Ph.D. thesis

THE ECONOMIC ASPECTS OF INNOVATION IN SHEEP BREEDING

Gábor Bence Csatári

Supervisor:

Dr. András Jávor

Professor

Dr. András Nábrádi

Professor

UNIVERSITY OF DEBRECEN
Doctoral School of Animal Husbandry

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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. The 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 innovation and making them appropriate for practical utilization. The up-to-date economy due to its innovational and adaptive activity is able to increase the efficiency of its production and furthermore, to produce products meeting the requirements of consumers' demand.

While in poultry, pig and cattle breeding the keeping and breeding technologies, product processing and product structure developed thanked to several innovations during the last 50 years, only little adaptation happened in sheep breeding and in processing its products (except for the last 10 to 15 years), and considerable innovation did not occur at all. One of the ways to increase the market successfulness is the immediate realization of the innovation in production (Borsos, 2005); without this none of the enterprises may be successful for a long term.

The condition and opportunities of the Hungarian sheep breeding is basically determined by the efficiency of production and the product structure of the enterprise. More than 90% of the domestic sheep stock belong to the Merino variety group, thus it determines the keeping technology as well. Regarding semi-intensive keeping technology the only marketable product of the sheep branch may be the lamb under the present economic conditions. Sheep milk realizes the greatest revenue only in a few firm, though at present it is the only one product in the sheep branch, which has a whole processing industry in Hungary (in case of lamb selling in carcass does not reflect any detected economic size).

The branch holds high innovational potential itself which makes the realization of products of high added value possible.

During my work my research aimed at investigating the turnover of the investment needed for the realization of the innovation and the economic aspects of the technology developed in the following three fields:

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

The AWASSI stock company in Bakonszeg is the only one sheep farm in Hungary where sheep milk is produced under intensive keeping technology similarly to dairy

cows. During my investigation I strived to determine that under which processing level the sheep milk is worth producing regarding intensive technology.

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

The intensive keeping technology may only be operated by programmed reproduction biology from the aspect of production. Research and development program aiming at rutting induction serves the elimination of the seasonality of products made from sheep milk, which economic turnover 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 by a daily milk production of 4 liters after lambing, on the other hand the lambs are able to suckle only a half liter milk each day. If lambs were not separated from the ewe at the moment of the birth, the milk production of the ewe would reduce to the level of the daily demand of the lamb, which would resulted in a significant milk loss, but at the same time costs of keeping would not decrease.

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

The evaluation of the technology of the intensive dairy sheep in Awassi stock company in Bakonszeg and of the innovations based on the carried out research and development investigated separately reflects an unreal condition. The certain elements such as the intensive keeping and breeding technology, genetic and reproduction biological researches determining the biological basis of the continuance of milk production as well as the artificial rearing of lamb should be subjected to a complex investigation in order to get a real reflection on the profitability of the activity.

I carried out the complex investigation on three processing levels (sheep milk, sheep cheese and sheep kefir) of the sheep milk being the primarily product. These three products represent different production costs and altering added value.

My hypotheses are the followings:

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

2. METHODS UTILIZED

The basis of the dissertation is the assumption that selling sheep milk in unprocessed form results in deficit under intensive keeping technology. That is why the Awassi stock company in Bakonszeg produced a product of extremely high added value, which is the sheep kefir.

As seasonal rutting is typical to sheep (except for a few breeds in Mediterranean areas and of other warmer climate), sheep kefir disappeared from the shelves of supermarkets in the year of the market introduction, as there was not any milk production. This was not tolerated by the traders and consumers, thus in the next year negotiations had to be almost newly started with supermarket chains in order to get the sheep kefir in the list of purchased and sold products.

The innovations investigated (intensive keeping technology, aseasonal rutting, artificial insemination, artificial lamb raring) happened for the sake of producing continuous and sound quality of sheep kefir. The fact that in which year the certain production data were fixed is not relevant from the point of view of the dissertation, because the innovation as an investment was examined.

Data Collecting Methods Used

- The production and breeding data necessary for the investigations were collected from the farm manager software Bariska. This software was made for dairy sheep farms on the basis of the software RISKA used in dairy cow farms. By the help of it the recorded data may be systematized by several aspects at the same time. Unfortunately, the preciseness of the production records from the year 2005 may be doubted, as personal conditions were not ensured for field data

recording. In this way only the information gathered till 2004 were considered during the work.

- I coordinated the realizing of programs of R&D applications written by me, thus professional reports, innovation results were available, which contained several valuable pieces of information for writing the dissertation.
- I acquired the techniques of synchronizing rutting and artificial insemination even in practice thus I have direct experiences in the topic.
- In order to select animals tending to seasonal rutting I took part in blood taking and the primarily examination of samples.
- I studied the technology of artificial lamb raring in practice during my work in the lamb raring house (feeding, daily weighing, checking hygiene, transporting lambs of one-day-old from the lambing house to the artificial lamb raring house.)
- In order to calculate recovery and certain indicators, the necessary information were collected from the financing and accounting registration of the company. The registration system of the company (typical to agricultural companies) are not up-to-date, as the majority of the information were recorded on paper, in this way the systematization of data was more difficult.
- I personally took part in the market introduction of sheep kefir; I represented the company in domestic (Hódmezővásárhely) and international exhibitions (SIAL Paris).

<u>The methods used in the dissertation are the followings:</u>

- Calculating recovery in present value
- Complex economic evaluation by spider charts, by which I investigated six factors as follows:
    - Liquidity indicator
    - The value added content of the produced final products
    - The innovation lifecycle curve of the examined product
    - The quality and quantity of sheep milk
    - Market demand for the product
    - Aseasonal sheep milk production

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. 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 project. I examined the rentability 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 the fact that how much the net result produced of the investment is during the planned period discounted on 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 at one hand, and the expenses in connection with the continuous maintenance and operation on the other hand.

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

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

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 case of a positive NPV, the investment is generally accepted, furthermore it depends on the decision-maker that 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 equals with the yield of the calculative interest rate. In case of a negative NPV, it is not worth realizing the investment from just financial aspects, as the yield of the investment is lower than that being reached by the calculative interest rate, but the operation of our investment does not necessarily shows a deficit. (Szűcs – Szőllősi, 2008)

In case of capital limitation the combination of investments should be realized in which the highlighted projects reflect the biggest NPV regarding the available capital of wholly lockup. (Pálinkó – Szabó, 2006)

On the basis of the above mentioned the result of an innovational project as an immaterial investment may be determined on the basis of NPV calculation in the most precise way; however, the uncertainty of the expected cash flows should be taken into consideration in certain fields. (Pakucs és Papanek, 2006)

I illustrated the complex economic analysis relating to the certain 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)

Grading the factors modifying the certain 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 introduced as follows:

1 – very bad

2 – bad

3 – appropriate

4 – good

5 – very good

The spider chart is based on examining six factors; their conditions determine significantly 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 determent ones.

I investigated even 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 as 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 used widely. The curve includes the typical developing position changing stages of the process starting from establishing the product and ending with declining. Figure 7 illustrates the whole 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 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

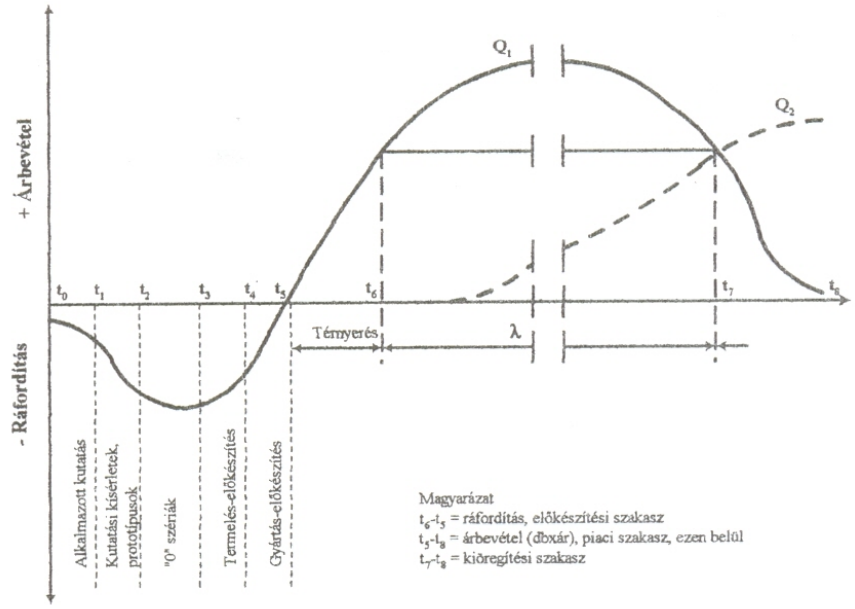


Figure 1: The Typical Stages of the Whole Lifecycle

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 of the CORA to the quantity of products being potentially produced.

The meaning of points of the spider chart in case of the market demand for the products:

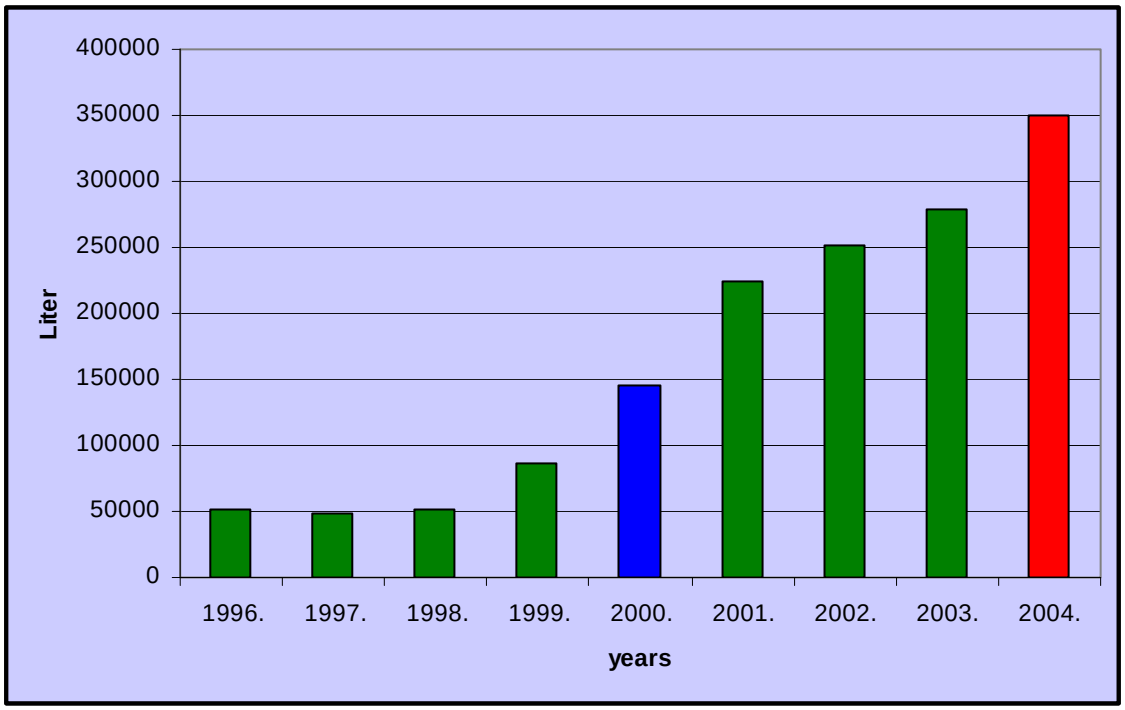
Value in the spider chart	**Market demand for the product (how many % the ordered product quantity is of the products being potentially produced)**
1 – very bad	<40%
2 – bad	40-59%
3 – appropriate	60-69%
4 – good	70-79%
5 – very good	≥80%

3. MAJOR INVESTIGATIONS AND FINDINGS OF THE DISSERTATION

3.1. 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 liter milk in the year of foundation (Figure 2). The intensive keeping technology was introduced in 2000, which is signed 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 selling 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 case of selling it as commodity milk. Inspite of the

increasing individual production the loss grows as the production cost increases by the rate of the inflation, on the other hand the price of sheep milk stagnated in the examined years. The utilization of intensive technology may only be profitable in case of producing and selling products of high added value (cheese, kefir).

3.2. 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 of the genetic improvement in dairy sheep farms. Identifying the spontaneous rutting animals is almost impossible because of the characteristics of the species under 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 decade, and different variations of the combined GnRH - $PGF_{2\alpha}$ - GnRH treatment (GPG or OvSynch protocol) spread widely all over the world. This process being more favourable than the tradition techniques from food-sanitary aspects synchronizes not only rutting, but the ovulation, thus making the use of insemination (fix AI) in a fixed time possible. This method is used in two forms in sheep: during the traditional GPG technology similarly to cows $PGF_{2\alpha}$ treatment of luteolytical dosed happens on the 7^{th} day after the first GnRH treatment, and on the 5^{th} day on the basis of the protocol modified by Amiridis et al. (2004).

Our objective was to compare the efficiency of these two methods with each other and the traditional gestagen + eCG based techniques.

In *experiment 1a* carried out in the peak period of the biological breeding season, the ovary function was cyclical of every ewe at the beginning of the experimental treatments on the basis of P4 samples. By all three methods more than 60% of the animals became pregnant from the fixed time AI, which is an extremely good result. It exceeds the level generally being reachable by transcervical sperm deposition according to data in relevant literature.

Experiment 2:

The melatonin treatment used in subcutaneous implants being absorbed slowly having an agent content of 18 mg is one of the popular methods of cycle induction. This preparation raises the melatonin level of the plasma for 60 to 70 days, in this way the

LH basic secretion increases from the 35th to 40th day, which is followed by evolving oestrogen-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 favourable 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 as more favourable 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 (otherwise being authorized, effective and used all over the world). However, there is hardly any data on its efficiency out of the territories of the Mediterranean Sea basin, and there is not any data available on intensive dairy Awassi sheep at all. Under the domestic climatic and business conditions the objective of our present experiment in the late winter and spring (*experiment 2a*) and in the summer periods (*experiment 2b*) was to

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

furthermore, to measure the fact that

(b) what result the fixed time insemination used after melatonin pre-treatment can generate after the GnRH-$PGF_{2\alpha}$-GnRH treatment considered as favourable from food-sanitary aspects.

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

The high ratio (54%) of a year old lambs might also probably contributed to the low lambing ratio. Our previous examinations in harmony with the data in literature let us conclude the fact that the ratio of ewe having a cycle ovary function even out of the breeding season typically depends on the age; the ratio of those having cyclic function even in spring is higher among the ewe 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 it turned out that the intensive keeping technology shows a deficit, if sheep milk is sold without processing. In this way the turnover of the reproductive biological research and development is worth investigating by a complex turnover calculation.

3.3. 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 the intensive dairy sheep technology, which success concerns 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 the technology may only be organized if lamb rearing may be made independent from milk production (such as in case of dairy cows). As lamb rearing based on milk replacer could not spread in the domestic practice and even adaptable solution was not found abroad, this problem was solved by 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 profit, which is thanked to the weaning weight of 17 kilograms (in the other years the weaning weight was 14 kilograms). Milk out of ewe 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 which can be hardly replaced by other nutriments due to the relevance of its qualitative parameters. The personal costs reflect well the outstanding labour efficiency of the technology.

The short profitability of artificial rearing of lamb is worth examining only in case of ram lambs (all of the ewe breeding yearlings get into the rearing system, which primarily aims at rising the number of the production sock), as those of unknown origin are sold when weaning them from nutriments. According to my experiences, if ram lambs cannot be sold at weaning from the milk replacer, serious weight loss should be

expected in the following two weeks, during coming over the yearling nutriment. This weight loss cannot be supplemented by expensive yearling nutriment in case of hogget.

3.4. 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 Awassi stock company in Bakonszeg and of the innovations based on the carried out research and developments investigated separately reflects an unreal condition. The certain elements such as the intensive keeping and breeding technology, genetic and reproduction biological researches determining the biological basis of the continuance of milk production as well as the artificial rearing of lamb should be subjected to a complex investigation in order to get a real reflection on the profitability of the activity.

A producing stock of 1100 Awassi sheep and the production data of the year 2004 form the basis of the investigation.

I carry out the complex evaluation on three processing levels (sheep milk, sheep cheese and sheep kefir) of the sheep milk being the primarily product. These three products represent different production costs and altering added value. Manufacturing dairy products takes place in the Cheese Factory in Kunszentmárton owned by the stock company. Besides the production data introduced in the tables of the previous chapters, the processing costs and the realizable revenues have to be regarded as well 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 due to manufacturing both of the products. The cheese output is 6,5 liter 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 by a significant loss generation regarding a sheep milk purchase price of 130 HUF. The present value of the cash flow (NPV) is -28.556.000 Ft yearly.

In case of the 6 factors illustrated in the radar chart influencing the profitability it turns out that Liebig's Law of the Minimum (Loch-Nosticzius, 1992) prevails, which means that the success is controlled by the limiting factor, and 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 that is 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

Number of years	1	2	3	4	5	6	7	8	9	10	11	
Year	**2004.**	**2005.**	**2006.**	**2007.**	**2008.**	**2009.**	**2010.**	**2011.**	**2012.**	**2013.**	**2014.**	**Total**
Inflation expected		**5%**	**5%**	**5%**	**5%**	**5%**	**5%**	**5%**	**5%**	**5%**	**5%**	
Discount rate	100%	105%	110%	116%	122%	128%	134%	141%	148%	155%	163%	
TOTAL REVENUE	**40 976**	**43 025**	**45 176**	**47 435**	**49 807**	**52 297**	**54 912**	**57 657**	**60 540**	**63 567**	**66 746**	**582 139**
Price of sheep milk	*32 904*	*34 550*	*36 277*	*38 091*	*39 995*	*41 995*	*44 095*	*46 300*	*48 615*	*51 045*	*53 598*	*467 464*
Price of lamb	*8 072*	*8 475*	*8 899*	*9 344*	*9 811*	*10 302*	*10 817*	*11 358*	*11 926*	*12 522*	*13 148*	*114 674*
TOTAL EXPENSES	**112 031**	**89 103**	**76 659**	**80 492**	**84 517**	**88 743**	**93 180**	**97 839**	**102 731**	**107 867**	**113 261**	**1 046 424**
Keeping costs of ewes	*57 456*	*60 329*	*63 346*	*66 513*	*69 838*	*73 330*	*76 997*	*80 847*	*84 889*	*89 134*	*93 590*	*816 269*
Rearing costs of lambs	*12 076*	*12 680*	*13 314*	*13 980*	*14 678*	*15 412*	*16 183*	*16 992*	*17 842*	*18 734*	*19 671*	*171 561*
Investment cost (R&D)	*42 499*	*16 094*										*58 593*
BALANCE OF CASH FLOW	**-71 055**	**-46 078**	**-31 483**	**-33 057**	**-34 710**	**-36 446**	**-38 268**	**-40 181**	**-42 191**	**-44 300**	**-46 515**	**-464 285**
PRESENT VALUE OF BALANCE OF CASH FLOW (NPV)	**-71 055**	**-43 884**	**-28 556**	**-28 556**	**-28 556**	**-28 556**	**-28 556**	**-28 556**	**-28 556**	**-28 556**	**-28 556**	**-371 945**
PRESENT VALUE OF ACCUMULATED BALANCE OF CASH FLOW (NPV)	**-71 055**	**-114 939**	**-143 495**	**-172 051**	**-200 608**	**-229 164**	**-257 720**	**-286 276**	**-314 833**	**-343 389**	**-371 945**	

Source: own investigations

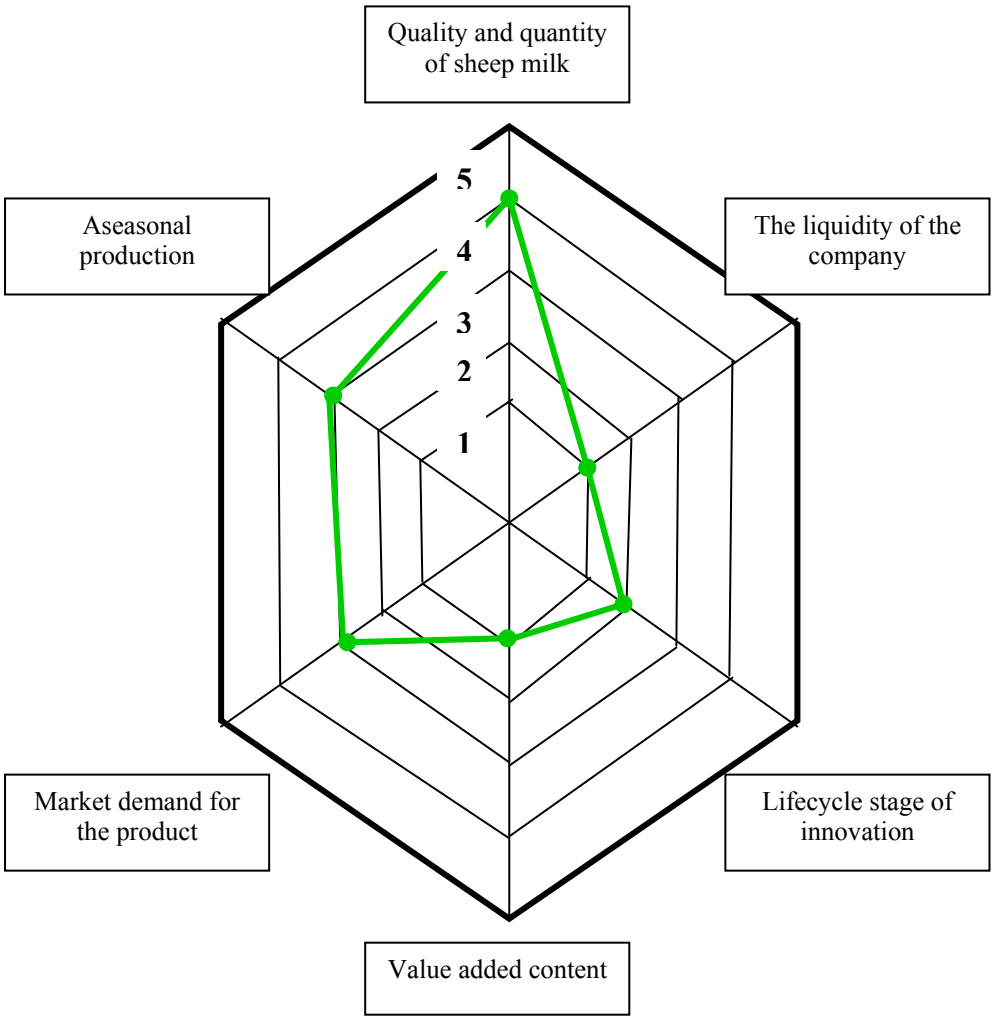


Figure 3: Evaluating Factors Influencing the Result of the Innovation in Case of the Final Product of Sheep Milk

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, which basic data is contained in Table 4. According to the calculations it may be concluded that the balance of the cash flow in 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 Case of the Final Product of Sheep Cheese

Data in thousand HUF

Number of years	1	2	3	4	5	6	7	8	9	10	11	
Year	**2004.**	**2005.**	**2006.**	**2007.**	**2008.**	**2009.**	**2010.**	**2011.**	**2012.**	**2013.**	**2014.**	**Total**
Inflation expected		**5%**	**5%**	**5%**	**5%**	**5%**	**5%**	**5%**	**5%**	**5%**	**5%**	
Discount rate	100%	105%	110%	116%	122%	128%	134%	141%	148%	155%	163%	
TOTAL REVENUE	**83 986**	**88 185**	**92 595**	**97 224**	**102 086**	**107 190**	**112 549**	**118 177**	**124 086**	**130 290**	**136 805**	**1 193 173**
Price of sheep milk	*32 904*	*34 550*	*36 277*	*38 091*	*39 995*	*41 995*	*44 095*	*46 300*	*48 615*	*51 045*	*53 598*	*467 464*
Price of lamb	*8 072*	*8 475*	*8 899*	*9 344*	*9 811*	*10 302*	*10 817*	*11 358*	*11 926*	*12 522*	*13 148*	*114 674*
Added value – sheep cheese	*43 010*	*45 161*	*47 419*	*49 789*	*52 279*	*54 893*	*57 638*	*60 519*	*63 545*	*66 723*	*70 059*	*611 034*
ÖSSZES KIADÁS	**152 258**	**131 341**	**121 010**	**127 060**	**133 413**	**140 084**	**147 088**	**154 442**	**162 165**	**170 273**	**178 786**	**1 617 920**
Keeping costs of ewes	*57 456*	*60 329*	*63 346*	*66 513*	*69 838*	*73 330*	*76 997*	*80 847*	*84 889*	*89 134*	*93 590*	*816 269*
Rearing costs of lambs	*12 076*	*12 680*	*13 314*	*13 980*	*14 678*	*15 412*	*16 183*	*16 992*	*17 842*	*18 734*	*19 671*	*171 561*
Investment cost (R&D)	*42 499*	*16 094*										*58 593*
Production cost – sheep cheese	*40 227*	*42 238*	*44 350*	*46 568*	*48 896*	*51 341*	*53 908*	*56 603*	*59 434*	*62 405*	*65 526*	*571 496*
BALANCE OF CASH FLOW	**-68 272**	**-43 156**	**-28 415**	**-29 836**	**-31 328**	**-32 894**	**-34 539**	**-36 266**	**-38 079**	**-39 983**	**-41 982**	**-424 748**
PRESENT VALUE OF BALANCE OF CASH FLOW (NPV)	**-68 272**	**-41 101**	**-25 773**	**-25 773**	**-25 773**	**-25 773**	**-25 773**	**-25 773**	**-25 773**	**-25 773**	**-25 773**	**-341 332**
PRESENT VALUE OF ACCUMULATED BALANCE OF CASH FLOW (NPV)	**-68 272**	**-109 373**	**-135 146**	**-160 919**	**-186 693**	**-212 466**	**-238 239**	**-264 012**	**-289 786**	**-315 559**	**-341 332**	

Source: own investigation

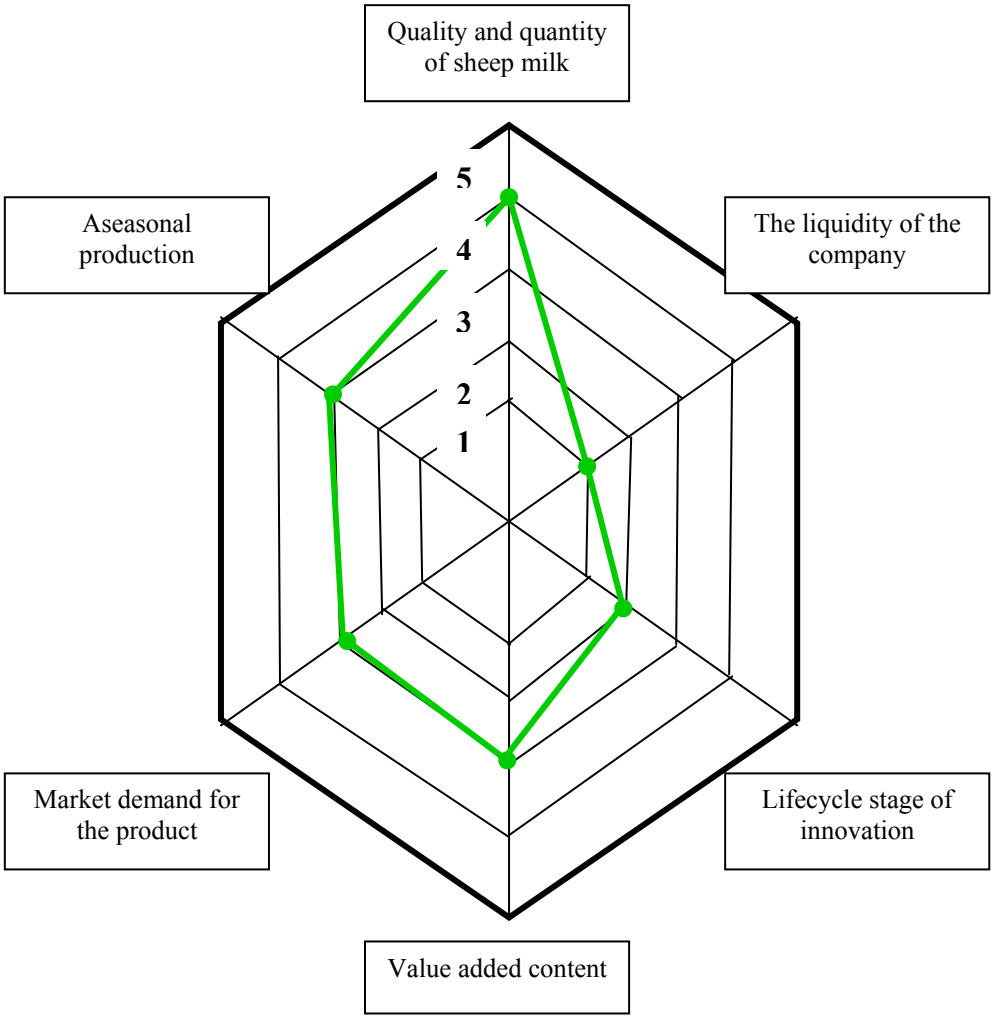


Figure 4: Evaluating Factors Influencing the Result of the Innovation in Case of the Final Product of Sheep Cheese

Source: own investigation

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

The balance of cash flow in Table 7 in 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 through realizing the program.

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

Data in Thousand HUF

Number of years	1	2	3	4	5	6	7	8	9	10	11	
Year	**2004.**	**2005.**	**2006.**	**2007.**	**2008.**	**2009.**	**2010.**	**2011.**	**2012.**	**2013.**	**2014.**	**Total**
Inflation expected		**5%**	**5%**	**5%**	**5%**	**5%**	**5%**	**5%**	**5%**	**5%**	**5%**	
Discount rate	100%	105%	110%	116%	122%	128%	134%	141%	148%	155%	163%	
TOTAL REVENUE	**238 316**	**250 232**	**262 744**	**275 881**	**289 675**	**304 158**	**319 366**	**335 335**	**352 101**	**369 706**	**388 192**	**3 385 706**
Price of sheep milk	*32 904*	*34 550*	*36 277*	*38 091*	*39 995*	*41 995*	*44 095*	*46 300*	*48 615*	*51 045*	*53 598*	*467 464*
Price of lamb	*8 072*	*8 475*	*8 899*	*9 344*	*9 811*	*10 302*	*10 817*	*11 358*	*11 926*	*12 522*	*13 148*	*114 674*
Added value – sheep kefir	*197 340*	*207 207*	*217 567*	*228 446*	*239 868*	*251 861*	*264 454*	*277 677*	*291 561*	*306 139*	*321 446*	*2 803 567*
TOTAL EXPENSES	**241 061**	**224 584**	**218 915**	**229 861**	**241 354**	**253 421**	**266 092**	**279 397**	**293 367**	**308 035**	**323 437**	**2 879 526**
Keeping costs of ewes	*57 456*	*60 329*	*63 346*	*66 513*	*69 838*	*73 330*	*76 997*	*80 847*	*84 889*	*89 134*	*93 590*	*816 269*
Rearing costs of lambs	*12 076*	*12 680*	*13 314*	*13 980*	*14 678*	*15 412*	*16 183*	*16 992*	*17 842*	*18 734*	*19 671*	*171 561*
Investment cost (R&D)	*42 499*	*16 094*										*58 593*
Production cost – sheep kefir	*129 030*	*135 482*	*142 256*	*149 368*	*156 837*	*164 679*	*172 913*	*181 558*	*190 636*	*200 168*	*210 176*	*1 833 102*
BALANCE OF CASH FLOW	**-2 745**	**25 647**	**43 829**	**46 020**	**48 321**	**50 737**	**53 274**	**55 938**	**58 734**	**61 671**	**64 755**	**506 180**
PRESENT VALUE OF BALANCE OF CASH FLOW (NPV)	**-2 745**	**24 426**	**39 754**	**39 754**	**39 754**	**39 754**	**39 754**	**39 754**	**39 754**	**39 754**	**39 754**	**379 465**
PRESENT VALUE OF ACCUMULATED BALANCE OF CASH FLOW (NPV)	**-2 745**	**21 681**	**61 435**	**101 189**	**140 942**	**180 696**	**220 450**	**260 204**	**299 957**	**339 711**	**379 465**	

Source: own investigations

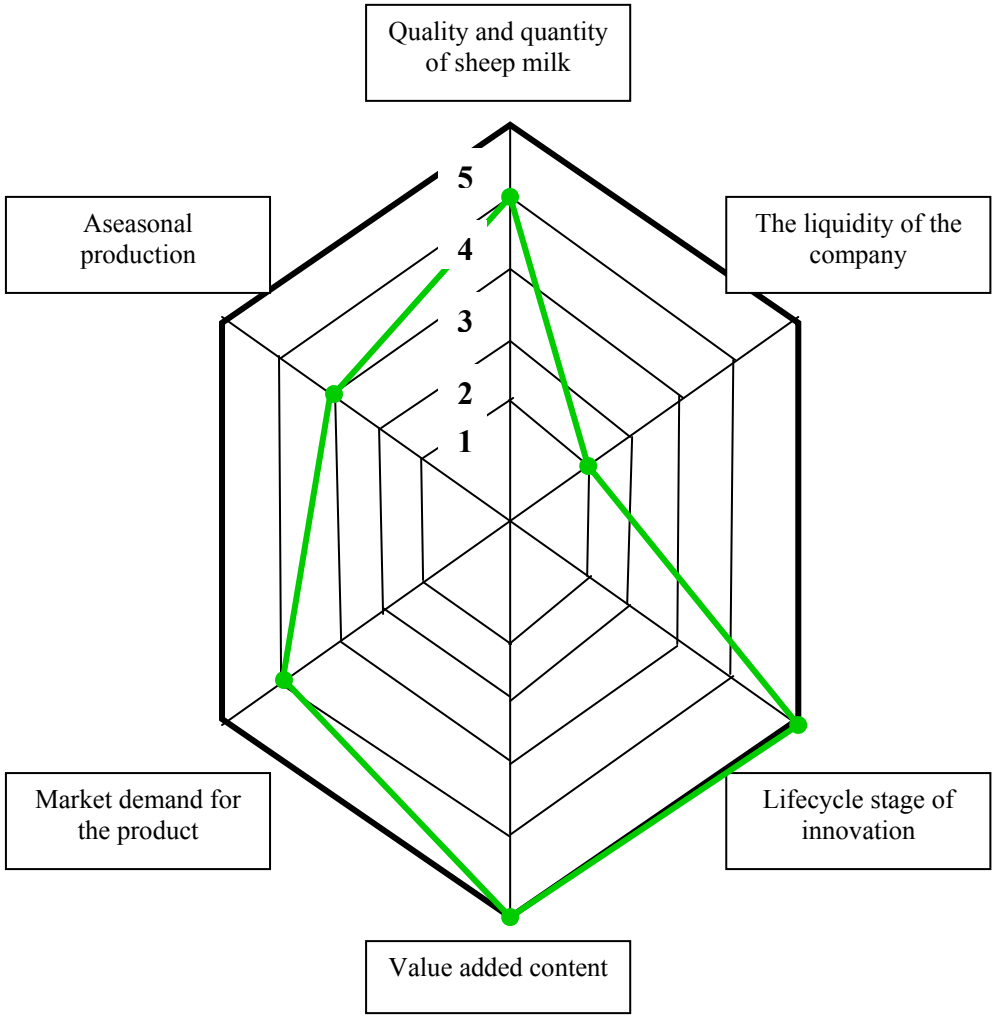


Figure 5: Evaluating Factors Influencing the Result of the Innovation in Case of the Final Product of Sheep Kefir

Source: own investigation

The outstandingly high added value of sheep kefir is thanked to the innovative activities behind the development of the product. This is the product, for which it is worth producing sheep milk within an intensive keeping technological system in case of Awassi for the sake of its production. By comparing 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 the second year after the realization, it is capable of generating significant profit, the unfavourable

liquidity of the company, however, may make even the best product unsuccessful. It probably contributed to the fact that the liquidation of the Awassi stock company in Bakonszeg started in October of 2008.

4. THE NEW SCIENTIFIC FINDINGS OF THE DISSERTATION

4.1. New Scientific Findings

1. Certain elements such as intensive keeping and breeding technology, genetic and reproduction biological researches 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 get a real reflection on the profitability of the activity.

2. When economic 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. By this method every countable factor may be taken into consideration during the calculation.

4. In 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.

4.2. The Practical Use of the Scientific Findings

1. I illustrated the complex economic evaluation relating to the certain 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, and 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 that is the ratio of processing level is the easiest. In the present case the determent 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.

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 the second year after the realization, it is capable of generating significant profit, the unfavourable liquidity of the company, however, may make even the best product unsuccessful.

5. PUBLICATIONS IN THE SUBJECT OF THE DISSERTATION

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