THE ECONOMIC ASPECTS OF INNOVATION IN SHEEP BREEDING

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Abstract: During my investigations, I highlighted three innovations, all of which serve the production of a final product, sheep kefir. This product contains a unique added value and involves several innovational opportunities.

I examined the complex economic analysis of the innovations and technological elements investigated with respect to revenues from the sale of sheep milk, sheep cheese (kashkaval) and sheep kefir. The kashkaval-type sheep cheese does not contain sufficient added value to cover the costs of innovational investments. Investigating the innovational activity for developing sheep kefir and for its market introduction, its cash flow balance becomes positive already in the second year after realization, and is able to generate significant profit.

Key words: sheep breeding, innovation, recovery calculation, sheep kefir, sheep milk production

1. Preliminaries and Objectives of the Dissertation

The significance of innovation as a modifying factor of the profitability of farming is outstanding even in agriculture. An economic unit (enterprise, business) may only be profitable in the long run if it is capable of adapting new technological elements, developing them as own innovations and making them practical. The developed economy, due to its innovational and adaptive activity, is able to increase the efficiency of its production and, furthermore, to produce products meeting consumers' demands.

While in poultry, pig and cattle breeding, the keeping and breeding technologies, product processing and product structures developed over the last 50 years, comparatively little adaptation has occured in sheep breeding and in the processing of its products, and considerable innovation did not occur at all. One of the ways to increase the market successfulness of sheep products is to immediately introduce innovation to production (*Borsos,* 2005); without it, no enterprise may be successful.

The condition and opportunities of the Hungarian sheep breeding are basically determined by the efficiency of production and the product structure of such an enterprise. More than 90% of the Hungarian domestic sheep stock belong to the Merino variety group, and this determines the keeping technology used here. Regarding semi-intensive keeping technology, the only marketable product of the sheep branch under present economic conditions may be the sale of lamb. Sheep milk realizes the greatest revenue only in a few companies, although it is true that at present sheep milk is the only product in the sheep branch, which has an entire processing industry in Hungary (in the case of lamb carcass sales, does not reflect any detected economic size).

My research investigated the turnover of the investment needed to realize innovation and also examined the economic aspects of the technology developed in the following three areas:

– The economic aspects of intensive keeping technology based on dairy Awassi

The AWASSI stock company in Bakonszeg is the only sheep farm in Hungary where sheep milk is produced under intensive keeping technology similarly to milk from dairy cows. During my investigation, I strived to determine under which intensive technological processing level sheep milk is worth producing.

– The economic aspects of insemination, synchronizing rutting and rutting induction in Awassi stock

Intensive keeping technology may only be operated by programmed reproduction biology from the aspect of production. Research and development programs aiming at rutting induction serve in eliminating the seasonality of products made from sheep milk, the economic turnover of which is significantly determined by the value added content of the price of the products made from sheep milk.

– Economic aspects of artificial lamb rearing technology in intensive dairy sheep

The significance of the artificial rearing of lambs is the fact that one Awassi ewe may start its lactation at a daily milk

production rate of 4 liters after lambing. On the other hand, the lambs are able to suckle only half a liter of milk each day. If lambs were not separated from the ewe at the moment of birth, the milk production of the ewe would reduce to the level of the daily demand of the lamb, which would result in a significant milk loss, but at the same time, the costs of keeping would not decrease.

I determine the profitability of the technology by investigating the production costs of artificial rearing of lambs and the realizable production value.

My hypotheses are the following:

– The higher processed level and higher added value are essential conditions for the profitability of dairy products of sheep.
– The higher processed level may contribute to good economic results, combined with continuous or better expanded production in time.
– The significant effect of synchronizing rutting may be reflected at farm level through a longer milk producing period.

2. Methods utilized

The basis of the dissertation is the assumption that selling sheep milk in unprocessed form results in losses if a farm uses intensive keeping technology. For this reason, the Awassi stock company in Bakonszeg produces a product of extremely high added value, which is sheep kefir.

As seasonal rutting is typical of sheep (except for a few breeds in Mediterranean areas and in other warmer climates), sheep kefir disappeared from the shelves of supermarkets in the same year it was introduced to the market, as there was not any milk production. This shortage was not tolerated by traders and consumers, so in the following year, negotiations had to be restarted with supermarket chains to get sheep kefir onto the list of purchased and sold products.

The innovations investigated (intensive keeping technology, aseasonal rutting, artificial insemination, artificial lamb raring) where made for the sake of producing continuous and sound quality sheep kefir.

Determining the efficiency of innovation may be realized most effectively if the simplest representative method is utilized; I used recovery calculation regarding net present value in my dissertation. By this method, every countable factor may be taken into consideration during the calculation. In practice, recovery calculation in present value is used for preparing decisions relating to investments, which may be producing investments, firm purchase or research-development projects. I examined the financial feasibility of the technology used and the turnover of R&D investments on the basis of net present value.

Net Present Value (NPV): the net present value of investments is the difference between the expected cash flows relating to the investment and the investment costs regarding the time value of money. Expenses, including the initial ones, are negative outflows, while revenues are inflows marked with a positive sign. The net present value expresses how much the net result produced of the investment is during the planned period discounted at the time of the investment. The calculation is capable of comparing and ranking project varieties competing for the same source.

The net profit is the difference between the present value of the inflows and the present value of the incurring outflows including the initial investment costs, as well as the expenses in connection with the continuous maintenance and operation.

The indicator of NPV may be calculated on the basis of the following correlation:

$$NPV = -C_o + \sum_{t=1}^{n} \frac{1}{(1+r)^t} \times C_t$$

NPV = net present value
C_o = the initial cost of investment
C_t = the difference between the total expected revenues and expenses in the given period of time
t = number of the given period
n = number of periods
r = discount rate (calculative interest rate)

If the net present value of the total cash flows in connection with the investment is of a positive sign regarding the minimal expected turnover (calculative interest rate), the real profitability of the investment is better than the minimal expected profitability. In the case of a positive NPV, the investment is generally accepted, but it also depends on the decision-maker whether the planned profit is sufficient to the investor as the yield of the given period.

If the NPV is zero, the increment of the investment is equal to the yield of the calculative interest rate. In the case of a negative NPV, it is not worth realizing the investment solely from financial aspects, as the yield of the investment is lower than that reached by the calculative interest rate, even though the operation of our investment does not necessarily show a deficit. (*Szűcs – Szőllősi,* 2008)

I illustrated the complex economic analysis relating to the specified products in radar charts *(Figure 3, 4, 5)* which qualify factors modifying the result of the innovation. The radar chart (also known as a spider chart or a star chart because of its appearance) reflects the value of the certain categories on a separated axes starting from the centre of the chart and ending on the external chart ring. (*Kiss – Manczel,* 1965, *Nemes Nagy,* 2004)

The grading of factors that modify specific results is reflected in the distance from the centre of the spider web. The value of points close to the centre of the spider chart is 1 (which means that it is of very bad qualified); the farthest point is 5 (which means that it is of very good qualified). The meaning of the points is as follows:

1 – very bad
2 – bad

3 – appropriate
4 – good
5 – very good

The spider chart is based on the examination of six factors; their conditions significantly determine the success of certain innovations. The profitability of products as a result of farming and innovation may be characterized by several indicators, but it is the analyzer who has to select the most determinant from among them.

I also investigated the liquidity condition of the business carrying out the innovation as the factor modifying the result of the innovation. Indicators reflecting the liquidity condition compare assets expected to be converted to cash in a year (current assets) and (current) liabilities in a year. The **liquidity indicator** reflects the liquidity of the business. A venture is considered to be solvent if the value of assets being converted to cash in a year is higher than the value of short-term liabilities. The indicator may be accepted if its value exceeds 1,3; and the higher the value is the most reliable the liquidity of the enterprise is. (*Nábrádi – Nagy,* 2005).

$$\text{Liquidity} = \frac{\text{Current assets}}{\text{Current liabilities}} \times 100$$

The meaning of points of the spider chart in case of liquidity indicator is the following
:

Value in the spider chart	Value of the liquidity indicator
1 – very bad	<1,00
2 – bad	1,00-1,29
3 – appropriate	1,30-1,49
4 – good	1,50-1,79
5 – very good	≥1,80

The result of the innovation is influenced by the **value added content of the product**, which was calculated by the contribution indicator. Contribution = net revenue of selling – direct cost of selling. (*Nábrádi – Nagy,* 2005).

The meaning of points of the spider chart in case of value added content of the final product is the following:

Value in the spider chart	Value added content of the final product (HUF/liter sheep milk)
1 – very bad	<50
2 – bad	50-99
3 – appropriate	100-149
4 – good	150-200
5 – very good	>200

Lifecycle curves of products and services are models that are widely used. The curve includes the typical position changing stages of the process starting from the establishment of a product and ending with its decline. *Figure 7* illustrates the entire lifecycle curve of products. This includes the R&D phases of preparing (applied research, prototypes, "0" series, preparation of production, preparation of manufacturing) and the classical 4 stages (introduction, growth, maturity, decline). The curve is a general model as the lifecycle curve of a certain product depends on several factors. (*Bucsy,* 1976, *Szakály,* 2002).

The meaning of points of the spider chart in the case of the final product:

Value in the spider chart	Lifecycle curve of the final product (how long it is in the market in years)
1 – very bad	>50
2 – bad	50-26
3 – appropriate	25-11
4 – good	10-6
5 – very good	<5

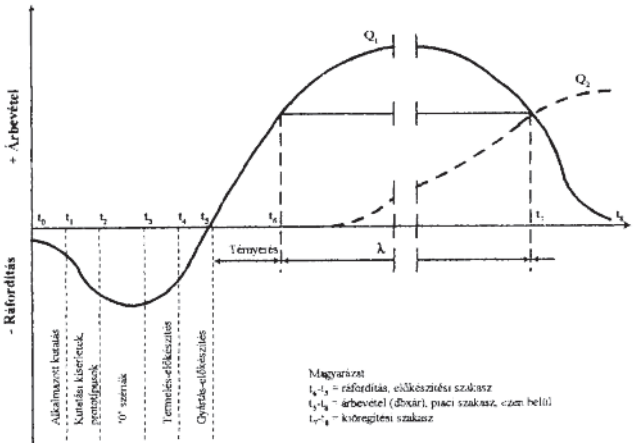


Figure 1: The Typical Stages of the Whole Lifecycle
Source: Szakály, 2002.
Árbevétel – Revenue
Ráfordítás – Inputs
Alkalmazott kutatás – Applied research
Kutatási kísérletek, prototípusok – Experimental researches, prototype
„0" szériák – „0" series
Termelés- előkészítés – Preparation of production
Gyártás előkészítés – Preparation of manufacturing
Térnyerés – Growth
Magyarázat – Note
ráfordítás, előkészítési szakasz – inputs, development stage
árbevétel, piaci szakasz – revenue, market stage
kiöregedési szakasz – declining stage

The meaning of points of the spider chart in case of the quality and quantity of sheep milk:

Value in the spider chart	Sheep milk quality and quantity	
	Lactation milk production (liter/animal)	Somatic cell number (unit/ml)
1 – very bad	<100	>800.000
2 – bad	100-129	700.001-800.000
3 – appropriate	130-169	600.001-700.000
4 – good	170-240	500.001-600.000
5 – very good	≥240	≤500.000

In order to examine the value of **market demand for the product** I compared the quantity of products ordered by the PROVERA LTD realizing the purchase for CORA to the quantity of products being potentially produced.

The meaning of points of the spider chart as relates to the market demand for the products:

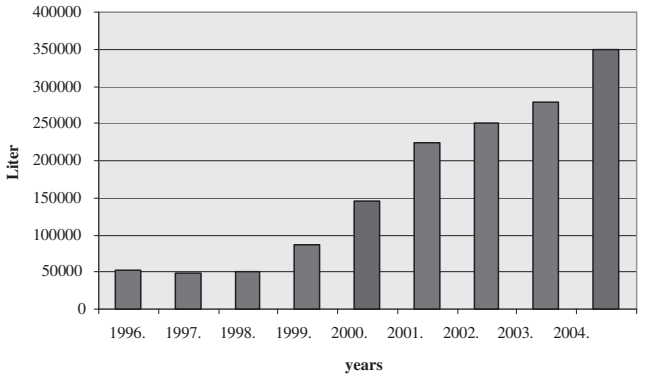
Value in the spider chart	Market demand for the product (how many% the ordered product quantity is of the products being potentially produced)
1 – very bad	<40%
2 – bad	40-59%
3 – appropriate	60-69%
4 – good	70-79%
5 – very good	>80%

3. Major investigations and findings of the dissertation

a. The Economic Aspects of Intensive Keeping Technology Based on Dairy Awassi

The need to increase sheep milk production in Bakonszeg evolved near 15 years ago. The idea became a program, thus the dairy Awassi was imported and its domestic breeding started.

Regarding the volume of milk production, the stock company made its production seven times higher than the produced 50 thousand liters of milk in the year the program was launched *(Figure 2)*. Intensive keeping technology was introduced in 2000, which is represented by the blue column.



Source: own investigations

Figure 2: Milk Production of Awassi in Intensive Keeping Technology

Table 1: Production Value, Production Cost and Profit under Intensive Keeping Technology

Year	2000.	2001.	2002.	2003.	2004.
Production value (HUF/ewe)	**30.348**	**35.241**	**36.969**	**40.505**	**37.251**
Sheep milk (HUF/ewe)	*25.346*	*27.482*	*30.226*	*32.955*	*29.913*
Lamb (HUF/ewe)	*5.002*	*7.759*	*6.743*	*7.550*	*7.338*
Production cost (HUF/ewe)	**37.196**	**39.509**	**43.530**	**47.833**	**52.233**
Fodder cost (HUF/ewe)	*32.000*	*35.200*	*38.720*	*42.592*	*46.851*
Labour cost (HUF/ewe)	*2.596*	*1.624*	*1.936*	*2.273*	*2.215*
Veterinary cost (HUF/ewe)	*900*	*900*	*1.000*	*1.000*	*1.100*
Other cost (HUF/ewe))	*1.700*	*1.785*	*1.874*	*1.968*	*2.066*
Profit (HUF/ewe)	**-6-.848**	**-4.268**	**-6.561**	**-7.328**	**-14.981**

Source: – own investigation

– Hungarian Central Statistical Office (HSCO): Agricultural time series and censuses. Purchasing average price of live animal between 1946 and 2006.

To calculate the per ewe production value and production cost, I used natural indicators relating to one biological cycle (from lambing to lambing). During the calculation of the production value, the purchase price (130 HUF/liter) of sheep milk was taken into consideration. On the basis of the lamb rearing technology, the per ewe revenue from the sales of lambs was determined by calculating a weaning weight of 14 kilograms and the all-time purchase price of milk-fed lamb.

The greatest share, 86% of production cost, is fodder cost. Personal cost includes the gross wage increased by the employer's cost of one shepherd. Other costs include the costs of rutting synchronizing and artificial insemination, as well as the current expenses of the intensive farm.

On the basis of *Table 1*, by using the technology of intensive sheep milk production, sheep milk shows a deficit in the case of its sale as commodity milk. Despite the increasing individual production, the loss grows as the production cost increases by the rate of the inflation. Yet, the price of sheep milk stagnated in the examined years. The utilization of intensive technology may only be profitable in the cases of the production and sale of products of high added value (cheese, kefir).

b. The Economic Aspects of Artificial Insemination, Rutting Synchronicity and Rutting Induction in Awassi

The widespread utilization of artificial insemination is one the most relevant tools used in genetic improvement on dairy sheep farms. Identifying spontaneous rutting animals is almost impossible because of the characteristics of the species under the intensive keeping method.

Experiment 1:

The cycle induction/synchronizing as a new method worked well in dairy cows during the last one and a half decades, and different variations of the combined GnRH – PGF_2 – GnRH treatment (GPG or OvSynch protocol) spread widely all over the world. This process was more favorable than the traditional techniques from food-sanitary aspects, as it synchronizes not only rutting, but also ovulation, thus making possible the use of insemination (fix AI) at a fixed time. This method is used in two forms in sheep: during the treatment using traditional GPG technology similarly as with cows, PGF_2 luteolytical dosaging takes place on the 7th day after the first GnRH treatment, and on the 5th day on the basis of the protocol modified by *Amiridis* et al. (2004). Our objective was to compare the efficiency of these two methods and the traditional gestagen + eCG based techniques.

Experiment 2:

The melatonin treatment used in subcutaneous implants is absorbed slowly. Because they have an agent content of 18 mg, this is one of the most popular methods of cycle induction. This preparation raises the

melatonin level of the plasma for 60 to 70 days, in this way increasing LH basic secretion from the 35th to 40th day, which is then followed by evolving estrogen-active follicles and ovulation. The melatonin treatment is utilized from the time of summer solstice (from the middle of June) to bring forward the first follicle ripening reflecting the beginning of the breeding season. There are favorable experiences gained in Mediterranean sheep varieties in late winter and early spring by using it for cycle induction. This method is based on using a hormone, which is produced even by the body. Its use is considered more favorable in dairy animals from food-sanitary aspects than the synthetic gestagen (e.g. chronogest, or fluorogeston in other name, as well as Medroxyprogesterone-acetate) based techniques (it is authorized, effective and used all over the world). However, there are hardly any data on its efficiency outside of Mediterranean countries, and there is no data available on intensive dairy Awassi sheep. Under domestic climatic and business conditions, the objective of our present experiments in the late winter and spring and in the summer periods was to

(a) compare the suitability of traditional gestagen+eCG treatment and the melatonin treatment with the purpose of cycle induction;

furthermore, to measure

(b) what result the fixed time insemination used after melatonin pre-treatment can generate after the GnRH-PGF_2-GnRH treatment may be considered as being favorable from food-sanitary aspects.

According to the result of the melatonin treatment, which was weaker than expected, the suspicion arose that the given manufacturing series of the preparation was possibly ineffective or the utilized dose in Awassi is insufficient to generate any biological effect.

The high ratio (54%) of one year-old lambs might also have contributed to the low lambing ratio. Our previous examinations, in harmony with the data in literature, allow us to conclude that the ratio of ewes with cyclical ovary functions even outside the breeding season typically depends on age; the ratio of those having cyclic function even in spring is higher among ewes lambing on several occasions.

Table 2: Costs of Research and Development

Year	1. year	2. year	Total
Personal costs (HUF)	2.866.000	2.953.000	5.819.000
Material costs (HUF)	21.083.000	13.141.000	34.224.000
– external commissions (HUF)	*1.394.000*	*806.000*	*2.200.000*
– other material costs (HUF)	*19.689.000*	*12.335.000*	*32.024.000*
Purchasing R&D fixed assets (HUF)	18.500.000	0	18500.000
Total (HUF)	**42.449.000**	**16.094.000**	**58.543.000**

Source: own investigations

Table 2 shows the cost structure of the research and development project introduced. On the basis of Table 5, intensive keeping technology shows a deficit, if sheep milk is sold without processing. Therefore, the turnover from reproductive biological research and development is worth investigating using a complex turnover calculation.

c. The Economic Aspects of Artificial Rearing of Lamb in Intensive Dairy Sheep

The artificial rearing of lamb is one of the most important elements of intensive dairy sheep technology, the success of which affects the business on several points. It is obvious that such a high production and milking period can only be realized by early (one-day-old) lamb separation and that the technology may only be organized if lamb rearing may be made independent from milk production (such as in the case of dairy cows). As lamb rearing based on milk replacement could not spread in domestic practice and an adaptable solution was not found abroad, this problem was solved by the company's own investment.

Table 3: Production Value, Production Cost and Profit of Artificial Rearing of Lamb

Year	2000.	2001.	2002.	2003.	2004.
Production value (HUF/lamb)	**12.453**	**18.799**	**14.614**	**15.026**	**15.077**
Milk-fed lamb (HUF/lamb)	*6.538*	*10.011*	*7.750*	*8.058*	*8.109*
Milk out of ewe (HUF)	*5.915*	*8.788*	*6.864*	*6.968*	*6.968*
Production cost (HUF/lamb)	**9.285**	**9.544**	**11.100**	**11.714**	**12.198**
Fodder cost (HUF/lamb)	*7.200*	*7.360*	*8.990*	*9.455*	*9.936*
Personal costs (HUF/lamb)	*385*	*399*	*236*	*291*	*195*
Other costs (HUF/lamb)	*1.700*	*1.785*	*1.874*	*1.968*	*2.066*
Profit (HUF/lamb)	**3.168**	**9.255**	**3.514**	**3.312**	**2.879**

Source: own investigations

On the basis of the value in *Table 3*, it is clear that the profitability of artificial rearing of lamb significantly depends on the weaning weight and the all-time purchase prices of milk-fed lambs. Only the year 2001 resulted in a profit, thanks to the weaning weight of 17 kilograms (in the other years, the weaning weight was 14 kilograms). Milk from ewes shows the quantity which was not suckled by the lamb, but may be sold as commodity milk. Regarding profitability, among cost elements, the price of milk powder is dominant and can be hardly replaced by other nutriments, due to the relevance of its qualitative parameters. The personal costs reflect well the outstanding labor efficiency of the technology.

The short profitability of artificial rearing of lamb is worth examining only in the case of ram lambs (all of the ewes breeding yearlings are placed into the rearing system, which primarily aims at raising the number of the production sock), as those of unknown origin are sold when these are weaned from nutriments. According to my experience, if ram

lambs cannot be sold at weaning from the milk replacer, serious weight loss is to be expected in the ensuing two weeks, during converting to the yearling nutriment. This weight loss cannot be supplemented by expensive yearling nutriments in hoggets.

d. The Complex Economic Evaluation of Innovations and Technological Elements Examined in the Awassi Stock

The evaluation of the technology of the intensive dairy sheep in the Awassi stock company in Bakonszeg and of the innovations based on the research conducted and the developments we investigated separately reflects an unreal condition. Certain elements, should be subjected to a complex investigation, in order to obtain a true picture of the profitability of the activity. These elements include intensive keeping and breeding technology, genetic and reproduction biological research which determines the biological basis of the continuance of milk production and artificial rearing of lambs, A production stock of 1,100 Awassi sheep and the production data from the year 2004 form the basis of the investigation.

I carried out a complex evaluation on three processing levels (sheep milk, sheep cheese and sheep kefir) for sheep milk, with this milk as the primary product. These three products represent different production costs and altering added value. The manufacturing of dairy products takes place in a cheese factory in Kunszentmárton, owned by the stock company. In addition to the production data introduced in the tables in the previous sections, the processing costs and the realizable revenues have to be regarded during the complex evaluation *(Table 4)*.

Table 4: Production Value, Production Cost and Profit of the Milk Processing Firm

	Sheep cheese	**Sheep kefir**
Production value (HUF/kg)	1.950	910
Production cost (HUF/kg)	1.034	580
price of sheep milk (HUF/kg cheese)	*845*	*130*
cost of processing	*189*	*450*
Profit (HUF/kg)	916	330

Source: own investigation

From the point of view of the processor (regarded as separately operating organizations), a significant economic profit may be realized by manufacturing both of the products. The cheese output is 6.5 liters of sheep milk to 1 kilogram sheep cheese in the cheese factory in Kunszentmárton.

The calculations in Table 5 prove that the intensive keeping technology may be operated with significant loss generation, as the sheep milk purchase price is 130 HUF. The present value of the cash flow (NPV) is -28,556,000 Ft yearly.

In the case of the 6 factors illustrated in the radar chart influencing profitability, it turns out that Liebig's Law of the Minimum (*Loch-Nosticzius,* 1992) prevails, which means that success is controlled by limiting factor, and principally by increasing this factor, growth of the results may be reached. There are two limited factors, such as the liquidity of the company and the added value content of the product. Among them, changing the added value content, i.e. the ratio of processing level, is the easiest.

Table 5: Economic Evaluation of Innovations and Technological Elements in Case of the Final Product of Sheep Milk

Data in thousand HUF

Year	**1.**	**2.**	**3.**	**Total**
Inflation expected		**5%**	**5%**	
Discount rate	100%	105%	110%	
TOTAL REVENUE	**40 976**	**43 025**	**45 176**	**129 177**
Price of sheep milk	*32 904*	*34 550*	*36 277*	*103 731*
Price of lamb	*8 072*	*8 475*	*8 899*	*25 446*
TOTAL EXPENSES	**112 031**	**89 103**	**76 659**	**277 793**
Keeping costs of ewes	*57 456*	*60 329*	*63 346*	*181 131*
Rearing costs of lambs	*12 076*	*12 680*	*13 314*	*38 070*
Investment cost (R&D)	*42 499*	*16 094*		*58 593*
BALANCE OF CASH FLOW	**-71 055**	**-46 078**	**-31 483**	**-148 616**
PRESENT VALUE OF BALANCE OF CASH FLOW (NPV)	**-71 055**	**-43 884**	**-28 556**	**-143 495**
PRESENT VALUE OF ACCUMULATED BALANCE OF CASH FLOW (NPV)	**-71 055**	**-114 939**	**-143 495**	

Source: own investigations

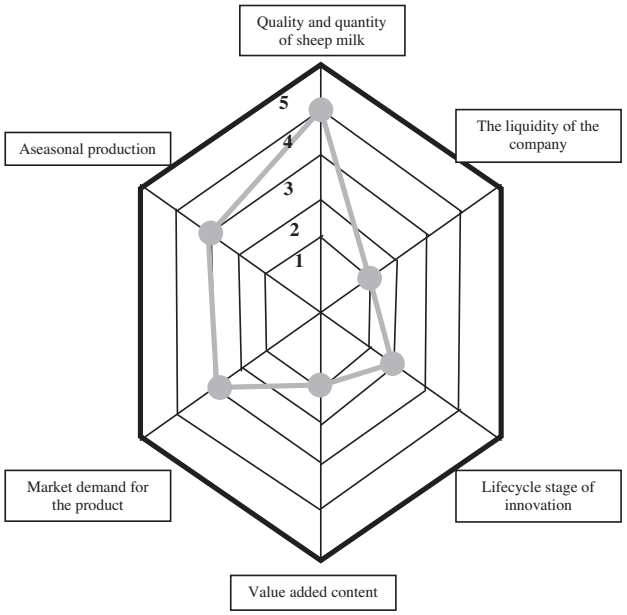


Figure 3: Evaluating Factors Influencing the Result of the Innovation in the case of the Final Product of Sheep Milk
Source: own calculation

The calculations in *Table 6* relate to a whole verticum. The sheep milk is processed in the cheese factory in Kunszentmárton. Due to the production of sheep cheese, it is

already an added value generation (added value – sheep cheese row in *Table 6*), and processing costs appear among the costs, the basic data for which is contained in *Table 4.* According to the calculations, it may be concluded that the balance of the cash flow in terms of its present value (NPV) is -25,773,000 Ft yearly, thus the added value generated through sheep cheese turns to be little to alter the balance of the cash flow into the positive range.

Table 6: The Economic Evaluation of Innovations and Technological Elements in the Case of the Final Product of Sheep Cheese

Data in thousand HUF

Year	**1.**	**2.**	**3.**	**Total**
Inflation expected		**5%**	**5%**	
Discount rate	100%	105%	110%	
TOTAL REVENUE	**83 986**	**88 185**	**92 595**	**264 766**
Price of sheep milk	*32 904*	*34 550*	*36 277*	*103 731*
Price of lamb	*8 072*	*8 475*	*8 899*	*25 446*
Added value – sheep cheese	*43 010*	*45 161*	*47 419*	*135 590*
TOTAL EXPENSES	**152 258**	**131 341**	**121 010**	**404 609**
Keeping costs of ewes	*57 456*	*60 329*	*63 346*	*181 131*
Rearing costs of lambs	*12 076*	*12 680*	*13 314*	*38 070*
Investment cost (R&D)	*42 499*	*16 094*		*58 593*
Production cost – sheep cheese	*40 227*	*42 238*	*44 350*	*126 815*
BALANCE OF CASH FLOW	**-68 272**	**-43 156**	**-28 415**	**-139 843**
PRESENT VALUE OF BALANCE OF CASH FLOW (NPV)	**-68 272**	**-41 101**	**-25 773**	**-135 146**
PRESENT VALUE OF ACCUMULATED BALANCE OF CASH FLOW (NPV)	**-68 272**	**-109 373**	**-135 146**	

Source: own investigation

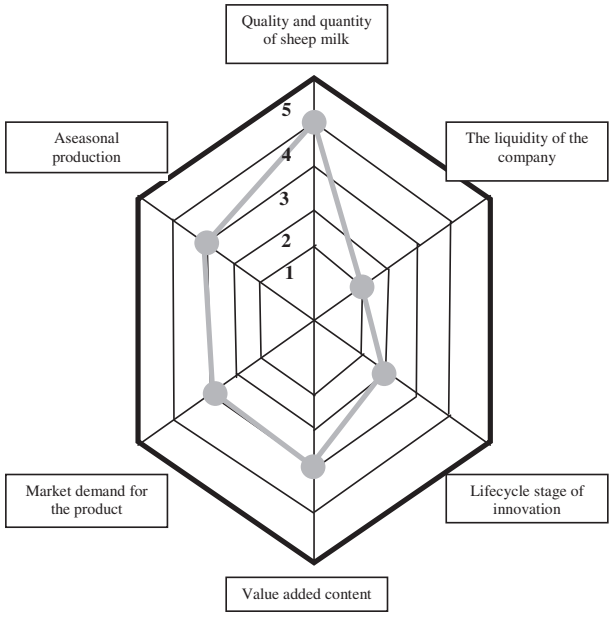


Figure 4: Evaluating Factors Influencing the Result of the Innovation in the case of the Final Product of Sheep Cheese
Source: own investigation

On the basis of *Figure 4,* a slight increase in the added value content of the product was not able to move the balance of the cash flow into the positive range.

Table 7: The Economic Evaluation of Innovations and Technological Elements in the case of the Final Product of Sheep Kefir

Data in Thousand HUF

Year	**1.**	**2.**	**3.**	**Total**
Inflation expected		**5%**	**5%**	
Discount rate	100%	105%	110%	
TOTAL REVENUE	**238 316**	**250 232**	**262 744**	**751 292**
Price of sheep milk	*32 904*	*34 550*	*36 277*	*103 731*
Price of lamb	*8 072*	*8 475*	*8 899*	*25 446*
Added value – sheep kefir	*197 340*	*207 207*	*217 567*	*622 114*
TOTAL EXPENSES	**241 061**	**224 584**	**218 915**	**684.560**
Keeping costs of ewes	*57 456*	*60 329*	*63 346*	*181 131*
Rearing costs of lambs	*12 076*	*12 680*	*13 314*	*38 070*
Investment cost (R&D)	*42 499*	*16 094*		*58 593*
Production cost – sheep kefir	*129 030*	*135 482*	*142 256*	*406 768*
BALANCE OF CASH FLOW	**-2 745**	**25 647**	**43 829**	**66 731**
PRESENT VALUE OF BALANCE OF CASH FLOW (NPV)	**-2 745**	**24 426**	**39 754**	**61 435**
PRESENT VALUE OF ACCUMULATED BALANCE OF CASH FLOW (NPV)	**-2 745**	**21 681**	**61 435**	

Source: own investigations

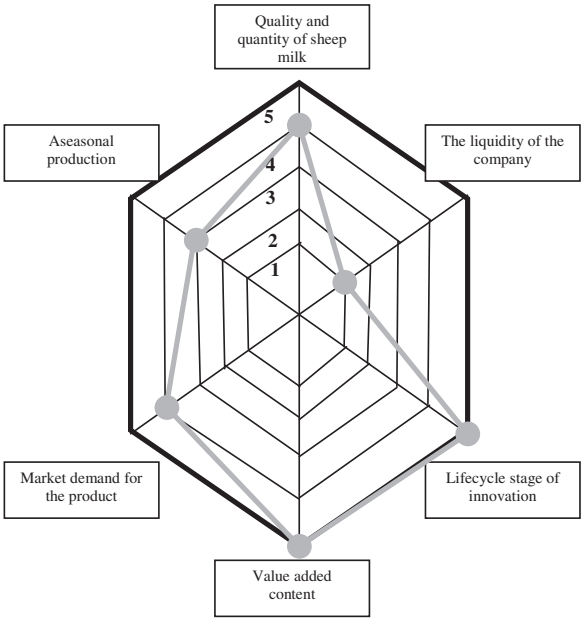


Figure 5: Evaluating Factors Influencing the Result of the Innovation in the case of the Final Product of Sheep Kefir
Source: own investigation

The balance of cash flow in *Table 7* in terms of its present value is positive (39,754,000 HUF yearly), except for the first year. During the first two years, because of the costs of

the reproduction biological research and development program introduced in chapter 3.2., only a modest result might be gained, but the availability of sheep kefir on the shelves of hypermarket chains was ensured only by realizing the program.

The outstandingly high added value of sheep kefir is due to the innovative activities behind the development of the product. For this product it is worth producing sheep milk within an intensive keeping technological system in case of Awassi .By comparing this product to sheep cheese, the value added content is of 5-level instead of the level of 3; furthermore, the lifecycle stage of innovation is of 4-level instead of the level of 2.

Examining the innovative activity carried out for the sake of developing and introducing the sheep kefir into the market, it is clear that the balance of the cash flow is positive, since from the second year following its realization; it is capable of generating significant profit. However, the unfavorable liquidity of the company may make even the best product unsuccessful. This unfortunate situation probably contributed to the fact that the liquidation of the Awassi stock company in Bakonszeg was started in October of 2008.

4. The New scientific findings of the Dissertation

1. Certain elements, such as intensive keeping and breeding technology, genetic and reproduction biological research determining the biological basis of the continuance of milk production, as well as artificial rearing of lamb, should be subjected to a complex investigation, in order to obtain a true picture of the profitability of the activity.
2. When economically evaluating the innovation processes, the inputs of the innovation should be considered as investments.
3. Determining the efficiency of innovation may be realized in a most effective way if the simplest representative method is utilized; I used turnover calculation regarding net present value in my dissertation. Using this method, every countable factor may be taken into consideration during the calculation.
4. In the case of the innovation projects investigated in sheep breeding, the turnover of inputs is highly influenced by the final product. The success of the innovation and the company is basically determined by the added value content and the lifecycle stage of innovation of the final product developed through the innovation and the market demand for the product.
5. I illustrated the complex economic evaluation relating to the specific products in **radar charts** which qualify factors modifying the result of the innovation. In case of the factors illustrated in the radar chart influencing the profitability it turned out that Liebig's Law of the Minimum prevails, which means that the success is controlled by the limiting factor. Principally by increasing this factor, the growth of the result may be reached. There are two limited factors, such as the liquidity of the company and the added value content of the product. Among them, changing the added value content, which is the ratio of the processing level, is the easiest. In the present case, the determining factors were the liquidity of the company, the added value content of the final product, the innovation lifecycle stage of the product and the market demand for the product; and by improving of all these, the result of the innovation might be increased, as well.
6. Examining the innovative activity carried out for the sake of developing and introducing the sheep kefir into the market, it is clear that the balance of the cash flow is positive, since the second year after the realization; it has been capable of generating significant profit. The unfavorable liquidity of the company, however, may make even the best product unsuccessful.

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