply, how much time it takes until we recoup the invested money. It is also called the return time of the capital [6].

$$\text{Payback time} = \frac{\text{Sum of the initial investment}}{\text{Expected annual net cash flow}} \quad (1)$$

The discounted payback time is a variation of payback time. It includes the benefits of both payback time and dynamic indicators. It shows that from the aspect of net present value, when the investment is returned, or how many years' discounted income it takes to get returned [5].

$$\text{Discounted payback time} = \frac{\text{Initial capital investment}}{\text{Annual net cash flow}} \quad (2)$$

$$\text{PVIFA} (r \%, t \text{ year}) = \frac{\text{Original capital investment}}{\text{Annual net cash flow}} \quad (3)$$

The net present value is the sum of cash flows discounted at a given rate in a determined period [7].

$$\text{NPV} = -C_0 + \sum_{t=1}^n \frac{C_t}{(1+r)^t} = -C_0 + \text{PV} \quad (4)$$

where: t - time of the cash flow, n - total cash flow time, r - interest rate,  $C_t$  - net cash flow at t time,  $C_0$  - initial cash flow, PV - present value (Source: Own edition)

If the net present value is positive, the initial cash flow is smaller than the future income, so the investment increases the company's value and thus the project has to be accepted. If the net present value is negative, the initial capital investment was bigger than the expected future income, so the investment should be refused. If the net present value is zero, the project has no effect on the enterprise, so its acceptance does not induce either advantages or disadvantages [5].

The internal payback rate is an internal interest rate which shows that how much expected yield a unit of investment results. It is a discount rate, at which discounting the cash flows from the investment, their total present value is zero (NPV=0) and where the capital investment returns only once during the investment period [4].

$$-C_0 + \sum_{t=1}^n \frac{C_t}{(1+\text{IRR})^t} = 0 \quad (5)$$

If the internal payback rate is bigger than the expected yield, the investment has to be accepted, it can be realized. Then, the net present value is positive. If the internal interest rate is smaller than the expected yield, the project has to be refused since it will be in the red. In this case the total discounted value of the cash flows coming from the investment is less than zero. If the internal interest rate is equal with the expected yield, it is indifferent whether the investment is accepted or refused [5].

The profitability index shows how much of a profit unit can be expected after an invested capital unit. This indicator is the ratio of the present value of the operational cash flow and the present value of the initial cash flow [6].

$$\text{PI} = \frac{\sum_{t=1}^n \frac{C_t}{(1+r)^t}}{C_0} \quad (6)$$

If the profitability index is bigger than 1, it means that the investment of 1 forint brings about a return of more than 1 forint, so the investment can be realized. If the index is less than 1, it means that the investment of 1 forint does not bring about a return of 1 forint, so the investment should not be





accomplished. In case the profitability index is exactly 1, it is indifferent whether the investment is accepted or refused, since the investment of 1 forint returns 1 forint pay-off [5].

### 3. RESULTS

To complete the economical calculations, it is necessary to know the revenues and expenditures created under the operation of the device, and the cash flows during useful life. We subtracted the annual expenditure and amortization from the annual revenue, from which we calculated the corporate tax, which then we subtracted, too, after that we added to that the amortization level and finally, we got the annual net cash flow. We carried out my calculations by means of the Microsoft Excel programme. Since we are comparing the device at utilization of 20, 40, 60, 80 and 100%, we are calculating with these values as follows. An annual net operational cash flow of 2 776 667.69 Fts ( $\approx$ 8 956.99 EUR) belongs to the utilization of 20%, 2 862 179.31 Fts ( $\approx$ 9 232.84 EUR) to that of the 40%, 3 934 045.67 Fts ( $\approx$ 12 690.47 EUR) to the 60%, 4 482 841.16 Fts ( $\approx$ 14 460.78 EUR) to the 80% and 5 293 172.08 Fts ( $\approx$ 17 074.75 EUR) to the output level of 100%.

The payback time of the 20% utilization is 6.27 years. The entrepreneur wants the investment to pay off within 7 years. It also means that the investment has a smaller risk than expected, since it is paid back in shorter time than the investor expected. The payback time is less than this so on the basis of this indicator, we would recommend this return level. The discounted payback time shows that the investment will be paid back in the 9th year. We do not recommend this output level on the basis of this indicator because it is higher than the expected 7 years. The net present value is the most frequently applied method, it is the main criteria for making decision on the feasibility of an investment. The  $r=0.08$ , as the expected yield of projects with similar risks is 8%. At the present level, the NPV -2 950 260.50 Fts ( $\approx$ -9 516.97 EUR). We do not recommend this utilization level because the net present value is negative, so the operation of the device would be in the red. By calculating the internal payback rate we could see how much expected yield an investment unit may bring about for the entrepreneur. At this level the internal interest rate is 3%. A project can be accepted if its internal interest rate is more than the expected yield of the project. The expected yield here is 8%, which is higher than 3%, so the project cannot be accepted according to this indicator. The return rate shows that how many forints of income the investment of 1 Ft can result, which is 0.83 here. Thus, we can see that one unit of our capital investment does not bring about one unit of profit, since the return rate is only 0.83 - 1 forint investment results only 0.83 Ft. As it is less than 1, we cannot recommend this utilization level, either, because it leads to loss-making.

We have made the economical calculations in case of the output level of 40%. The payback time turned to be 6.08 years. According to this indicator the annual cash flows would balance the initial cash flow in shorter time than 7 years, also the investment risk is lower than what the entrepreneur expected. That is why we recommend to accept this utilization level on the basis of this indicator. The discounted payback time is 9 years at this level which is not suitable from the economical point of view. The net present value - 2 505 055.34 Fts ( $\approx$ -8 080.82 EUR). Since the net present value here is lower than 0, it does not increase the value of the enterprise. As it is about a method used for the assessment of mutually exclusive projects, we would not recommend to accept this level, producing sufficiently enough loss for the enterprise throughout the years. The internal interest rate is 4% which is exactly the half of the expected 8%, which means that the investment can perform only the half of what the entrepreneur would expect. For the yield of the device does not reach the level of the expected yield, we do not justify the acceptance of this operation level. The payback rate at the utilization level of 40% is 0.86. It means that after 1 invested forint 0.86 forint can be expected, so it does not bring about 1 forint revenue, the invested capital does not produce at least the same profit, so the investment does not pay off. We can see that this measure forecasts loss for the investor, that is why we do not urge this utilization level. On the basis of indicators we would not suggest the utilization level of 40% either because the investment produces loss at this level, too.

The payback time is 4.42 years at the output level of 60%. We can see that the payback time is shorter at this level than what the entrepreneur expected, therefore the investor can accomplish in a shorter time that his/her solvency can return to the initial state before the investment and the initial expenditure will be refunded. From this point of view we recommend the realization of this utilization level. The cumulated sum of the discounted revenues reaches the invested sum in the 6th year. As this index number is more accurate and more reliable than the payback time, we can use it for the preparation of certain investment decisions more certainly. The investor determined 7 years as a





maximum payback time, so regarding this indicator we back the utilization level of 60%. At this level the NPV is 3 075 477.58 Fts ( $\approx 9\,920.90$  EUR). This number is higher than 0, thus we can see it is the first operation level which would bring about profit after the 7th year. So, in case of mutually exclusive projects, like the present situation, this application level turned to be better than the two previous ones. As the net present value is positive, we would favour this production level, since in case of positive net present value we can reach profit. The internal interest rate is 11%. It is higher than the expected 8%. It also supports what we could see in the calculation of net present value: the investment will be profitable. The yield provided by investments of the same risk is smaller, so we recommend its realization. The payback rate of this level is 1.18. As it is bigger than 1, the investment produces profit at this utilization level. It means that the investor's money gains profit for him/her, in addition to the payback. As it produces profit, we recommend the output level of 60% from the aspect of payback rate, too.

The payback time related to the 80% is 3.88. It is almost the half of the expected 7 years, thus the invested sum will return at about half-time of the investment, and after that the entrepreneur would expect some profit, too. It is less than the 7 years given by the entrepreneur, so we uphold this output level. On the basis of the cumulated sum of the discounted cash flows the investment will pay off in the 5th year, which means that the invested capital will return in the 5th year. It is shorter time than the 7 years specified by the investor, so I find the production level acceptable. According to this calculation the net present value is 5 932 709.99 Fts ( $\approx 19\,137.77$  EUR), so it is positive. As the positive net present value means profit, which indicates that by the end of the 7th year the investor will have reached a profit of almost 6 million forints, regarding this investment. Taking it into consideration, we would recommend the realization of the investment at this level. Having made the proper calculation, we can see that the internal interest rate is 17%. It is almost twice as much as the expected 8% yield. It can be concluded from the index number that the investment will be profitable, it predicts a positive net present value. We can see that the internal interest rate of the 80% utilization level is more than the expected 8%, so we find this operation level acceptable. The payback rate of the 80% utilization level is exactly 1.34 which means that 1 forint investment brings about 1.34 Fts revenue for the entrepreneur. Thus, we back the realization of this operation level on the basis of this indicator.

We can see that the investment pays off very quickly at 100% output level, within 3.29 years. It means, that the invested capital returns within the shortest time at this utilization level, also the company can preserve its liquidity the most easily at this operation. It is much lower than the 7 years determined by the investor. It can be experienced that the invested capital pays off within the shortest time at this output level, so we recommend this level most. On the basis of the cumulated sum of the discounted net present values the investment pays off in the 4th year. We got a similar result regarding the discounted payback time, so it is the fastest recovery rate. It means that the investor can reach the invested sum at the half of the expected payback time, so we recommend this output level for him/her. Regarding the net present value, we obtained the most positive result of the output levels. It can be seen that the net present value is positive, 10 151 592.65 Fts ( $\approx 32\,747.07$  EUR). It means that the investor can expect half times more of the invested capital as the sum coming from the investment. Thus, we can state that the investment will produce profit in the expected period of time, also it will increase the enterprise's value. This level resulted the highest net present value of the five output levels, so we recommend to realize this operation level most. The full utilization results 24% internal interest rate. It is more than three times more than the expected 8%, so we can foresee three times more yield than what is expected in case of investments of similar risk. Thus, we recommend the 100% utilization of the investment operation. The payback rate is 1.58, which means that after 1 invested forint, we can suppose 1.58 Ft revenue. So, the investor can expect more than 50% profit provided the device is utilized at this level. All in all, we advocate the full utilization of the smoking system from this point of view, too.

#### **4. CONCLUSIONS**

As a conclusion, we can see that the economical calculations can give accurate results to make decision in connection with an investment. Apart from the static calculation which we do not use because of its inaccuracy. Calculating the payback times, we could experience that the investment will pay off within the expected time at each 5 output levels. However, considering the time value of cash flows we could get a much more accurate picture of the pay-off. On the basis of this indicator it can be concluded that neither the 20% nor the 40% output level are appropriate for the return of capital investment within the expected time, but in case of the other 3 levels it is acceptable. In case of the net present value, regarded as the first criteria, it can be seen that the net present value increases together with the output





level. Now that we are examining 5 output levels, its calculation is very advantageous, since this method is perfect to compare mutually exclusive projects. While the 20% level resulted a negative NPV, the 60% positive, and with 100% utilization the entrepreneur can hope a more than 150% revenue as compared to the invested capital. Regarding the internal interest rate we can experience that a higher output level results in a higher internal interest rate. While at the lowest level we can calculate only 3% revenue, it is 24%, which is 8 times more, at the highest level. The return rate shows a result similar to the 3 previous indicators. 1 forint would produce only 0.83 Ft revenue at the lowest output level, while the highest one almost doubles it: 1.58 Ft. We can conclude that there are significant differences between the return rates of the different output levels. We can expect 0.85 Ft profit from the 20% output level, 1.18 Ft from the 60%, 1.34 Ft from the 80%.

All in all, we can state that comparing the 5 production levels by means of the 5 economical indicators, the 100% level is the most profitable one. In case of both the payback time and the discounted payback time we got the shortest period here. Also the highest one, regarding the internal interest rate. Observing the return rate, we can say that the entrepreneur can hope the highest revenue after each of his invested forint in this case. The calculation of the net present value supports these statements, since it had the highest value there. However, we must add that the full utilization of the operation is followed by relatively high expenses. If the entrepreneur is not liquid enough, this high expenses may provoke the fall of the business. Considering all, the 60% of the 5 examined output levels might as well be enough, since it can bring profit for the investor. Summing up, if the entrepreneur wants to obtain the highest profit, we would recommend the 100% utilization, but if he/she wants to preserve a sure liquidity, it is sufficient to apply a lower output level.

#### Acknowledgement

This research has been supported by the Ministry of Human Capacities, **Human Capacities Grant Management Office** and the National Talent Program (Proj. No NTP-HHTDK-017-0004).



#### References

- [1] G. Novotniné Dankó, J. Popp, P. Balogh, A. Nyíri, I. Nagy, Sz. Kusza, G. Rozgonyi, Cs. Szabó, Zs. Benedek, Z. Zomborszky, Cs. Juhász, A. Nagy, Sz. Metzger, Sertéstenyésztés, Szaktudás Kiadó Ház Zrt., Budapest, 2015
- [2] T. Kanyó, J. Kasza, Tartósfőipari technológia I., FVM Vidékfejlesztési, Képzési és Szaktanácsadási Intézet, Budapest, 2007
- [3] E. Katits, Pénzügyi döntések a vállalat életciklusában, KJK-KERSZÖV Jogi és Üzleti Kiadó Kft., Budapest, 2002
- [4] É. Pálkó – M. Szabó, Vállalati pénzügyek, Typotex, Budapest, 2008
- [5] Vánné Illés, Vállalkozások pénzügyi alapjai, SALDO Pénzügyi Tanácsadó és Informatikai Zrt., Budapest, 2007
- [6] I. Bélyácz, A vállalati pénzügyek alapjai, Aula Kiadó, Budapest, 2007
- [7] R. Cinnamon, B. Helweg-Larsen, How come you don't understand your account? – The essential guide to financial management, 2002, In: G. Szász, A vállalkozás pénzügyi folyamatainak megértése: nélkülözhetetlen útmutató a pénzügyi menedzsmenthez, Alexandra Kiadó, Pécs, 2005
- [8] J. Tobak, A. Nábrádi, A vállalati működést befolyásoló tényezők összehasonlító elemzése a hagyományos és a családi tulajdonú vállalatok esetében, In: K. Takácsné György, Innovációs kihívások és lehetőségek 2014–2020 között: XV. Nemzetközi Tudományos Napok, 1704 p., Konferencia helye, ideje: Gyöngyös, Magyarország, 2016.03.30–2016.03.31., Gyöngyös: Károly Róbert Főiskola, 2016. pp. 1545–1552

ANNALS of Faculty Engineering Hunedoara  
– International Journal of Engineering

copyright © UNIVERSITY POLITEHNICA TIMISOARA,  
FACULTY OF ENGINEERING HUNEDOARA,  
5, REVOLUTIEI, 331128, HUNEDOARA, ROMANIA  
<http://annals.fih.upt.ro>

