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ANALIZA STROŠKOV IN KORISTI V PRIDELAVI IN PREDELAVI MLEKA SANSKE KOZE

COST - BENEFIT ANALYSIS OF PRODUCTION AND PROCESSING OF SAANEN GOAT MILK

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The purpose of the investment projects is goat milk production and processing of produced milk into semi-hard cheese. To get the highest possible quality and quantity of products, thus the highest profit, it is necessary to respect factors which influence production (choosing the breed, choosing livestock within the breed, proper feeding, proper housing, controlled reproduction, healthcare of animals, etc.). The goat dairy farm has 500 does with average lactation of 730 l per doe and the cheese factory has capacities big enough to process all the milk produced there. The main goal of this master thesis was to answer whether the investment in projects (goat dairy farm and cheese factory) is financially feasible. Cost-Benefit Analysis (CBA), as a basic methodological approach, gave the answer to this question. All costs and benefits of the projects were determined and evaluated. In case of dairy goat farm, Net Present Value (NPV) is 334.227 € and Internal Rate of Return (IRR) is 21.48% and it is higher than the discount rate (5.5%). The second project, cheese factory, also has positive NPV (308.668 €). IRR (22.31%) is higher than the discount rate (5.5%). Investments in both projects are financially feasible. Within CBA sensitivity analysis was done and investments were evaluated in terms of financial security. Sensitivity analysis was done in a way that NPV, IRR, Profitability Index (PI) and Discounted Payback (DP) were calculated in case of different scenarios, where there were changes in one of the investment variables. These changes include changes of (+/- 10% and 20%) in prices of the product (milk and cheese) and investment costs (dairy goat farm and cheese factory). Both projects are most sensitive to changes in prices (milk price change +/- 10%, NPV changes by +/- 70.98% and cheese price change +/- 10%, NPV changes by +/- 111.67%). To get the answer if the investment in projects is financially feasible, sensitivity analysis was done in which the increase in investment costs by 10% (both projects), decrease in milk price by 10% (dairy goat farm) and decrease in milk price and cheese price by 10% (cheese factory) were taken into account. In case of dairy goat farm, NPV is positive (51.751 €), despite changes in investment costs and milk price. IRR is 7.76%. In case of cheese factory, NPV is also positive (168.392 €), despite changes in investment costs and milk and cheese price. IRR is 13.8%. Based on these information, both projects are financially feasible.

Key words: financial analysis, CBA, NPV, IRR, goat milk, goat cheese

CH: VII, 65 pp., 19 tabs., 2 figs. 2 graphs, 36 refs.
Analiza stroškov in koristi v pridelavi in predelavi mleka Sanske koze

Namen investicijskih projektov je pridelava mleka in predelava mleka v poltrdi sir. Z namenom pridobitve najvišje možne količine in kvalitete pridelka, torej z namenom najvišjega dobička, je nujno potrebno vpoštovati faktorje, ki vplivajo na pridelavo (izbor pasem, izbira živali znotraj pasme, pravilna prehrana, pravilno ohišje, pravilno parjenje, skrb za zdravje živali itd.). Kmetija mlečnih koz zavzema 500 koz povprečne mlečnosti 730 l/kozo. Tovarna sira ima dovolj kapacitet, da predela celotno količino pridelanega mleka. Glavni cilj magistrske naloge je odgovoriti na vprašanje ali je investicija v projekt (kmetija mlečnih koz in tovarna sira) finančno upravičena. Odgovor na to vprašanje nam poda analiza stroškov in koristi (CBA), ki jo uporabimo kot osnovni metodološki pristop. Vsi stroški in koristi projekta so določeni in ocenjeni. V primeru kmetije mlečnih koz njena NSV (neto sedanja vrednost) znaša € 334.227. Njena ISD (interna stopnja donosa) pa dosega 21,48% in je višja od diskonte stopnje (5,5%). Znotraj drugega projekta ima tovarna sira prav tako pozitivno NSV (308.668 €). ISD (22,31%) je višja od diskonte stopnje (5,5%).

Investiciji v oba projekta sta finančno upravičeni. Znotraj CBA je narejena analiza občutljivosti. Ocenjena je tudi finančna varnost investicij. Analiza občutljivosti je narejena tako, da so izračunane vrednosti NSV, ISD, indeks dobičkonosnosti in diskontrirana doba vračila v primeru različnih scenarijev, kje so bile spremembe v eni od investicijskih spremenljivk. Te spremembe vključujejo spremembe (+/- 10% in 20%) v cenah pridelkov (mleko in sir) in investicijskih stroških (kmetija mlečnih koz in tovarna sira). Oba projekta sta najbolj občutljiva na spremembe v cenah (sprememba cene mleka +/- 10%, NSV se spremeni +/- 70,98%; sprememba cene sira +/- 10%, NSV se spremeni za +/- 111,67%). Z namenom pridobitve odgovora o finančni varnosti investicije, je narejena analiza občutljivosti, v kateri je upoštevana rast investicijskih stroškov za 10% (pri vsakem projektu posebej), zmanjšanje v ceni mleka za 10% (kmetija mlečnih koz) in zmanjšanje v ceni mleka in sira za 10% (tovarna sira). V primeru kmetije mlečnih koz je, kljub spremembam investicijskih stroškov in v ceni mleka, NSV pozitivna (51.751 €). ISD je 7,76 %. V primeru tovarne sira je, kljub spremembam investicijskih stroškov in v ceni mleka ter sira, NSV tudi pozitivna (168.392 €). ISD je 13,8%. Na podlagi teh informacij, sta oba projekta finančno upravičena.

Ključne besede: finančna analiza, CBA, NSV, ISD, kozje mleko, kozji sir

OP: VII, 65 s., 19 pregl., 2 sliki. 2 grafi, 36 virov literature.
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1 INTRODUCTION

1.1 Problem description

Through history, goats have been used for different purposes (milk, meat, skin, fiber) and that practice has continued until today. Yet, (Dubeuf, Morand-Fehr and Rubino, 2003) observe that the goat sector has been significantly less supported publicly and academically than other animal production sectors like cow’s milk, beef meat, poultry, pigs or horses. However, since dietary properties of goat’s milk have good influence on human health, they also have positive effects on global demand. During the last 20 years, the number of goats around the world increased (by about 60%), not only in the low-income countries (75%), but also in those with high (20%) or intermediate incomes (25%) (Morand-Fehr et al., 2003). In Slovenia, there were 22,283 goats in 2014, more than in 2013 (21,240 goats), but less than in 2007 (28,228 goats) (http://www.stat.si).

Accordingly, at the present time, goat farming appears to be very well adapted to meet the social demands concerning product quality, animal welfare and environmental respect in industrial countries (Morand-Fehr et al., 2003).

There are certain indicators that can be taken into account in evaluating the potential of a market for goat dairy products. The first two indicators could show us what volumes the market could accept and at what prices. They would have to consider the following:

- The potential capacity of the market according to the population standard of living.
- The local price of cow’s milk (crude milk or powder).
- The acceptance for goat’s milk according to cultural habits (Dubeuf, 2005).

In the example of the UK, the processors of goat’s milk can be roughly divided into three groups. There are those who keep a small number of goats as a hobby and who process small amounts of milk, mainly into cheese which is sold to help finance their hobby. Then there are the small scale processors, often producer/processors who make moderate amounts of product which will be mainly sold through specialty shops to the catering
industry and/or retailed by the processors themselves and finally there are the large scale processors who will sell the largest part of their output through supermarkets or retail multiples. Between 15 and 20 million l of goat’s milk is processed for consumption each year. This will be divided approximately into cheese 60%, drinking milk 20%, yoghurt 10% and the rest includes butter, cream and ice-cream (Mowlem, 2005).

The products manufactured by the processors will be also influenced, to some extent, by the scale of their operation. The larger processing dairies tend to produce a smaller range but much larger volumes and vice versa. The one thing that does not seem to have a big impact on sales of goat dairy products is price. The two markets, health and specialty foods, do not seem to be price sensitive (Mowlem, 2005).

At the beginning of the thesis, critical factors are shown that we have to respect in order to get high quality products and high productivity, such as choosing livestock, feeding, housing, reproduction, milking, healthcare of animals, etc.

Next, an investment project for a dairy goat business (500 Saanen goats) which lasts 11 years is analyzed. This analysis provides the information about investment, fixed and variable costs in detail and sales revenue from milk, but also other products. The same analysis is used for cheese production (facilities for semi-hard cheese production). After that, using dynamic methods of investment evaluation – Net Present Value, Internal Rate of Return, discounted payback and profitability index, we get the information about financial effectiveness of the project. These methods help us in decision-making process, providing valuable information about financial status of investment in the future.

Finally, using sensitivity analysis, information was obtained on how cost increase and/or sales revenue decrease impact NPV and IRR, which helps us to evaluate risks of this investment project.
1.2 Thesis objectives

The objectives of the thesis are as follows:

- To determine scientifically best ways to choose breed, livestock, housing of the livestock, feeding strategy, milking process, reproduction process, to provide healthcare and to produce semi-hard cheese in order to achieve high quality of production and high productivity;
- Total costs analysis of Saanen goat dairy (milk production and cheese production);
- Dynamic methods of investment analysis (CBA), to determine financial value of the projects;
- Sensitivity analysis, i.e. to determine how this project responds to the changes in costs and prices and to assess the risk of project realization based on given input parameters.

1.3 Hypothesis

H.1. The investment project in a dairy goat farm is financially feasible\(^1\);
H.2. Processing milk and selling semi-hard cheese is financially feasible\(^2\);
H.3. The investment project in a dairy goat farm (investment costs 497,640 €, milk price 0,81 €/l) is financially secure\(^3\);
H.4. The investment project in a cheese factory (investment cost 427,831 €, milk price 0,81 €/l, cheese price 13,5 €/kg) is financially secure\(^4\).

\(^{1}\) The investment project lasts 11 years (the year of investment plus 10 years), discount rate is 5,5%.
\(^{2}\) The investment project lasts 11 years (the year of investment plus 10 years), discount rate is 5,5%.
\(^{3}\) If NPV stays positive after sensitivity analysis (milk price 10% lower and investment costs 10% higher), the investment project is financially secure.
\(^{4}\) If NPV stays positive after sensitivity analysis (milk price and cheese price 10% lower and investment costs 10% higher), the investment project is financially secure.
2 LITERATURE REVIEW

2.1 Significance and specifics of goat milk production

In case of milk production, goats cannot give the same quantities of milk as milk and combined breeds of cows. The fact is, however, that there are fewer problems with goat breeding than with cow breeding.

Goats are characterized with the following characteristics:
1. Goats have significant capability for high milk production;
2. Goats can give 10 times more milk than their body weight;
3. They easily process forage food into milk;
4. Goats can be grown without forest damage;
5. The price of goat’s milk is 20-30% or more higher than the cow’s milk;
6. Investments in a goat dairy farm are cheaper than investments in a cow dairy farm (Ostojić, 2005a).

With development of goat’s milk science it has been found that:
1. Goats and sheep are, in many external characteristics, similar and they are highly adaptable to different conditions;
2. Goats have greater need for food per kg of bodyweight, but for that bodyweight they give twice as much milk as cows, and a lot more than sheep;
3. The composition of cow’s and goat’s milk is similar, as well as their needs for milk production;
4. Goat’s milk is more digestible than cow’s milk;
5. Production of goat’s milk is cheaper than cow’s milk;
6. Goats are the most fertile ruminants.

Goat breeding should get more support than cow breeding because of goat’s ability to adapt, possibilities of using different technologies for goat breeding (meat and milk),
getting high prices for products or animals from organic farming. All these reasons give goat breeding considerable advantage (Alexandre, et al., 2010).

All of the above have positive effects on business success which is much more productive than cow farms (Ostojić, 2005a).

2.2 Milk

Goats can give us a lot of different products, such as meat, skin, hair, but the most important product is milk. Goat’s milk is used in direct consumption and a lot more as a processed product (different types of cheese). Compared to cow’s milk, goat’s milk is a better source of energy, has more favorable ratio of fats and proteins, more A and B vitamin. Main components are the same as components in other mammals (cows, sheep, humans), but there are some differences in component ratios and quantities:

- Casein of goat’s milk gives softer curd compared to cow’s milk (for that reason, cheese is easily digestible);
- Fat globules are smaller (below 4 microns) and easier to digest;
- Goat’s milk has more favorable ratio of Ca and Mg and is a good source of other minerals (P, K), except Fe and Zn;
- Numerous elements give milk high biological value (generally these findings can apply to cow’s and sheep milk) (Kompan et al., 1996);
- It has therapeutic, dietetic and health value (Ostojić, 2005b).

It is important to mention that goats are resistant to different diseases, especially tuberculosis because of virulence of capric strains of *Mycobacterium*. For that reason, goat’s milk is recommended for people that suffer from this disease. It is also recommended for children, elders, convalescents, in cardio-vascular diseases, gastro-intestinal diseases, stress situations and persons that have different types of allergies. Considering expansion of allergies all over the world, it is reasonable to expect the demand for this product to increase.
Table 1: Saanen goat milk composition in Slovenia (Miklič et al., 1999)

<table>
<thead>
<tr>
<th>Analysis g/100g</th>
<th>Goat milk 3. month of lactation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry matter</td>
<td>10,72</td>
</tr>
<tr>
<td>Fat</td>
<td>3,25</td>
</tr>
<tr>
<td>Dry matter without fat</td>
<td>7,46</td>
</tr>
<tr>
<td>Proteins</td>
<td>2,54</td>
</tr>
<tr>
<td>Lactosis</td>
<td>4,12</td>
</tr>
</tbody>
</table>

Table 2: Mineral composition of goat, sheep, cow and human milk (Raynar-Ljutovac et al., 2008); Gueguen, 1997, Gueguen, 1997, Haenlein and Wendorff, 2006 (per kg) and Paccard and Lagriffoul (2006a,b) (per kg)

<table>
<thead>
<tr>
<th>Mineral (mg)</th>
<th>Goat</th>
<th>Sheep</th>
<th>Cow</th>
<th>Human</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium (mg)</td>
<td>1.260</td>
<td>1.950-2.000</td>
<td>1.200</td>
<td>320</td>
</tr>
<tr>
<td>Phosphorus (mg)</td>
<td>970</td>
<td>1.240-1.580</td>
<td>920</td>
<td>150</td>
</tr>
<tr>
<td>Potassium (mg)</td>
<td>1.900</td>
<td>1.360-1.400</td>
<td>1.500</td>
<td>550</td>
</tr>
<tr>
<td>Sodium (mg)</td>
<td>380</td>
<td>440-580</td>
<td>450</td>
<td>200</td>
</tr>
<tr>
<td>Chloride (mg)</td>
<td>1.600</td>
<td>1.100-1.120</td>
<td>1.100</td>
<td>450</td>
</tr>
<tr>
<td>Magnesium (mg)</td>
<td>130</td>
<td>180-210</td>
<td>110</td>
<td>40</td>
</tr>
<tr>
<td>Ca/P (mg)</td>
<td>1,3</td>
<td>1,3-1,6</td>
<td>1,3</td>
<td>2,1</td>
</tr>
<tr>
<td>Zinc (µg)</td>
<td>3.400</td>
<td>5.200-7.470</td>
<td>3.800</td>
<td>3.000</td>
</tr>
<tr>
<td>Iron (µg)</td>
<td>550</td>
<td>720-1.222</td>
<td>460</td>
<td>600</td>
</tr>
<tr>
<td>Copper (µg)</td>
<td>300</td>
<td>400-680</td>
<td>220</td>
<td>360</td>
</tr>
<tr>
<td>Manganese (µg)</td>
<td>80</td>
<td>53-90</td>
<td>60</td>
<td>30</td>
</tr>
<tr>
<td>Iodine (µg)</td>
<td>80</td>
<td>104</td>
<td>70</td>
<td>80</td>
</tr>
<tr>
<td>Selenium (µg)</td>
<td>20</td>
<td>31</td>
<td>30</td>
<td>20</td>
</tr>
</tbody>
</table>

2.3 Factors that influence dairy goat productivity

Through field research and reading literature on the subject, several factors were noticed that influence quantity and quality of goat milk produced on the farm.

The most important factors are:

1. Choosing the breed;
2. Choosing livestock within the breed;
3. Proper housing;
4. Controlled reproduction;
5. Proper feeding;
6. Proper milking;
7. Disease prevention and healthcare.

These factors have been listed by (Dubeuf, 2005), where he said that it is paradoxical that, although goats still have a marginal or traditional image, many innovations have improved their competitiveness in organized intensive and semi-intensive dairy systems. These innovations include:

- Breeding and selecting for milk production (Alpine and Saanen in France, Murciana Granadina and Malaguena or Canarian breeds in Spain, Damascus in Cyprus),
- Specialized nutrition,
- Better welfare and livestock management,
- On-farm sanitary conditions,
- Housing,
- Improvement and control of reproduction through hormonal treatments and use of photoperiodicity.

These innovations may have a highly significant impact on the production potential of goat’s milk, but they require much more investment than the traditional practices and as well as a good academic level by the farmers (Dubeuf, 2005).

2.3.1 Choosing the breed

Choosing the Saanen breed is influenced by several important factors which are related to its genetic potential (the highest milk production, high milk quality, high fertility, mild temperament). Also, it is very suitable for intensive production. Because of that, the investment in Saanen goat milk production can be profitable.
Saanen goat properties

The Saanen goat is named after Saane, area in Bern canton, Switzerland, where it has been created. It represents a perfect model of white milk goat with high productivity. In good feeding and housing conditions in one lactation period, it can produce twenty times more milk than its weight. It represents a goat breed which gives the biggest quantities of milk in the world. The Saanen goat is all white and shorthaired. Both does and bucks are hornless. Hornless goats are not dangerous for people, especially for children. Besides, hornless goat has mild temperament (Marković, 1945). It is one of the heaviest goat breeds which has ever been created in Switzerland. Ridge height of bucks is on average 80-95 cm and body weight is 80-120 kg. Ridge height of does is on average 75 cm and body weight is 65 kg and more (depending on external conditions). Sackcloth is white and skin is usually freckled. Ears are erected, nose is straight and slightly indented. Both bucks and does have
beard and buck beard is bigger and stronger. Because of high productivity, this breed is much appreciated and it is used for milk production all over the world. It is successfully nurtured in intensive conditions, where it can produce high quantities of milk. Fertility is also very high (2 kids and more). Average milk production per 30-month old doe in 280 days lactation period is approximately 800 kg. In the breeding stock selected, milk production can be 1000 kg and more. Most productive does can give more than 5 kg of milk per day (Krajinović and Savić, 1992). This breed is very often used for crossbreeding and many breeds are created based on the Saanen goat (French saanen goat, German white goat, Holland white goat, American white milk goat, Slovenian saanen goat, Banat White etc.).

2.3.2 Choosing the livestock within the breed

Selection or choosing parents represents one of the basic zoo-technical processes which is of extreme importance for successful goat production. It is based on choosing the best parents for mating regarding their production traits and their pedigree. The basic goal of this selection is that each generation of descendants is better than the previous one regarding production and reproductive traits (Bogdanović, 2011).

The purpose of the selection is to form as productive herd as possible over the years. It is desirable to use modern scientific achievements in population genetics.

While choosing parents, different methods can be used:

1. Choosing animals for mating based on their morphology;
2. Choosing animals for mating based on pedigree;
3. Choosing animals for mating based on production traits (performance test);

---

5 Milk production of Slovenian saanen goat in 2005 was, on average, 585 l/goat/lactation which lasts 251 days (Salehar et al., 2006).
Choosing animals for mating based on their morphology

Goat evaluation based on their external characteristics is based on the evaluation of the whole body (size and shape, harmony of the body shape) as well as accurate evaluation of individual body parts in order to eliminate possible defects. It is very important to notice defects which are hereditary characteristics. These defects are negatively evaluated and animals with such characteristics are excluded from the herd. It is desirable that livestock have all characteristics which are usual for the breed and that they have well expressed secondary sexual characteristics.

After finishing evaluation of the whole body, evaluation of individual body parts starts in the following order: head, neck, body (ridge, back, loins, aitchbone, croup, tale, chest, stomach, and udder), legs, posture, walk, skin and pelage (Bogdanović, 2011). Each individual body part is evaluated and the sum of all points for one animal represents a final mark. A person who carries out evaluation has to know all parameters in order to do it proficiently.

In this part, the most common defects in body shape are listed which are not desirable and which are rigorously evaluated:

- Head, which does not have harmonious shape and clear breed characteristics;
- Neck with sharp transition towards chest resulting in weak musculature;
- On body, low, short and peaked ridge is not desirable;
- Saddle shaped back is a mark of weak constitution;
- Long and tight loins with weak musculature;
- Tight croup;
- Weak chest with tight ribs;
- Bloated stomach;
- Udder which have/had mastitis, with an extra mamma, udder with too large or too small mammas and mammas which do not produce milk.
Different defects in leg shape and posture in bucks can, more often than not, aggravate and sometimes completely disable normal mating process and because of that, these animals have to be culled from the herd (Bogdanović, 2011).

Choosing animals for mating based on pedigree

For this method it is necessary to possess data for three generations of ancestors and it is based on the fact that ancestors with good traits give progeny with good traits.

Choosing animals for mating based on production traits (performance test)

In this case, data from the farmers’ own dairy production (quantity and quality of milk, meat, fertility, etc.) is used and animals left for mating are the ones which have the best production results and animals with low production results are excluded from the herd.

Choosing animals for mating based on progeny (progeny test)

A progeny test represents examination of parents based on progeny traits. With the progeny test from one parent we determine the ability of a parent for passing its traits in order to use it in the production in the best way. The progeny test is the most important method for the estimation of breeding values in goats and sheep (Krajinović and Savić, 1992).

2.3.3 Livestock housing

Optimal housing conditions are an important factor in achieving maximum production results. The first and the most important step is a choice of farm location, which is influenced by a lot of direct and indirect factors. The right choice of location implies building a farm in dry and decant terrain with water, roads and manpower availability. It is important to possess land for pasture or for feed production. Also, what is needed to have in mind is the object disposition which will enable protection from cold winds.
Goats are not fond of moisture, especially polluted air (dust, microorganisms, and harmful gases), draft, strong winds, strong ventilation, inadequate temperature and high temperature oscillation. Bad housing conditions negatively influence both production and animals’ health. It is necessary to respect microclimate, zoo-hygienic and technical housing conditions.

Paramount in the design of goat housing must be the welfare of animals, specifically in environmental matters. The keeper’s own feelings must be directed to this concern. As a rule of thumb, temperature and humidity conditions can be obtained using the following techniques (Toussaint, 1997).

Table 3: Heat, moisture and CO₂ production of a 60 kg adult goat

<table>
<thead>
<tr>
<th>H₂O vapor g/h</th>
<th>Total heat including H₂O vapor in kcal/h</th>
<th>CO₂ l/h</th>
</tr>
</thead>
<tbody>
<tr>
<td>60</td>
<td>120</td>
<td>29</td>
</tr>
</tbody>
</table>

Source: The housing of milk goats (Toussaint, 1997)

Table 4: Environmental requirements for goat keeping inside a house

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Minimum</th>
<th>6°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optimum</td>
<td>10 to 18°C</td>
<td></td>
</tr>
<tr>
<td>Maximum</td>
<td>27°C</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Relative humidity</th>
<th>Optimum</th>
<th>60 to 80 %</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Ventilation</th>
<th>Winter flow</th>
<th>30 m³/h/animal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summer flow</td>
<td>120 m³/h/animal</td>
<td></td>
</tr>
<tr>
<td>Maximum air speed</td>
<td>0,5 m/s</td>
<td></td>
</tr>
</tbody>
</table>

| Light | 1/20 covered surface with lighting inside surface |

Source: The housing of milk goats (Toussaint, 1997)
Inadequate zoo-hygienic conditions, especially combined with bad microclimate conditions, have similar influence and refer to wet and dirty footcloth, hygienically incorrect, moldy, rotten, and frozen food.

Technical conditions primary refer to the number of animals in a barn relative to space in cubic meters. Too many animals in a barn affect space pollution, increase nervousness in animals, especially kids, because they don’t have enough space for walking and playing, prevents application of different zoo-technical processes (separation of sick animals).

Space requirements are as follows: 0,50 m² (minimum) for an adult goat in stall housing, 1,50 m² for an adult goat in open housing with an outside yard, 0,30 m² for a kid before weaning. In order to provide sufficient feeding area and, also, to plan for adequate movement for the goat, the surface of the bedding area for each animal must be adapted with a necessary feeding-trough (0,40 m per goat). Air volume should also be considered. With 3 m width for a central feeding corridor, each goat should have an air volume of 9 m³. In designing the building, it is important to avoid confining animals into too small an area, because limiting their space will have the effect on raising temperature and humidity, or even when the volume of air per goat is too large, the environment in the house will be too cold (Toussaint, 1997). When building these objects, it is highly recommended that all these parameters be appreciated in order to get optimal ambient conditions, microclimate conditions, to prevent their negative influence on goat health and, on the other hand, to increase production and achieve better economic effects.

2.3.4 Goat reproduction

The increase of total productivity in one dairy goat farm is directly dependent on the increase of reproductive efficiency. Goats exhibit their mating activity once per year from September to January/February. The basic factor which influences seasonal mating is duration of daily light (daily photoperiod) and it influences mating in a way that the shorter the day, the more stimulated animals are for reproduction.
In the small ruminant sector, the profitability of enterprises depends primarily on the efficiency of offspring production and the most important factor affecting flock efficiency is reproduction (Alexandre et al., 2010).

Young does reach full physiological puberty at the age of circa 6 months. Puberty is dependent on feeding, body weight, body condition and season of birth, so age of reaching puberty can vary from 5 to 9 months (Bogdanović, 2011). Noble breeds reach pubescence earlier than other breeds. In intensive systems, profitable selection and a feeding program must be designed to allow does to reach puberty by 7 months of age and to kid at 12-14 months of age (Mellado, 2011). Young bucks can exhibit their mating activity all year round. They reach puberty at the age of 5-6 months and mating maturity at the age of 12-14 months.

The length of estrus cycle in goats is 20-21 days, and the duration of estrus is typically 24-36 h with ovulation occurring near the end of estrus. Most goat breeds shed more than one egg when ovulating, and the goat’s average gestation length is 150 days (Mellado, 2011). The signs of estrus are: making specific sounds, fast tale movements (right/left), occurrence of vaginal rheum and “standing reflex” (a goat in estrus tries to be close to a mating buck and stands next to the buck). For goat estrus detection, teaser bucks are used. Estrus cycle seasonality prevents continuity in milk production, so during the winter it causes milk deficit and during the summer milk “surplus”. In order to provide continuity of milk production, different conditions are made for mating and reproduction outside of usual mating period. For that purpose, several protocols are made, such as:

- Usage of hormone progesterone or their synthetic analogues;
- Putting bucks in the same barn with goats before estrus cycle (a natural way, it can accelerate estrus occurrence up to 4 weeks);
- Usage of artificial lighting\(^6\) (20 hours/day of artificial light for 2 months – January/February and then artificial light is reduced to 14 hours/day and that provokes estrus occurrence).

\(^6\) Only in countries where it is allowed, for example USA and South Africa. Not allowed in Slovenia.
Goat mating can be natural or by artificial insemination. Different ways of natural mating are:

- “Free” mating – it is not recommended for modern farmers because selection of animals for mating cannot be done. Bucks and goats are in the same space, so it is impossible to establish time of insemination or which buck inseminated which goat.

- Harem/class mating – in this way of mating one mating buck is used for several goats, being with them the whole day or 2 hours/day. Class mating is slightly better than harem mating because goats are selected in classes and every class gets appropriate mating buck;

- Individual mating – the best way of natural mating, where all deficiencies from previous ways of mating are eliminated. Individual mating is used in farms where farmers keep mating records (parents, date of insemination, date of kidding, progeny sex). There is a plan of mating, with respect to all zoo-technical conditions, teaser bucks which reveal goats in estrus and then goats in estrus mate with appropriate bucks.

- Artificial insemination – has certain advantages compared to natural ways of mating, such as: mating bucks are used more efficiently, production traits can be improved faster, more goats insemination is achieved at the same time (exclusively combined with synchronization of reproduction cycle), venereal diseases are prevented. However, it should be emphasized that percentage of this type of insemination is smaller compared to natural insemination (60-70 %).

2.3.5 Goat feeding

Feeding is one of the most important processes in raising goats, because it highly determines not only the level of production, but also reproductive and health status of the animal. With adequate and well-balanced diet, even low productive animals can achieve satisfying level of production and their production potential can be used completely. On the other hand, if feeding of the noble highly productive breeds is unsuitable, their genetic
potential will not be manifested and their production will be well below their possibilities (Bogdanović, 2011).

Goats are a domestic ruminant species which use around 90 different plants for their feeding. The main feed for these animals is forage food and they also have to get certain amounts of concentrate food in order to get necessary nutrients, energy, proteins, minerals and vitamins.

FORAGE FOOD – can be used as fresh or dry. Fresh forage food can be green feed, the cheapest food for goats (pasture or cut green mass which is brought into barn) and browse or tipsy branches (ash tree, elm, hazel, and bramble). Dry forage food – the most important dry forage food is hay (the best hay is alfalfa hay, also red clover, meadow hay with different types of grass, vetch, pea, etc.). Straw is also part of this group and it is used as supplement feed, provides cellulose and the best is oat straw. Other forage foods are roots and tubers food (potato, beet), leaves, byproducts of food industry, silage, etc.

CONCENTRATE FOOD – concentrate feed enables reaching milk production which will be the most profitable. This food includes whole-wheat grains, cereals and legumes, specially prepared concentrate mixtures for goats (desirably pelleted because of easier consumption), byproducts of mill industry (bran, industrial oil), NPN compound, minerals (macro elements – Ca, P, Mg, K, Na, Cl, S; microelements – Fe, Zn, Cu, Co, Mn, Se), vitamins (A, D, E as the most important ones). Vitamins and minerals are necessary for normal growth and development as well as for normal metabolic functioning.

WATER – daily needs of drinking water per goat are 2-3 liters per kg of daily dry matter of food. Water has to be clean and hygienic. Water quality is important because poor water quality can limit water intake by the animal, leading to reduced dry matter intake and lower animal production (Hart, 2011).

FEEDING DURING MATING – adding of concentrate positively influences ovulation.
PREGNANT GOATS FEEDING – first 2/3 of pregnancy do not demand special changes in diet. However, in the final third of pregnancy, it is necessary to increase energy value of meals for 30-50% and to increase protein intake up to 100% (for fetal development and for successful lactation in the future). At the end of the pregnancy meals are reduced to 75 – 50%.

FEEDING DURING LACTATION – postnatal meals are made of brans and quality hay and then dry feed is increased and green food is added. The biggest stress that the doe faces at this time is that milk production increases faster than her ability to consume nutrients, which results in a negative energy balance. Milk production peaks 6-9 weeks after kidding (approx. 1 week later in doelings), whereas intake does not peak until 12-16 weeks after kidding. Consequently, the doe will lose body condition during this time, often to a BCS\textsuperscript{7} of 2.0. When body condition gets much below 2.0 BCS, the doe stops increasing milk production at that time, thus reducing milk production for the remaining lactation. This is why it is important that does have sufficient body condition before parturition and that they are encouraged to increase energy intake after parturition, without causing them to have a digestive upset (Hart, 2011).

FEEDING DURING DRY PERIOD – dry period is desirable 6-8 weeks before kidding in order to make body reserves and to regenerate milk glands. The best food in this period is meadow hay, and alfalfa should be avoided because of high Ca and low P and possible occurrence of milk fever.

MATING BUCKS FEEDING – in order to provide optimal mating form for bucks, optimal feeding is necessary. During mating period, bucks have the same meal quantity as goats in the first phase of pregnancy. Considering that spermatozoid maturation lasts 1,5-2 months, it is necessary to increase buck feeding 6 – 8 weeks before breeding with 400 – 500 grams of concentrate per day. In the period of breeding average meal should be similar to meals of pregnant goats in the second half of pregnancy and should contain 2,5 kg of

\textsuperscript{7} Body condition score – can be on a scale of 1-5.
hay and 0.4 kg of concentrate. Besides adequate feeding, it is very important for them to be outside in the paddock for better breeding value and libido (Djordjević et al., 2009).

KID FEEDING – colostrum, the first food of kids, has high level of nutrients, maternal antibodies which provide passive immunization and that is of big importance for the kids. It is necessary that kids intensively suckle in the first 10 hours of life because immunoglobine concentration decreases after 12 hours. In the next three weeks, a kid is fed with mother milk, it is in the same space as the mother goat and it suckles at will. Kids’ adjustment to forage and dry feed (hay, concentrate) starts gradually in 7-14 days of life and more intensively in 20-25 days of life. Later feeding depends on whether kids will be used for fattening or mating.

2.3.6 Goat milking

There are two basic ways of milking: manual milking and machine milking. Machine milking has a lot of advantages over manual milking and the most important thing is getting milk which has better microbiological and hygienic properties, fewer workers are needed and the efficiency of production is increased (Bogdanović, 2011). Because of these advantages, bigger farms use this type of milking which demands special space – milking parlor where all the equipment for machine milking, receiving and refrigeration of milk is installed. It is very important that these rooms are made in respect to all hygienic - sanitary standards and regulations. The first usage of this system was in France in 1930 and since then it has improved constantly (from 40 milked goats/hour to 500 milked goats/hour).

In case of machine milking certain problems can occur, such as:

- Undesirable shape of udder, which demands extra work and increased time of milking,
- Worker should be quick and well trained since milking lasts approximately 1-2 minutes and it is not easy to find competent workers,
- After milking a lot of milk is left for residual milk milking and for that purpose the following processes are used (machine milking with machine residual milk
milking, machine milking with manual residual milk milking and two-phase machine milking).

In spite of all advantages compared to manual milking, it is necessary to be sure that:
- Workers are well trained, because efficiency, milk quantity, milk quality, animal health and regular machine usage, more or less, depends on them;
- Quality machine is chosen;
- Select goats on “machine udder”.

2.3.7 *Goat disease prevention and healthcare*

Healthcare program is based on monitoring, detecting, suppressing and extermination of infectious diseases. This is a task for veterinary service and it is regulated with a series of legal acts. It includes clinical and laboratory-diagnostic research, immunoprofilaxis and prevention. The goal of healthcare is to provide good health status of animals such as to enable undisturbed physiological activities and production of quality meat, milk, wool and good mating progeny (Matarugić, Šaric and Miljković, 2003). Development of a comprehensive biosecurity program recognizes the interaction between the animal and its ability to resist a disease, a variety of infectious agents, and the environment. Changes in management practices can be very cost-effective in reducing the incidence of preventable diseases and decreasing the need for pharmaceuticals (Bowen, 2011). Clean environment is very important and vaccine or drug cannot replace it (Table 5). Producers should test the cleanliness of the environment in a way that they kneel on the bedding to check the wetness and breathe the air at the goat level for detection of different odors, such as ammonia. For example, diseases such as parasitism, pneumonia and paratuberculosis can be prevented by removing dirty bedding and opening a closed barn.

Table 5: Specific pathogen prevention program

<table>
<thead>
<tr>
<th>Step 1:</th>
<th>Remove newborn kids from the adult population at birth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 2:</td>
<td>Feed newborn kids 1 ounce of heat-treated colostrum per pound of body weight 3 times in the first 24 hours of life</td>
</tr>
</tbody>
</table>
### 2.4 The terms investment, Cost-Benefit Analysis and particularities of agricultural investments

Investment means renunciation of consumption in the present to get benefits in the future. It represents investing financial means in making production goods.

Cost-Benefit Analysis (CBA) is a method for assessing the economic efficiency of public policies through systematic measurement of social costs and social benefits. When economic efficiency is the only relevant social goal, CBA provides an appropriate decision rule: choose the policy, or set of policies, that maximizes net social benefits (Haveman and Weimer, 2001).

CBA enables estimation of project proposal’s enforceability and profitability in the early phases of its development. A simple financial analysis can point too key weaknesses of a project proposal. These weaknesses could become obvious at some stage of project realization without CBA, but CBA helps us to avoid unnecessary waste of time on assets and projects which are not profitable (Čupić, 2009).
Money can be invested in different ways. The first type of investment is a seasonal investment in production (buying production goods, such as seed, scion, fertilizers, plant protection products, etc.) and the second type of investment is an investment in fixed assets, such as agricultural land, machines, buildings, livestock and plantations (Rozman, Turk and Pažek, 2009). It is important to mention that investments in agriculture are different from investments in other branches of economy and it is necessary to respect numerous particularities as factors of influence.

These particularities can be classified in 4 groups:

1. Particularities which are influenced by existence and activities of natural conditions (very common in agriculture, permanent battle for decreasing their influence is necessary in order to eliminate, alleviate or convert natural factors to make beneficial conditions for production);

2. Particularities which come from existence of biological processes and organic production (time dimension in investment cycle is conditioned by duration of natural processes);

3. Particularities which are related to reproduction in agriculture (particular time of fructification for some fruit, as well as specific reproduction cycle in livestock breeding);


2.5 Phases in investment evaluation process

2.5.1 Defining investment alternative

The most important step in this process is defining investment alternatives. The ability to create and develop ideas in new business projects, as well as to develop ideas in existing projects is certainly one of the critical moments in directing a company towards future profitability. It is important for every company to have organized activities in creating and
developing ideas, starting at creating positive conditions for new ideas, to their specific evaluation in proposed projects (Orsag, 2002).

2.5.2 Data collection

Data collection and its quality statistical processing are preconditions for correct implementation of ideas for business actions into specific projects and correct evaluation in the process of capital budgeting. It is very important to collect and process data systematically and in an organized way. Parts of data are collected continuously in business records (accounting and business statistics) and other information is collected and processed based on engineers’ data, market trends and other financial information (Orsag, 2002).

Data is, in essence, an input in the research process and by processing it we get information which helps us to make business decisions (Meler, 2005).

2.5.3 Cash flow projection

Cash flow projection is the hardest part of capital budgeting process and it is recommended that this job is done by several experts from different scientific areas in order to get the most accurate projection. Based on collected data, investment costs, expected net cash flows and residual values are defined and so they become a specific project where we can make investment decisions. By establishing recommended projects, conditions for their fair evaluation are made.

2.5.4 Funding sources

When defining an investment project, it is necessary to establish all investments, which demand its realization and coordinate it with available funds. All problems and solutions in
case of investment funding are solved and presented in the so called financial construction, which includes:

- Determination of estimated value of necessary investment according to purpose and type, meaning by volume, structure and dynamics;
- Determination of funding sources, which can be: company-investor, banks, other interested companies, domestic-foreign partners, domestic-foreign financial and other institutions, domestic-foreign equipment and technology suppliers.

In order to ensure necessary funds for the realization of investment projects, an investor is very often forced to, beside his own funds, ensure funds in different ways from different sources (Jovanovic, 2008). The investor’s own funds do not cause direct financial liabilities, unlike borrowed funds, and they originate from accumulation funds and depreciation funds. Borrowed funds, in most cases, present bigger part of necessary investment funds, and a company is obliged to return them with a certain fee (interest). They are usually in the form of cash and include funds from domestic or foreign banks. This way of funding is often unfavorable and unstable.

2.5.5 Alternative evaluation and decision-making

Using methods of financial decision-making we do alternative evaluation. First, individual evaluation of financial efficiency of each project is performed. In that manner, the number of projects which passed the tests of financial acceptability based on certain financial decision-making criterions is limited. A final investment decision will be made when mutual characteristics of each project are compared in the process of project ranking (Orsag, 2002).

2.5.6 Execution analysis

By making investment decisions, a company starts with a process of investment in selected projects. That process has to be analyzed in order to detect certain lapses which are created
during cash flow projection. It is necessary to evaluate detected lapses again, do required adjustments during the investment period in order to avoid negative influence of the project on creating company value. Analysis is also necessary in effectuation phases. Every new circumstance should be evaluated and adapted in order to achieve higher efficiency in the company and higher company value (Orsag, 2002).

2.6 Elements for investment project evaluation

2.6.1 Investment costs

Cash flows go through two important periods in a project life-cycle, period of investing and period of effectuating. The investing period is characterized by appearance of cash expenditures, respectively investment costs. They have to show the level of initial investment in a certain project. In the real investment it is invested directly into fixed assets and that is purchase of necessary means of production such as machines, devices, equipment and provision of other production conditions by building or buying necessary facilities. Investment costs can also refer to investing in intangible assets, such as buying licenses, costs of trademark insurance, etc.

2.6.2 Periods of investing and effectuating

The period of investing is a very important factor which determines the efficiency of a project and indicates necessary time to capacitate investment for generating profit and cash flows. At that time, the company only invests in a project that still does not give financial effects (building new sections, building new objects for special equipment, education of workers). The longer this period is, the project will later start to make necessary cash flows for company value increase, so it will have less present value. For that reason, acceleration of investing and shortening of investment period is one of the key factors for increasing investment efficiency.
The period of effectuating provides economic and financial efficiency of an investment project. In this period, the investment project creates profit and cash flows which provide the increase of company’s present value. The longer this period is, the greater is the financial efficiency of the project, but it should be noted that the more cash flows that are generated by an investment project are away from the present, because of time value of money, it will have less present value.

2.6.3 Cash expenditures and cash receipts

Cash expenditures are necessary for appearance of cash receipts, in other words, for undisturbed business processes that an investment project demands. They refer to continuous provision of production process with materials, energy and other inputs, for continuous payments of salaries, payments of obligations for third parties in the process of production and realization of produced effects. Cash receipts generated in the period of effectuating are related to receipts from sales of different products and/or performed services of project (Orsag, 2002).

2.6.4 Residual value of project

The term residual value refers to the project value at the end of effectuating period. This is land value, building and equipment value that is left after the project stops to give financial effects, as well as value of net reversible capital which will be free after exploitation of project stops. Considering that this value is realized at the end of effectuating period of the project, it is also called liquidation value. Residual value of fixed assets should be treated as receipts of money, noting that their time value is relatively small (Orsag, 2002).

Residual value is equal to difference between total investment in the project and the sum of depreciation during investment project exploitation time (Mikerević, 2009).
2.6.5 Net cash flows of project

The difference between current cash receipts and current cash expenditures which appeared in the effectuating period of the project represents net cash flows of project. The forecast of net cash flow is based on the forecast of accounting categories, incomes and expenses, namely on the forecast of accounting profit (Orsag, 2002). Thereby, it is started at the forecast of sales dynamics and size, according to which dynamics and size of incomes and expenses at the time of effecting will be estimated.

2.6.6 Discount rate

Discount rate is a measure of time value of money, namely reduction of future cash receipts on present value. For calculating discount (present) value discount factor is used. This factor is also called decumulation factor and represents reciprocal value of interest factor. It is calculated in the second financial tables and for the same amount of cash flows in the fourth financial tables (Andrijašević and Račić-Žlibar, 1997).

3 MATERIALS AND METHODS

3.1 Dynamic methods of investment evaluation

3.1.1 The term dynamic methods of investment evaluation

Unlike static evaluation which does not take time into consideration in the process of analysis and evaluation of investment projects and relies on data from one, average year of project exploitation, dynamic evaluation of investment project profitability takes time into consideration in the process of analysis and evaluation of investment project and covers the whole period of investing and exploitation of investment project. In the dynamic evaluation we use parameters from the whole period of investment and exploitation of
investment project. Dynamic methods are complex indicators that, in different ways, cover investment and affluence of effects from the investment and enable us to realistically analyze different aspects of investment project and evaluate validity of its realization.

Dynamic methods used in this work are:
1. Discounted payback method,
2. Net Present Value method,
3. Internal Rate of Return method,
4. Profitability index method (Orsag, 2002).

**Discounted payback method**

Discounted payback is a method in which we strive to respect time value of money. In this method time which is necessary for discounted cash flows of investment projects to “cover” values of their investment costs is calculated.

Discounted factors necessary for reduction of net cash flows on present value are already calculated in the second financial tables. This can be shown using the following formulas:

\[ I = \sum_{t=1}^{tp} \frac{V_t}{(1 + k)^t} \quad \text{or} \quad I = \sum_{t=1}^{tp} V_t \cdot II_k^t \]

Table 6: Factors of discounted payback formula

<table>
<thead>
<tr>
<th>Description</th>
<th>Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>net present value (€)</td>
<td>NPV</td>
</tr>
<tr>
<td>discounted cash flow (€)</td>
<td>( V_t^* )</td>
</tr>
<tr>
<td>discount factor</td>
<td>k</td>
</tr>
<tr>
<td>investment cost (€)</td>
<td>I</td>
</tr>
<tr>
<td>the second financial tables</td>
<td>( II_k^t )</td>
</tr>
</tbody>
</table>

Like in original payback, the fastest possible payback of invested goods is required. The most important characteristic of discounted payback is using time value of money. However, discounted payback has the same flaw as original payback, because it does not
take into consideration the effects of the project after investment costs payback (Orsag, 2002).

*Net Present Value method*

Net Present Value is a basic criterion for financial decision-making. Because of that, the method of net present value can be considered as a basic method of investment decision-making, i.e. basic method of financial decision-making in general. The term clean or net present value represents a difference between positive and negative effects which are the result of certain activity (Orsag, 2002).

The term present value points to the fact that all effects have to be reduced to present value in order to be comparable between each other. This is done with a discount technique in which discount rate is the cost of investor’s capital. Only future cash flows of the project are discounted. Discount factors are in the second financial tables for discount rate which corresponds to the cost of investor’s capital for the years in which cash incomes are expected (Orsag, 2002).

Calculating net present value can be described in 3 steps:

1. To calculate present values of expected cash flows in the entire lifespan of effecting;
2. To sum discounted net cash flows in the entire lifespan of the project effecting;
3. To determine net present value by subtracting investment costs from sum of net cash flows in the entire lifespan of the project effecting (Orsag, 2002).

\[
\text{NPV}(S_0) = \sum_{t=1}^{n} \frac{V_t}{(1 + k)^t} - I \quad \text{or} \quad \text{NPV}(S_0) = \sum_{i=1}^{n} V_i^* - I
\]

Table 7: Factors of NPV formula

<table>
<thead>
<tr>
<th>NPV</th>
<th>Net Present Value (€)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(V_i^*)</td>
<td>discounted cash flow (€)</td>
</tr>
<tr>
<td>(k)</td>
<td>discount factor</td>
</tr>
<tr>
<td>(I)</td>
<td>investment cost (€)</td>
</tr>
</tbody>
</table>
Net Present Value is very simple to calculate in the case where projects have constant net cash flows in the whole period of effecting. A discount factor in case of the same periodical amount of money is calculated in the fourth financial tables.

\[
\text{NPV}(S_0) = V_t \cdot \frac{(1+k)^n-1}{(1+k)^n \cdot k} - I \quad \text{or} \quad \text{NPV}(S_0) = V_t \cdot IV_k^n - I
\]

A Net Present Value criterion is in line with the fundamental goal of a company, maximizing its present value. Positive NPV of the project indicates the increase of company’s present value. Keeping that in mind, projects, which have negative NPV should not be accepted, because they would decrease company’s value. Efficiency threshold, respecting NPV, can be written as: \( \text{NPV} \geq 0 \).

**Internal Rate of Return method**

Internal Rate of Return is a rate where NPV of the project is equal to zero. It is the second fundamental criterion of financial decision-making. It is a discount rate which reduces all net cash flows of the project in the whole lifespan of effecting on its investment costs. With that rate, we get zero, borderline NPV of the project (Orsag, 2002).

\[
\sum_{t=1}^{n} \frac{V_t}{(1 + r)^n} = I; \quad \sum_{t=1}^{n} \frac{V_t}{(1 + r)^n} - I = 0
\]

\( r \) – Internal Rate of Return

Calculating Internal Rate of Return is done with a method of trial and error. In the iteration of calculating NPV we search for a rate in which NPV is equal to zero. Because of the iteration of the calculating NPV, this method is called an iteration method (Orsag, 2002).

Iteration of trial and error is done in a way that first we choose a discount rate for which we assume that it will be near internal rate of return. Using that discount rate, we calculate NPV. If that rate does not give us zero NPV, we continue the same process with a different
rate. If we get NPV, which is positive, we take higher discount rate and vice versa. In the process of iteration, the discount rate wanted is often a whole number (%). In that case, we need to find two different discount rates (one positive and one negative), and internal rate of return is between these two rates. When we find these two rates, internal rate of return can be calculated with linear interpolation (Orsag, 2002).

A formula for linear interpolation is as follows:

\[ y = y_1 + \frac{y_2 - y_1}{x_2 - x_1} \cdot (x - x_1) \]

- \( y \)- wanted Internal Rate of Return
- \( y_1 \)- Discount rate (NPV > 0)
- \( y_2 \)- Discount rate (NPV < 0)
- \( x \)- NPV for Internal Rate of Return (NPV = 0)
- \( x_1 \)- NPV for discount rate \( y_1 \)
- \( x_2 \)- NPV for discount rate \( y_2 \)

In the case of equal cash flows, internal rate of return calculation is simpler, because the present value of cash flow is calculated with discount factor of equal periodical amounts. Values of discount factor are given in the fourth financial tables, and formula for calculating is as follows:

\[ IV^f_t = \frac{I}{V_t} \]

Considering this method, a critical point of accepting or rejecting the project refers to the costs of investor’s capital. The project has to have Internal Rate of Return which is at least equal to the costs of company’s capital. Mathematically it is written as: \( r \geq k \).

Internal Rate of Return is connected with criterion of NPV. Projects which have positive NPV have also internal rate of return that is bigger than the discount rate and vice versa. Regardless their connection, these methods cannot equate with each other.
NPV calculation is conditioned by the choice of discount rate, and internal rate of return is not. Also, NPV is a measure of absolute efficiency (increase of value of capital), and internal rate of return is a relative measure (direction and degree of increase of capital value).

Profitability index method

Profitability index is an additional criterion for improving investment decision-making. Profitability index cannot be calculated without NPV. This method takes into consideration time value of money through the costs of capital and cash flow values of the project in the entire lifespan of effecting. Unlike NPV, decision in the case of profitability index is based on ratio between discounted net cash flows in the entire lifespan of project effecting and investment costs. This method measures relative profit strength of discounted net cash flows to value of investment costs (Orsag, 2002).

A formula for profitability index is as follows:

\[ P_i = \frac{\sum_{t=1}^{n} \frac{V_t}{(1+k)^t}}{I} \]  or  \[ P_i = \frac{\sum_{t=1}^{n} \frac{V_t}{(1+k)^t} - V_0}{I} = \frac{V_t - IV_0}{I} \]

Efficiency threshold of the project, in case of profitability index, is determined in the same way as for NPV, equality between present value of net cash flows of the project and its investment costs. In that case, profitability index is equal to 1, so a project must not have profitability index less than 1 (Orsag, 2002).

If the profitability index is greater than 1, NPV will be positive and vice versa \((P_i \geq 1)\) (Orsag, 2002).
This criterion is used for improving investment decision-making. Profitability index improves investment decisions because, between two projects with the same NPV, it chooses one with the lower investment costs (Orsag, 2002).

3.2 Sensitivity analysis

Financial and economic analysis is often based on uncertain evaluation of data regarding a project and there is always a risk that relevant parameters were not evaluated accurately. That is a reason why project risk factors need to be included. Risk is defined as uncertainty in case of expected project effects. One of the methods that is used for risk assessment is sensitivity analysis (Čupić, 2009).

Sensitivity analysis should enable identification of project’s critical factors. These factors are the ones whose positive or negative changes have the biggest influence on project profitability. As a rule of thumb, critical factors are the ones whose estimated value change by 1% causes change of net present value of the project by more than 1%.

Sensitivity analysis is implemented through the following steps:

- Identification of project factors;
- Excluding irrelevant factors from further analysis;
- Elasticity analysis;
- Choosing critical factors (Čupić, 2009).

These factors can be: inflation rate, electricity price, product price changes (category of price variability), number of people, demand structure, market size for analyzed product (demand factors category), productivity, land price, transportation costs, rent costs, useful life of equipment (total investment category), raw material prices, energy prices (business costs category), number of employees (a factor that determines business costs), tariffs, the selling price of products (price of product category), production volume (per hour, day, month, year), market share (factors which determine business incomes), etc.
After identification, it is necessary to exclude factors which could lead to wrong conclusions. Only factors that are independent from other factors and maximally explicated should be taken into consideration. Also, the subject of this analysis should only be important factors (highly or medium important) (Čupić, 2009). In this work, using sensitivity analysis for evaluation of investment security, the assumptions given below were followed:

1. In the case of dairy goat farm:
   - Increase of investment cost by 10%;
   - Decrease of milk price by 10%.

2. In case of cheese factory:
   - Increase of investment cost by 10%;
   - Decrease of cheese price by 10%.

In case that NPV is positive, respecting these assumptions of sensitivity analysis, we can say that investment projects are secure. If, on the other hand, NPV is negative, we can say that these projects are not financially feasible.

### 3.3 Start-up assumptions – Saanen goat dairy

#### 3.3.1 Land

This hypothetical goat farm is located in Slovenia and consists of 3 ha of rented land - 2ha of pasture and 1ha of housing estate. Price of rented pasture is 161 €/ha, while the price for housing estate is 279 €/ha. The land is rented for 11 years. The farm is fenced with 800m long fence.
3.3.2 Saanen goat herd

The herd consists of 500 does, 10 bucks (one buck can inseminate 50 does) and replacement kids.

Annually, 20% of the does and the bucks are replaced.

Average number of kids per doe is 1.8.
However, in this example, it is also calculated that some does will not kid (5%) and that there will be kid mortality rate (5%). The number of kids in the herd is 812.

Half of the kids are does. Also, 50% of the kids are sold for meat.

Kids are 3 months old, when they are sold, and their average weight is 15 kg and their price is 2.5 €/kg.

Another 50% of the kids are sold for breeding.

Price of buck kid for breeding is 160 € and the price of doe kid is 100 €. Genetically superior kids are sold for breeding, and the best doe kids are left for replacement.

Replacement bucks are bought on the market, because of genetic diversity of the herd, and their price is 1.000 €/buck. Doe price is 400 €. Because of the replacement, there is 100 cull does and 2 cull bucks in the herd. These are the animals with the smallest productivity in the herd. Their price is 0.45 €/kg (both does and bucks) and the average weight of doe is 65 kg and of buck is 80 kg.

The main product of Saanen goats is milk. Every goat in the herd is milked, lactation period lasts approximately 280 days and average milk production per goat is 730 l of milk. Milk price is 0.9 €/l. Since Slovenian goat’s milk production is insufficient for market demand, all milk is sold as soon as it is produced.
A by-product that we get in this herd is manure. One goat produces 1 ton of manure per year (price 0,04 €/kg) and one kid produces 300 kg of manure per year (price 0,03 €/kg).

The average set up, milking and cleaning time before and after milking is 5 minutes per doe and it is possible to milk 12 does at the same time.

3.3.3 Investment costs

In the following table 8, investment costs in case of dairy goat farm project are shown.

Table 8: Investment costs in the dairy goat farm project

<table>
<thead>
<tr>
<th>INVESTMENT</th>
<th>INVESTMENT COSTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>LIVESTOCK</td>
<td>PRICE €/HEAD</td>
</tr>
<tr>
<td>1. Does</td>
<td>400</td>
</tr>
<tr>
<td>2. Bucks</td>
<td>1.000</td>
</tr>
<tr>
<td>TOTAL LIVESTOCK COSTS</td>
<td></td>
</tr>
<tr>
<td>MILKING EQUIPMENT</td>
<td>PRICE €/SYSTEM</td>
</tr>
<tr>
<td></td>
<td>950</td>
</tr>
<tr>
<td>MACHINERY and VEHICLES</td>
<td>PRICE €/MACHINE</td>
</tr>
<tr>
<td>1. 30 HP Tractor and Loader</td>
<td>15.000</td>
</tr>
<tr>
<td>2. Pick-up truck 3/4 ton</td>
<td>19.000</td>
</tr>
<tr>
<td>3. Caddy 1/2 ton</td>
<td>14.000</td>
</tr>
<tr>
<td>TOTAL MACHINERY and VEHICLES COSTS</td>
<td></td>
</tr>
<tr>
<td>BUILDINGS</td>
<td>VALUE €</td>
</tr>
<tr>
<td>Milking parlor</td>
<td>100.000</td>
</tr>
<tr>
<td>Barn/Shelter - Does</td>
<td>40.000</td>
</tr>
<tr>
<td>Barn/Shelter - Bucks</td>
<td>10.000</td>
</tr>
<tr>
<td>Storage building</td>
<td>9.000</td>
</tr>
<tr>
<td>TOTAL BUILDINGS</td>
<td>159.000</td>
</tr>
<tr>
<td>FENCING</td>
<td>PRICE €/10 METERS</td>
</tr>
<tr>
<td></td>
<td>100</td>
</tr>
<tr>
<td>GOAT EQUIPMENT (tools and different equipment)</td>
<td>VALUE €</td>
</tr>
</tbody>
</table>
3.3.4 Fixed costs

Fixed costs consist of depreciation costs of all assets that are mentioned in the investment costs, rent for land (1ha of housing estate – 279 €/ha and 2ha of pastures – 161 €/ha), insurance (1.200 €/year), income tax (15% of the profit) and costs of bookkeeping, legal fees and office supplies (4.000 €/dairy).

Note: residual value of the assets is 10 % of their purchase price.

3.3.5 Animal feed

In the following table 9, variable costs (animal feed costs) in case of dairy goat farm project are shown.

Table 9: Animal feed costs in the dairy goat farm project

<table>
<thead>
<tr>
<th>DOE FEED</th>
<th>QUANTITY KG/DOE</th>
<th>PRICE €/KG</th>
<th>VALUE €</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winter</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>meadow hay</td>
<td>1,5</td>
<td>0,05</td>
<td>6.750</td>
</tr>
<tr>
<td>alfalfa hay</td>
<td>1,5</td>
<td>0,05</td>
<td>6.750</td>
</tr>
<tr>
<td>corn silage</td>
<td>2</td>
<td>0,06</td>
<td>10.800</td>
</tr>
<tr>
<td>concentrate</td>
<td>0,8</td>
<td>0,35</td>
<td>25.200</td>
</tr>
<tr>
<td>winter feed days</td>
<td>180</td>
<td></td>
<td>49.500</td>
</tr>
<tr>
<td>TOTAL WINTER DOE FEED</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Summer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>green feed</td>
<td>10</td>
<td>0,05</td>
<td>46.250</td>
</tr>
<tr>
<td>concentrate</td>
<td>0,8</td>
<td>0,35</td>
<td>25.900</td>
</tr>
</tbody>
</table>
### 3.3.6 Variable costs

There are 5 full time workers at the farm. The first worker is a university graduate worker and his gross wage is 1.700 €/month. The second worker is a high school graduate and his gross wage is 1.250 €/month. The other 3 workers are skilled workers and their average gross wage is 950 €/month. One worker can take care of 100 goats.

Veterinary costs (vaccines and treatments) are 15 €/goat, buck/year and 3 €/kid/year.

Costs of straw bedding yearly per doe are 1,6 € and per kid are 0,4 €.

Replacement percentage of bucks is 20% and there is 1 buck on 50 does, so every year 2 new bucks are bought for replacement and genetic variety (price 1.000 €/buck).

Marketing costs are 2,5 % of sales revenue.

#### Table: Feed Costs

<table>
<thead>
<tr>
<th>Description</th>
<th>Summer Feed Days</th>
<th>BUCK Feed</th>
<th>Rest of the Year</th>
<th>Total Buck Feed</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTAL SUMMER DOE FEED</td>
<td>185</td>
<td></td>
<td></td>
<td>72.150</td>
</tr>
<tr>
<td>BUCK FEED</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mating period (2 months)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>hay</td>
<td>3,5</td>
<td>0,085</td>
<td>178,5</td>
<td></td>
</tr>
<tr>
<td>concentrate</td>
<td>1</td>
<td>0,35</td>
<td>210</td>
<td></td>
</tr>
<tr>
<td>mating period feed days</td>
<td>60</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL BUCK MATING PERIOD FEED</td>
<td></td>
<td></td>
<td></td>
<td>388,5</td>
</tr>
<tr>
<td>Rest of the year</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>hay</td>
<td>3</td>
<td>0,085</td>
<td>777,75</td>
<td></td>
</tr>
<tr>
<td>concentrate</td>
<td>0,5</td>
<td>0,35</td>
<td>533,75</td>
<td></td>
</tr>
<tr>
<td>rest of the year feed days</td>
<td>305</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL BUCK REST OF THE YEAR FEED</td>
<td></td>
<td></td>
<td></td>
<td>1.311,5</td>
</tr>
<tr>
<td>Mineral block (number of blocks)</td>
<td>72</td>
<td>7,5</td>
<td>540</td>
<td></td>
</tr>
<tr>
<td>Dry minerals (ton)</td>
<td>1</td>
<td>320</td>
<td>320</td>
<td></td>
</tr>
<tr>
<td>Calf milk replacer (per kid)</td>
<td>812</td>
<td>40</td>
<td>32.490</td>
<td></td>
</tr>
<tr>
<td>Kid grains (per 15 months/kid - 1st kidding)</td>
<td>290</td>
<td>0,35</td>
<td>20.994</td>
<td></td>
</tr>
<tr>
<td>Kid hay (per 15 months/kid - 1st kidding)</td>
<td>410</td>
<td>0,085</td>
<td>7.208</td>
<td></td>
</tr>
</tbody>
</table>

Source: interview with farmers, (Delaney, 2012), (Giraud, Klonsky and Livingston, 2005), (Djordjević et al., 2009)
There are two milk tests per year and each costs 300 €. Every week, milk is transported to the buyers and that costs 50 €/week. Electricity costs in the dairy are 500 €/month. Machinery (fuel, oil, repair) costs are 100 €/dairy. Vehicles (fuel, oil, repair) costs are 5,500 €/dairy. Equipment (repair) costs are 250 €/dairy. Housing and Improvements (repair) costs are 3,000 €/dairy.

3.4 Start-up assumptions – semi-hard cheese processing facilities

3.4.1 Basic information

Price of the cheese is 15 €/kg, average milk and cheese ratio is 10:1 and cheese aging lasts 60 days.

3.4.2 Investment costs - equipment

In the following table 10, investment costs of equipment in case of cheese factory project are shown.

Table 10: Investment costs of equipment in the cheese factory project

<table>
<thead>
<tr>
<th>Raw milk cheese - aged more than 60 days</th>
<th>INVESTMENT COSTS - equipment</th>
<th>PRICE in €</th>
</tr>
</thead>
<tbody>
<tr>
<td>Furnace or steam boiler</td>
<td></td>
<td>8,000</td>
</tr>
<tr>
<td>Milk pump and hauling tank or milk cans</td>
<td></td>
<td>1,000</td>
</tr>
<tr>
<td>Stainless steel piping/milk hose</td>
<td></td>
<td>5,000</td>
</tr>
<tr>
<td>Vat</td>
<td></td>
<td>15,000</td>
</tr>
<tr>
<td>Cream separator</td>
<td></td>
<td>9,000</td>
</tr>
<tr>
<td>Drain/Press table</td>
<td></td>
<td>2,000</td>
</tr>
<tr>
<td>Hoops and followers for forming wheels and blocks of cheese</td>
<td></td>
<td>10,000</td>
</tr>
</tbody>
</table>
3.4.3 Investment costs – processing facilities

Costs for processing facilities are calculated using the following formula:

\[ C_p = \text{total cost of processing facility in } \text{m}^2 = $1.614,6 (€1432) \times Ap, \]

All facilities are at the same land as for the dairy goat farm.
Where \( A_p \) = area of processing facility in \( m^2 = 2.9954 \times (P)^{0.3866} \),
and \( P \) = total production capacity per year (kg or lb) (Bouma, Durham and Meunier-Goddik, 2014).

### 3.4.4 Investment costs – aging facilities

Costs for aging facilities are calculated using the following formula:

\[
C_a = \text{total costs of aging facility in } m^2 = 288.53 \times (A_a) + 24.074,
\]

Where \( A_a \) = area of aging facility in \( m^2 = 0.01096^9 \times P_a \),
and \( P_a \) = total production in aging facility at one time (kg or lb) (Bouma, Durham and Meunier-Goddik, 2014).

### 3.4.5 Fixed costs

Fixed costs consist of depreciation costs (useful life of equipment is 15 years and facilities is 30 years – project lasts 11 years, residual value is 10 % of purchase value), getting licenses, permits and fees cost 1,200 €, insurance cost is 1,200 €/year and taxes are 15 % of gross income.

### 3.4.6 Variable costs

In the following table 11, variable costs in case of cheese factory project are shown.

<table>
<thead>
<tr>
<th>VARIABLE COSTS</th>
<th>price</th>
<th>month</th>
<th>€</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cheese ingredients (rennet, salt)/kg</td>
<td>0.12</td>
<td></td>
<td>4.380</td>
</tr>
<tr>
<td>Energy</td>
<td>550</td>
<td>12</td>
<td>6.600</td>
</tr>
</tbody>
</table>

\(^9\) The survey of current artisan cheese companies resulted in an aging room estimation factor of 0.01096 m\(^2\)/kg (0.0535 ft\(^2\)/lb) of cheese being aged in the space at one time. An assumption of 2.44 m (8 ft) ceilings in the room was used (Bouma, Durham and Meunier-Goddik, 2014).
### 4 RESULTS AND DISCUSSION

In this thesis, CBA is used as a basic methodological approach for getting information about financial feasibility of the projects. Also, sensitivity analysis is used to determine risks related to project investments, based on investment costs increase and price of the products decrease.

To get the information about financial feasibility of the projects, dynamic methods of project evaluation are used: NPV, IRR (as basic methods), discounted payback and profitability index (as additional methods), as well as sensitivity analysis which is part of CBA for risk assessment.

#### 4.1 Dairy goat farm investment project

For the dairy goat farm with 500-goat herd, investment costs are 452,400 €, fixed costs are 13,687 € and variable costs are 296,042 €. Total costs are 762,129 €.

Sales revenue is 410,467 €. The project period is 11 years (0 year-year of investment + 10 years) and discount rate is 5.5 %. Based on this data and using dynamic methods described in the previous chapter, we got the following results.

At the end of the project, with 5.5 % discount rate, we have NPV which is 334,227 €. If we divide this number with the project period, we have average yearly income of 30,384 € or 2,532 €/month.

<table>
<thead>
<tr>
<th>Marketing</th>
<th>15%</th>
<th>82,125</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outside labor</td>
<td>1.700</td>
<td>12</td>
</tr>
<tr>
<td>Cheese room supplies</td>
<td>800</td>
<td>800</td>
</tr>
<tr>
<td><strong>TOTAL VARIABLE COSTS</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: interview with farmers, (Delaney, 2012), (Jerič, 2011).
Since NPV is positive, profitability index is higher than 1. When we put in a ratio NPV and investment costs of this project, we get a relatively high profitability index (1,44).

Internal rate of return is very high (21,48%) which is a good sign, since it gives us flexibility in case of sales/price decrease or cost increase. Discounted payback is 5,79 years and it means that, from that point, all our investment costs will be paid back and we will get out of “negative zone” and start making profit. Based on collected data and results that we got from calculating dynamic methods of investment evaluation, this project is financially justified, will maximize our capital in the long term and will bring us profit.

All the information mentioned above is displayed in the following table 12:
Table 12: Key financial parameters for the dairy goat farm project, including investment, fixed and variable costs, NPV and cumulative NPV for discount rate of 5.5% and 21.48% (IRR)

<table>
<thead>
<tr>
<th>TABLE FOR 500 GOATS HERD</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>VALUE €</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SALES REVENUE</td>
<td>410.467</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RESIDUAL VALUE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6.000</td>
<td>74.973</td>
<td></td>
</tr>
<tr>
<td>INVESTMENT COSTS</td>
<td>452.400</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FIXED COSTS</td>
<td>13.687</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VARIABLE COSTS</td>
<td>296.042</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL COSTS</td>
<td>762.129</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GROSS PROFIT</td>
<td>-351.661</td>
<td>100.739</td>
<td>100.739</td>
<td>100.739</td>
<td>100.739</td>
<td>100.739</td>
<td>100.739</td>
<td>100.739</td>
<td>100.739</td>
<td>100.739</td>
<td>106.739</td>
</tr>
<tr>
<td>NET PROFIT</td>
<td>-351.661</td>
<td>85.628</td>
<td>85.628</td>
<td>85.628</td>
<td>85.628</td>
<td>85.628</td>
<td>85.628</td>
<td>85.628</td>
<td>85.628</td>
<td>85.628</td>
<td>90.728</td>
</tr>
<tr>
<td>DISCOUNT RATE</td>
<td>1.00000</td>
<td>0.94787</td>
<td>0.89845</td>
<td>0.85161</td>
<td>0.80722</td>
<td>0.76513</td>
<td>0.72525</td>
<td>0.68744</td>
<td>0.65160</td>
<td>0.61763</td>
<td>0.58543</td>
</tr>
</tbody>
</table>

5.5%  

| NET PRESENT VALUE (NPV) | -351.661 | 81.164  | 76.933  | 72.922  | 69.120  | 65.517  | 62.101  | 58.864  | 55.795  | 56.036  | 56.303  | 87.437  | 334.227 |
| DISCOUNT RATE           | 1.00000 | 0.82318 | 0.67763 | 0.55781 | 0.45918 | 0.37799 | 0.31115 | 0.25613 | 0.21084 | 0.17356 | 0.14287 |

Source: My own calculations
Gavrič S. Cost - Benefit Analysis of production and processing of Saanen goat milk.
Master Thesis, Maribor, University of Maribor, Faculty of Agriculture and Life Sciences, 2016

4.2 Cheese factory investment project

Considering the cheese factory investment project, investment costs are 388,937 €, fixed costs are 16,711 € and variable costs are 442,805 €. Total costs are 848,453 €.

Sales revenue is 547,500 €. The project period is 11 years (0 year-year of investment + 10 years) and discount rate is 5.5 %. Based on this data and using dynamic methods described in the previous chapter, we got the following results.

At the end of the project, with 5.5 % discount rate, we have NPV which is 308,668 €. If we divide this number with the project period, we have average yearly income of 28,061 € or 2,338 €/month.

Since NPV is positive, the profitability index is higher than 1. When we put in a ratio NPV and investment costs of this project we get profitability index (1.36).
Internal rate of return is also very high in this project (22.31%) which is a good sign since it gives us flexibility in case of sales/price decrease or cost increase.
Discounted payback is 5.68 years and it means that, from that point, all our investment costs will be paid and we will get out of “negative zone” and start making profit.

Based on collected data and results that we got from calculating dynamic methods of investment evaluation, this project is also financially justified, will maximize our capital in the long term and will bring us profit.

All the information mentioned above is displayed in the following table 13:
Table 13: Key financial parameters for the cheese factory project, including investment, fixed and variable costs, NPV and cumulative NPV for discount rate of 5.5% and 22.31% (IRR)

| CHEESE PRODUCTION | YEAR | 0 | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  |
|-------------------|------|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| SALES REVENUE     | 547.500 |   |     |     |     |     |     |     |     |     |     |     |     |
| RESIDUAL VALUE    |       |   |     |     |     |     |     |     |     |     |     |     | 92.260 |
| INVESTMENT COSTS  | 388.937 |   |     |     |     |     |     |     |     |     |     |     |     |
| FIXED COSTS       | 16.711 |   |     |     |     |     |     |     |     |     |     |     |     |
| VARIABLE COSTS    | 442.805 |   |     |     |     |     |     |     |     |     |     |     |     |
| TOTAL COSTS       | 848.453 |   |     |     |     |     |     |     |     |     |     |     |     |
| GROSS PROFIT      | -300.953 | 87.984 | 87.984 | 87.984 | 87.984 | 87.984 | 87.984 | 87.984 | 87.984 | 87.984 | 180.244 |
| NET PROFIT        | -300.953 | 74.786 | 74.786 | 74.786 | 74.786 | 74.786 | 74.786 | 74.786 | 74.786 | 74.786 | 153.207 |
| CUMULATIVE NET CASH FLOW | -300.953 | -226.167 | -151.380 | -76.594 | -1.808 | 72.979 | 147.765 | 222.551 | 297.338 | 372.124 | 525.331 |
| DISCOUNT RATE     | 1 | 0.94787 | 0.89845 | 0.85161 | 0.80722 | 0.76513 | 0.72525 | 0.68744 | 0.65160 | 0.61763 | 0.58543 |
| 5.5%              |   |   |     |     |     |     |     |     |     |     |     |     |     |
| NET PRESENT VALUE (NPV) | -300.953 | 70.887 | 67.192 | 63.689 | 60.369 | 57.222 | 54.238 | 51.411 | 48.731 | 46.190 | 89.692 | 308.668 |
| DISCOUNT RATE     | 1 | 0.81759 | 0.66846 | 0.54653 | 0.44684 | 0.36533 | 0.29870 | 0.24421 | 0.19967 | 0.16325 | 0.13347 |

Source: My own calculations
4.3 Sensitivity analysis

Sensitivity analysis is done in a way that NPV, IRR, profitability index and discounted payback are calculated in case of different scenarios, where there were changes in one of the investment variables. These changes include changes of (+/- 10% and 20%) in prices of the product (milk and cheese) and investment costs (dairy goat farm and cheese factory).

Key variables in the dairy goat farm investment project are (Table 14, Table 15):
- Milk price,
- Investment costs.

Key variables in the cheese factory project are (Table 16, Table 17):
- Cheese price,
- Investment costs.
Table 14: Sensitivity analysis for the dairy goat farm in case of milk price change

<table>
<thead>
<tr>
<th>MILK</th>
<th>Price change</th>
<th>-20%</th>
<th>-10%</th>
<th>0%</th>
<th>10%</th>
<th>20%</th>
</tr>
</thead>
<tbody>
<tr>
<td>price (€)</td>
<td></td>
<td>0.72</td>
<td>0.81</td>
<td>0.9</td>
<td>0.99</td>
<td>1.08</td>
</tr>
<tr>
<td>NPV (€)</td>
<td></td>
<td>-140.246</td>
<td>96.991</td>
<td>334.227</td>
<td>571.464</td>
<td>808.700</td>
</tr>
<tr>
<td>change %</td>
<td></td>
<td>-141.96%</td>
<td>-70.98%</td>
<td>0.00%</td>
<td>70.98%</td>
<td>141.96%</td>
</tr>
<tr>
<td>IRR (%)</td>
<td></td>
<td>-1.38</td>
<td>10.11</td>
<td>21.48</td>
<td>33.8</td>
<td>47.98</td>
</tr>
<tr>
<td>change %</td>
<td></td>
<td>-106.42%</td>
<td>-52.93%</td>
<td>0.00%</td>
<td>57.36%</td>
<td>123.37%</td>
</tr>
<tr>
<td>PI&lt;sup&gt;10&lt;/sup&gt;</td>
<td></td>
<td>0.82</td>
<td>1.13</td>
<td>1.44</td>
<td>1.75</td>
<td>2.06</td>
</tr>
<tr>
<td>change %</td>
<td></td>
<td>-43.06%</td>
<td>-21.53%</td>
<td>0.00%</td>
<td>21.53%</td>
<td>43.06%</td>
</tr>
<tr>
<td>DP&lt;sup&gt;11&lt;/sup&gt; (years)</td>
<td></td>
<td>17.18</td>
<td>8.8</td>
<td>5.79</td>
<td>4.17</td>
<td>3.2</td>
</tr>
<tr>
<td>change %</td>
<td></td>
<td>196.72%</td>
<td>51.99%</td>
<td>0.00%</td>
<td>-27.98%</td>
<td>-44.73%</td>
</tr>
</tbody>
</table>

Source: My own calculation

In the case of price decrease by 10%, NPV is decreased by 70.98% (from 334.227 € to 96.991 €). Increase or decrease of price will bring additional increase or decrease of NPV by another 70.98%. Changes of other indicators are also shown in Table 14.

In case of investment cost change, for increase/decrease of investment costs by 10%, NPV is increased/decreased by 13.54%. Additional 10% change has the same trend. Changes of other indicators are shown in Table 15.

Table 15: Sensitivity analysis for the dairy goat farm in case of investment costs change

<table>
<thead>
<tr>
<th>MILK</th>
<th>Investment costs change</th>
<th>-20%</th>
<th>-10%</th>
<th>0%</th>
<th>10%</th>
<th>20%</th>
</tr>
</thead>
<tbody>
<tr>
<td>investment costs (€)</td>
<td></td>
<td>361.920</td>
<td>407.160</td>
<td>452.400</td>
<td>497.640</td>
<td>542.880</td>
</tr>
<tr>
<td>NPV (€)</td>
<td></td>
<td>424.707</td>
<td>379.467</td>
<td>334.227</td>
<td>288.987</td>
<td>243.747</td>
</tr>
<tr>
<td>change %</td>
<td></td>
<td>27.07%</td>
<td>13.54%</td>
<td>0.00%</td>
<td>-13.54%</td>
<td>-27.07%</td>
</tr>
<tr>
<td>IRR (%)</td>
<td></td>
<td>31.17</td>
<td>25.71</td>
<td>21.48</td>
<td>18.09</td>
<td>15.27</td>
</tr>
<tr>
<td>change %</td>
<td></td>
<td>45.11%</td>
<td>19.69%</td>
<td>0.00%</td>
<td>-15.78%</td>
<td>-28.91%</td>
</tr>
<tr>
<td>PI</td>
<td></td>
<td>1.63</td>
<td>1.53</td>
<td>1.44</td>
<td>1.36</td>
<td>1.29</td>
</tr>
<tr>
<td>change %</td>
<td></td>
<td>13.19%</td>
<td>6.25%</td>
<td>0.00%</td>
<td>-5.56%</td>
<td>-10.42%</td>
</tr>
</tbody>
</table>

<sup>10</sup>PI – Profitability index  
<sup>11</sup>DP – Discounted payback
In case of cheese price change by 10%, NPV is increased/decreased by 111.67% (-10% NPV is -36.034 €, +10% NPV is 653.371 €). Additional 10% change has the same trend. The rest of the indicators and their changes are shown in Table 16.

In case of investment cost change, for increase/decrease of investment costs by 10%, NPV is increased/decreased by 12.60%. Additional 10% change has the same trend. Changes of other indicators are shown in Table 17.

Table 16: Sensitivity analysis for the cheese factory in case of cheese price change

<table>
<thead>
<tr>
<th>CHEESE</th>
<th>Price change</th>
<th>-20%</th>
<th>-10%</th>
<th>0%</th>
<th>10%</th>
<th>20%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price (€/kg)</td>
<td>12</td>
<td>13.5</td>
<td>15</td>
<td>16.5</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>NPV (€)</td>
<td>-380.736</td>
<td>-36.034</td>
<td>308.668</td>
<td>653.371</td>
<td>998.073</td>
<td></td>
</tr>
<tr>
<td>change %</td>
<td>-223.35%</td>
<td>-111.67%</td>
<td>0.00%</td>
<td>111.67%</td>
<td>223.35%</td>
<td></td>
</tr>
<tr>
<td>IRR (%)</td>
<td>-17.53</td>
<td>3.55</td>
<td>22.31</td>
<td>44.13</td>
<td>73.85</td>
<td></td>
</tr>
<tr>
<td>change %</td>
<td>-178.57%</td>
<td>-84.09%</td>
<td>0.00%</td>
<td>97.80%</td>
<td>231.02%</td>
<td></td>
</tr>
<tr>
<td>PI</td>
<td>0.54</td>
<td>0.96</td>
<td>1.36</td>
<td>1.76</td>
<td>2.15</td>
<td></td>
</tr>
<tr>
<td>change %</td>
<td>-60.29%</td>
<td>-29.41%</td>
<td>0.00%</td>
<td>29.41%</td>
<td>58.09%</td>
<td></td>
</tr>
<tr>
<td>DP (years)</td>
<td>10.86</td>
<td>5.68</td>
<td>3.23</td>
<td>2.33</td>
<td>2.33</td>
<td></td>
</tr>
<tr>
<td>change %</td>
<td>91.20%</td>
<td>0.00%</td>
<td>-43.13%</td>
<td>-58.98%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: My own calculations

Table 17: Sensitivity analysis for the cheese factory in case of investment costs change

<table>
<thead>
<tr>
<th>CHEESE</th>
<th>Investment costs change</th>
<th>-20%</th>
<th>-10%</th>
<th>0%</th>
<th>10%</th>
<th>20%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investment costs (€)</td>
<td>311.149,6</td>
<td>350.043,3</td>
<td>388.937</td>
<td>427.830,7</td>
<td>466.724,4</td>
<td></td>
</tr>
<tr>
<td>NPV (€)</td>
<td>386.456</td>
<td>347.562</td>
<td>308.668</td>
<td>269.775</td>
<td>230.881</td>
<td></td>
</tr>
<tr>
<td>change %</td>
<td>25.20%</td>
<td>12.60%</td>
<td>0.00%</td>
<td>-12.60%</td>
<td>-25.20%</td>
<td></td>
</tr>
<tr>
<td>IRR (%)</td>
<td>32.14</td>
<td>26.6</td>
<td>22.31</td>
<td>18.88</td>
<td>16.04</td>
<td></td>
</tr>
<tr>
<td>change %</td>
<td>44.06%</td>
<td>19.23%</td>
<td>0.00%</td>
<td>-15.37%</td>
<td>-28.10%</td>
<td></td>
</tr>
<tr>
<td>PI</td>
<td>1.5</td>
<td>1.43</td>
<td>1.36</td>
<td>1.3</td>
<td>1.25</td>
<td></td>
</tr>
</tbody>
</table>

Source: My own calculations
As already mentioned, considering financial security of the projects, assumptions that are respected are price changes (dairy goat farm – milk price decrease by 10%, cheese factory – cheese price decrease by 10%) and changes in investment costs (dairy goat farm – investment cost increase by 10%, cheese factory – investment cost increase by 10%).

Table 18: Evaluation of financial security of the dairy goat farm project in case of investment costs increase (10%) and milk price decrease (10%)

<table>
<thead>
<tr>
<th>MILK</th>
<th>INVESTMENT COSTS CHANGE (+10%) AND MILK PRICE CHANGE (-10%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Investment costs (€)</td>
</tr>
<tr>
<td>NPV (€)</td>
<td></td>
</tr>
<tr>
<td>change %</td>
<td></td>
</tr>
<tr>
<td>IRR (%)</td>
<td></td>
</tr>
<tr>
<td>change %</td>
<td></td>
</tr>
<tr>
<td>PI</td>
<td></td>
</tr>
<tr>
<td>change %</td>
<td></td>
</tr>
<tr>
<td>DP (years)</td>
<td></td>
</tr>
<tr>
<td>change %</td>
<td></td>
</tr>
</tbody>
</table>

Information in Table 18 confirms the third hypothesis (H.3.), namely that the dairy goat farm project is financially feasible, since its NPV is positive (51,751 €), despite changes in investment costs and milk price. IRR is 7,76% (higher than 5,5% discount rate), the profitability index is 1,06 and discounted payback is 9,96 years. Also, we can see in Table 18 percentage changes in NPV (-84,52%), IRR (-63,87%) PI (-26,39%) and DP (+72,02%) compared to this project without changes in investment cost and milk price.
Table 19: Evaluation of financial security of the cheese factory project in case of investment costs increase (10%) and milk/cheese price decrease (10%)

<table>
<thead>
<tr>
<th>CHEESE</th>
<th>INVESTMENT COSTS CHANGE (+10%), MILK PRICE (-10%) AND CHEESE PRICE (-10%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Investment costs (€)</td>
</tr>
<tr>
<td>NPV (€)</td>
<td>427,831</td>
</tr>
<tr>
<td>change %</td>
<td>-45,45%</td>
</tr>
<tr>
<td>IRR (%)</td>
<td>13,8</td>
</tr>
<tr>
<td>change %</td>
<td>-38,14%</td>
</tr>
<tr>
<td>PI</td>
<td>1,2</td>
</tr>
<tr>
<td>change %</td>
<td>-11,76%</td>
</tr>
<tr>
<td>DP (years)</td>
<td>6,6</td>
</tr>
<tr>
<td>change %</td>
<td>16,20%</td>
</tr>
</tbody>
</table>

Source: My own calculations

Information in Table 19 confirms the fourth hypothesis (H.4.), namely that the cheese factory project is financially feasible, since its NPV is positive (168,392 €), despite changes in investment costs and milk\textsuperscript{12} and cheese price. IRR is 13,8\% (higher than 5,5\% discount rate), profitability index is 1,2 and discounted payback is 6,6 years. Also, we can see in Table 19 percentage changes in NPV (-45,45\%), IRR (-38,14\%) PI (-11,76\%) and DP (+16,2\%) compared to this project without changes in investment costs and milk and cheese price.

\textsuperscript{12}Lower milk price positively influences NPV of cheese factory project since milk is a basic ingredient in cheese production and for that reason production costs of cheese are lower. Because of the first scenario (dairy goat farm project) lower milk price was kept in this scenario too, as the two projects are connected (goats produce milk and milk becomes raw material for cheese production).
5 CONCLUSIONS

The purpose of the investment projects is goat milk production and processing of produced milk into semi-hard cheese. To get the highest possible quality and quantity of products, thus the highest profit, it is necessary to respect factors which influence production (choosing the breed, choosing livestock within the breed, proper feeding, proper housing, controlled reproduction, health care of animals, etc.). The goat dairy farm has 500 does with average lactation of 730 l per doe and the cheese factory has capacities big enough to process all the milk produced there.

The main goal of this Master thesis was to answer whether the investment in projects (goat dairy farm and cheese factory) is financially feasible. Cost-Benefit Analysis gave the answer to this question. All costs and benefits of the projects were determined and evaluated. In case of dairy goat farm, NPV is 334,227 € and IRR is 21,48% and it is higher than discount rate (5,5%). The second project, cheese factory, also has positive NPV (308,668 €) and IRR (22,31%) which is higher than the discount rate (5,5%). Investment in both projects is financially feasible, thus the first (H.1.) and the second (H.2.) hypotheses have been confirmed.

Within CBA, sensitivity analysis was done and investments were evaluated in terms of financial feasibility. Sensitivity analysis was done in a way that NPV, IRR, PI and discounted payback were calculated in case of different scenarios, where there were changes in one of the investment variables. These changes include changes of (+/- 10% and 20%) in prices of the product (milk and cheese) and investment costs (dairy goat farm and cheese factory).

Both projects are most sensitive to changes in prices (milk price change +/- 10%, NPV changes by +/- 70,98% and cheese price change +/- 10%, NPV changes by +/- 111,67%).

To get the answer if the investment in projects is financially feasible, sensitivity analysis was done in which the increase in investment costs by 10% (both projects), decrease in milk price by 10% (dairy goat farm) and decrease in milk price and cheese price by 10% (cheese factory) has been taken into account. In case of dairy goat farm, NPV is positive
(51.751 €), despite changes in investment costs and milk price. IRR is 7.76% (higher than 5.5% discount rate). In case of cheese factory, NPV is also positive (168.392 €), despite changes in investment costs and milk and cheese price. IRR is 13.8% (higher than 5.5% discount rate). Empirical results derived here indicate that both projects are financially feasible, while the third (H.3.) and the fourth (H.4.) hypotheses have been confirmed.
6 REFERENCES


7 ACKNOWLEDGEMENTS

First of all, I would like to thank my mentor Prof. Karmen Pazek for her helpful suggestions, meticulousness and patience during the work on my thesis.

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And, of course, many thanks to my family. They were always my support.