Improving the profitability of small-scale dairy cattle farms by increasing the added value

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Abstract: Based on the distribution of the cattle herd according to the specialization, the largest share is made up of dairy cows, their share is 77%. The economic difficulties of the dairy cattle sector and their solutions are not the same at the large-scale and small-scale farm levels. In this case, a small family farm dealing with dairy cattle is planned. During the calculation, the characteristics of small farms are considered, as well as the entire economic plan of the farm is set up, considering all expenses and income. From our calculations, it is shown how the various economic indicators develop in a three-person family farm. Increasing the added value clearly increases the profitability of the sector.

Keywords: added value, small farm, milk producer, profitability

Introduction

At the current global scene, where the agriculture is among the economy sectors which are particularly under the strong pressure of economic and climate trends, sustainability of small farmers is especially endangered (Jelocnik et al., 2024). Innovations implementation of dairy farming at every farmer's farm is the present-day need; during the era of scarce natural resources coupled with population explosion, putting obvious pressure for more food production (Nimbalkar et al., 2022). According to Britt et al. (2018) dairy consumption will increase because it provides essential nutrients more efficiently than many other agricultural systems.

Dairy farms account for the largest part of cattle breeding in our country. Their primary goal is to produce the right amount and high-quality raw milk suitable for human consumption. However, this has many influencing factors that professionals must take care of, even if it is also affected by things, they consider independent, such as the weather and the change of seasons (Mikó and Szilágyi, 2018).

The economic advantages of dairy production are the utilization of forages, the production of organic manure, the continuous sales revenue, the technology that can be easily mechanized, as well as the continuous employment. Although, in the case of a small farm, the return on whether the investment is even worth it in the long term is needed to be calculated. The disadvantages of milk production include the need for significant fixed and current assets - it is important to highlight the need for special assets, which cannot be used in other sectors, such as the milking machine. The need for fodder-producing land, the long generation interval and the long payback period. It is recommended to plan the first calving of heifers after they are two years old, making sure that it does not take place exactly at two years of age, also add to the list of negatives. The frequent market disturbances - due to the high consumer prices of a year and a half ago, the products of small-scale producers have become more sought after, but with the current moderate consumer prices, fewer people choose the more expensive, higher quality of home-made products. This is what is called price-sensitive customer behaviour. The low profitability and the significant labour requirement are also characteristics belonging to the dark side of dairy cattle farming. According to Alvarez et al. (2018) a more open and competitive dairy market has encouraged certain dairy farms to adopt value-adding strategies in order to achieve a higher profitability, which may be important for farms' survival.

Szűcs et al. (2007) emphasizes that the most important economic advantage of the sector is the continuous sales revenue and thereby ensuring a stable liquidity situation, as well as its outstanding margin (overhead capacity), which is of particular importance in complex agricultural enterprises with a mixed structure.

"By the concept of efficiency, we mean the economic use of resources" (Siklósi, 2009). The concept of efficiency can be found in many fields of science – both in the field of economics and technical science. According to Engle (1941), technical efficiency is part of economic efficiency. The difference is that technical efficiency can be interpreted by itself, absolute, while economic efficiency needs to be compared to something, relative.

Value added is a term frequently mentioned when discussing the future profitability of agriculture (Coltrain et al., 2000). The added value produced in the farms is compared to the gross production value when comparing the value creation capacity of the agricultural sectors (Fogarasi and Zubor-Nemes, 2017). Contrary to fact that initiates the increase in farm incomes or better use of available farm capacities, establishment of processing at the farm requires certain level of investment (Subic et al., 2014).

According to Kapronczai (2011), regarding the role of efficiency, Hungarian agrarian society represents different views. One half emphasizes efficiency orientation and competitiveness, while the other half treats challenges related to economic efficiency as a secondary issue, focusing on rural occupation. In their research, Kőműves and Lukács (2015) examined the situation of small-scale domestic dairy farms. Several farms were involved and the conditions for economical milk production were presented. Based on their previous experiences, however, they were aware that it is still difficult for small and family farms to make a living and earn a decent income. According to MacDonald et al., (2007) small dairy farms generally realize higher revenue per one unit of milk sold, the cost advantages of larger size allow large farms to be profitable, on average, even while most small farms are unable to earn enough to replace their capital. Investing in milk processing usually involves investment in basic herd (milking cows), stables, milk production and processing facilities and equipment, storing capacities, etc. (Subić et al., 2020). Although feeds generally cost more as cows are fed for higher milk production, increased productivity also enhances profitability, partly because of increased efficiency but also because fixed costs are decreased relative to total costs (Vandehaar, 1998).

Materials and Methods

Data are collected from small-scale dairy cattle farms in the Southern Great Plain, recorded the information received, then categorized it according to authors' objectives. The data collected were compared in this way and the tables published by the Central Statistical Office, and a sectoral technological and economic plan was created with the help of the Microsoft Excel program. The economic calculations were performed using the formulas found in the program, organized the individual parts of the model, then drew conclusions from the obtained results.

Then, a complete calculation series were set up, using the production value and production cost of the annual operation, as well as economic indicators, with the help of which a small-scale dairy farm was modelled. Accounting was recorded in a Microsoft Excel spreadsheet consisting of several worksheets.

The total yield of the herd has been designed in such a way that it complies with the regulations for small-scale producers, according to which a maximum of 200 litres of milk can be sold per day. The labour requirement was planned for a family of three. When planning our small-scale farm, the Hungarian Simmental breed was decided on, so according to the survey of the Hungarian Simmental Association, a specific milk yield of 7,000 kg per cow was calculated, similar to the value shown for 2020. Authors' calculation thus indicated that 15 cows is the ideal number in accordance with their criteria for the plan, which means an average of 13 milking and 2 dry cows.

Results and discussion

In the basic calculation, a basis a dairy family farm with 15 Hungarian Simmental cows was taken. The main source of income for the farm is therefore the raw milk sold to the dairy industry. The company's entire operating plan is prepared, considering the exchange rates of 2023. During the calculations, the produced milk to sell is planned at the Central Statistical Office milk price of 2023, so 78.4% of the total production value is resulted,

HUF 15.795 million. In terms of reproduction, two calves per year remain for further keeping, while the rest were sold at the age of 7-10 days, which means a total sales revenue of HUF 1,320,000 for the sector. It accounts for 6.6% of the production value. The planned annual sale of one heifer - which is HUF 504 thousand - and a cull cow - which is HUF 350 thousand - adds up to 4.2% of the production value. Manure represents a total of HUF 214 thousand in sales. However, the amount of the subsidies is 9.7% of the production value, which is HUF 1.961 million. The total sales revenue of the sector is HUF 17.394 million, the internal usage is HUF 790 thousand, while the production value is HUF 20.144 million.

Table 1. Returns and production value of the sector – Model 1

Product	Total yield (t)	Unit price (HUF/t)	Sales revenue (1000 HUF)	Internal use (1000 HUF)	Production value (1000 HUF)	Distribution (%)
Milk	90	176,000	15,006	790	15,795	78.4
Calf	0.7	2,000,000	1,320		1,320	6.6
Heifer	0.5	1,050,000	504		504	2.5
Beef cattle	0.0	1,100,000	0		0	0.0
Cull cow	0.6	600,000	350		350	1.7
First-calf heifer (head)		500,000	0		0	0.0
Cull heifer	0.0	900,000	0		0	0.0
Manure	178.0	1,200	214		214	1.1
[redacted]						0.0
Subsidies					1,961	9.7
Total			17,394	790	20,144	100.0

Source: own calculation

Table 2 summarizes the sector's costs. Material costs are HUF 17.087 million in total, HUF 1.133 million per cow. 67.5% of all costs are material costs. Since we planned a family farm, we did not count on separate personal costs, this is zero. The costs of special fixed assets total HUF 1,608,000, which means HUF 107,000 per cow. Special fixed asset-type costs are 6.4% of total costs. Summing up the previous ones, we got the total of direct costs, HUF 18.695 million for the sector, while HUF 1.239 million per cow. They account for 73.9% of all costs. The allocated costs are HUF 1,815,000 in the sector, which is HUF 120,000 per cow. The production cost is therefore HUF 20,510,000, of which HUF 1,360,000 per cow. The indirect costs are HUF 4,795,000 for the sector in total, which means HUF 318,000 per cow. The total production costs are therefore HUF 25.304 million, for one cow this amount is HUF 1.678 million. Of this, HUF 424,000 are fixed costs, while HUF 1,253,000 are variable costs.

Table 2. Summary of production costs – Model 1

Denomination	Total (1000 HUF)	Per Cow Costs (1000 HUF)	Distribution (%)
I. Material costs	17,087	1,133	67.5
II. Labour costs	0	0	0
III. Depriciation and Maintainance costs	1,608	107	6.4
IV. Other Direct costs	0	0	0
Total Direct costs	18,695	1,239	73.9
V. Machinery costs (allocated costs)	1,815	120	7.2
Total Direct Production costs	20,510	1,360	81.1
Indirect costs	4,795	318	18.9
Total Production costs	25,304	1,678	100.0

Source: own calculation

In Table 3, the economic indicators characteristic of the sector is summarized.

Table 3. The most important economic indicators of the sector, Models I – 1

Denomination	Total	Measure unit	Per cow value	Measure unit
Sales revenue	17.394	million HUF	1.153	million HUF
Production value	20.144	million HUF	1.336	million HUF
Production cost	25.304	million HUF	1.678	million HUF
Net income	-5.160	million HUF	-0.342	million HUF
Gross income	-5.160	million HUF	-0.342	million HUF
Value of fixed assets	7.421	million HUF	0.492	million HUF
Value of current assets	7.591	million HUF	0.503	million HUF
Total value of assets	15.012	million HUF	0.995	million HUF
Working time usage	6,336	hours	420	hours

Source: own calculation

The total sales revenue is HUF 17,394,000, which is HUF 1,153,000 per cow. The production value is HUF 20.144 million for the sector as a whole, which means HUF 1.336 million per cow. The production cost is HUF 25.304 million, of which HUF 1.678 million goes to one cow. The difference between the previous two indicators gives the net income - which in this case is the same as the gross income - HUF 5.160 million. The value of the fixed assets is HUF 7,421,000 in total, i.e. HUF 492,000 per cow. The value of current assets is HUF 7.591 million for the sector as a whole, while it is HUF 503 thousand for

one cow. The total asset value is HUF 15,012,000, which is HUF 995,000 per cow. In authors' calculation, the use of working time is determined at 6,336 hours, of which 420 hours per cow. Of course, since the model farm is a family business, exact working hours are not determined, but knowing the parameters of the economy, 6,336 hours of annual working hours are calculated just described for the 3 members of the family in total, which means 2,112 hours per year per person.

Additional indicators characteristic of the farm is summarized in Table 4. Profitability as a proportion of sales -29.7%. The cost-proportional profitability also represents a negative value, -20.4%. Return on assets -34.4%. We established the cost level at 125.6%. Based on the calculation, the sales revenue per working hour is HUF 2,745. The production value per working hour is HUF 3,180, while the net income per working hour is HUF 815. Obsolescence of fixed assets is 50%. The unit cost of milk is determined using a proportional division calculation: HUF 220/l.

Table 4. The most important economic indicators of the sector II – Model 1

Denomination	Indicators	Measure unit
Revenue-based income	-29.7	%
Cost-effective income	-20.4	%
Return on assets	-34.4	%
Cost level	125.6	%
Revenue per 1 working hour	2,745	HUF
Production value per 1 working hour	3,180	HUF
Net income per 1 working hour	-815	HUF
Obsolescence of assets	50	%
Unit cost of milk (according to production value)	220	HUF/litre

Source: own calculation

The farm included in the first calculation is practically unviable, as incomes are negative. At the same time, another sectoral plan is prepared with the aim of definitely increasing the competitiveness of the small-scale farm. The initial herd size – 15 cows – was taken as a basis. As a result of the low purchase price experienced during the large-scale sale of raw milk and the low demand for home-made milk experienced in the Southern Great Plain region, another solution is sought to set up a profitable and sustainable small-scale dairy farm concept. In the second calculation, in addition to the 3 tons of cheese and 2 tons of cottage cheese produced for local sales each year, another 5 tons of cheese is added. The surplus product just mentioned is sold in the form of an online store. Since the prices are significantly higher in some regions of the country, such as the capital city, based on authors' research on this topic, the purchase price for this lot is set at HUF 8 million/t. Table 5 presents the results of the draft created in this way in detail. The sales revenue from raw milk to be sold – unused – is HUF 3,940,000. The unit price of milk for internal use was set at the large-scale purchase price, which is HUF 176,000/t. The quantity of cheese produced was divided into two parts during the calculations, the first, the quantity to be sold locally, from which HUF 10 million sales revenue (4,000 HUF/kg unit

price) comes, represents a production value of HUF 12 million (8,000 HUF/kg unit price). "Cheese online" refers to the quantity sold in the online store – on a national basis – the resulting sales revenue is HUF 39,600,000, which is the same as its production value, 49.9% of the total. The cottage cheese represents sales revenue of HUF 4.875 million, which represents a production value of HUF 5 million. Since the number of cows is the same as the 15 in the first calculation, the reproduction rate is the same as in the first calculation, i.e. the sales revenue from the sold calves and the production value are both HUF 1.320 million. The sales revenue and production value from the sale of the heifer and the cull cow are also the same for both calculations, i.e. HUF 504 thousand and HUF 350 thousand, which is a total of HUF 834 thousand. Due to the size of the livestock, the production value of the manure is equal to the value included in the first calculation – HUF 214,000. The value of the subsidies is HUF 1,961,000. The previous calculations are summed up, so the total sales revenue, which is HUF 60,803,000, and the production value, which is HUF 79,321,000 are resulted. Both results significantly exceed the amount received in the previous draft.

Table 5. Returns and production value of the sector – Model 2

Product	Total yield (t)	Unit price (HUF/t)	Sales revenue (1000 HUF)	Internal use (1000 HUF)	Production value (1000 HUF)	Distribution (%)
Milk	90	350,000/ 176,000	3,940	14,518	18,458	23.2
Cheese local	3	4,000,000	10,000	2,000	12,000	15.1
Cheese online	5	8,000,000	39,600	0	39,600	49.9
Cottage cheese	2	2,500,000	4,875	125	5,000	6.3
Calf	0.7	2,000,000	1,320		1,320	1.7
Heifer	0.5	1,050,000	504		504	0.6
Beef cattle	0.0	1,100,000	0		0	0.0
Cull cow	0.6	600,000	350		350	0.4
First-calf heifer (head)		500,000	0		0	0.0
Cull heifer	0.0	900,000	0		0	0.0
Manure	178.0	1,200	214		214	0.3
[redacted]						0.0
Subsidies					1,961	2.5
Total			60,803	16,557	79,321	100

Source: own calculation

The costs characteristic of the sector was again summarized in a summary table – Table 6. Before a more detailed analysis of the total, it is important to highlight which costs were changed as a result of the changed economic situation. First of all, as a result of calibrating

the livestock to the original plan, the feed, litter, veterinary, semen and energy costs included in the first model are established. Due to the production of the product, the energy consumption is further increased as well as the raw material required for the production of the products is calculated. The costs of creating and maintaining the online store is also considered, not forgetting the marketing costs, here extra personal costs are not counted, according to authors' assumption, one of the family members does its operation. In order to meet the increased labour demand to the three working family members included in the basic calculation, hiring of two employees is also calculated. The packaging and shipping costs associated with the online store are intentionally not considered, since in most online stores this is charged as a shipping cost to the customer. Thus, if delivery promotions are not used, in that case this cost will also appear as revenue, so the result is zero, so the effectiveness of the calculation will not be affected. Considering the changes listed above, Table 6 shows how the sector's costs developed. Material costs are HUF 21.902 million, which is 55.7% of all costs. In contrast to the previous calculation, the second one already included labour costs, HUF 7,814,000, which is almost 1/5 of the total costs. The cost of special fixed assets is HUF 2,975,000, 7.6% of the total cost. By summing up the previous three numbers, the total direct costs are resulted, HUF 32.692 million, 83.2% of the total costs. The cost of auxiliary services is the same as in the first plan, HUF 1,815,000 in total, of which HUF 120,000 per cow. By summing up the above, we calculated the cost of production, which is HUF 34,507,000 in total, or HUF 2,288,000 per cow. The general cost is HUF 4.795 million, which is 12.2% of the total. The last line of the cost list shows all costs, HUF 39.301 million, of which HUF 2.606 million goes to one cow, of which HUF 515 thousand are fixed costs, while the remaining HUF 2.092 million are considered variable costs.

Table 6. Summary of production costs – Model 2

Denomination	Total (1000 HUF)	Per Cow Costs (1000 HUF)	Distribution (%)
I. Material costs	21,902	1,452	55.7
II. Labour costs	7,814	518	19.9
III. Depriciation and Maintainance costs	2,975	197	7.6
IV. Other Direct costs	0	0	0
Total Direct costs	32,692	2,167	83.2
V. Machinery costs (allocated costs)	1,815	120	4.6
Total Direct Production costs	34,507	2,288	87.8
Indirect costs	4,795	318	12.2
Total Production costs	39,301	2,606	100.0

Source: own calculation

The most important economic indicators for the sector are summarized in Table 7. The total sales revenue of the sector is HUF 60.803 million, of which HUF 4.031 million per cow. The total production value is HUF 18.604 million more than this, that is, a total of HUF 79.407 million, which means HUF 5.265 million per cow. The total production costs

– as already indicated in the previous table – are HUF 39.301 million, of which HUF 2.606 million per cow. The net income – which is the difference between the previous two values – is HUF 40,106,000 in total, HUF 2,659,000 per cow. The value of the net income derived from the calculation perfectly illustrates that the changes made in the operation of the model farm proved to be effective, and that the sector can be made competitive and sustainable in the long term. Personal expenses were added to the net income, so we got the gross income, which is HUF 47,920,000 in total, HUF 3,177,000 per cow. The total value of the invested assets is HUF 8,821,000, of which HUF 585,000 per cow. The total value of current assets in the sector is HUF 11.790 million, HUF 782 thousand per cow. Based on the above, the total asset value is HUF 20,611,000. As we mentioned earlier, the working time usage is only approximate, since we are talking about a private enterprise, so the exact working hours cannot be determined, but according to the calculation, the working time usage in the sector is a total of 10,560 hours, of which 700 hours per cow.

Table 7. The most important economic indicators of the sector, Models I – 2

Denomination	Total	Measure unit	Per cow value	Measure unit
Sales revenue	60.803	million HUF	4.031	million HUF
Production value	79.407	million HUF	5.265	million HUF
Production cost	39.301	million HUF	2.606	million HUF
Net income	40.106	million HUF	2.659	million HUF
Gross income	47.920	million HUF	3.177	million HUF
Value of fixed assets	8.821	million HUF	0.585	million HUF
Value of current assets	11.790	million HUF	0.782	million HUF
Total value of assets	20.611	million HUF	1.366	million HUF
Working time usage	10 560	hours	700	hours

Source: own calculation

In Table 8, additional economic indicators are listed. Profitability as a proportion of sales is 66%. The cost-proportional profitability is 102%. The return on assets ratio is 194.6%. The cost level is 49.5%. The sales revenue per working hour is HUF 5,760, which is more than double the value obtained during the first calculation. The production value per working hour is HUF 7,520, which is nearly 240% of the result obtained during the first calculation. Similar to the gross and net income, the net income per working hour is also significantly higher than in the first case, HUF 3,800. The obsolescence of the assets is the same in both cases, i.e. 50%. The cost of milk, calculated as a proportion of the contribution to the production value, is HUF 101/litre.

Table 8. The most important economic indicators of the sector II – Model 2

Denomination	Indicators	Measure unit
Revenue-based income	66.0	%
Cost-effective income	102.0	%
Return on assets	194.6	%
Cost level	49.5	%
Revenue per 1 working hour	5,760	HUF
Production value per 1 working hour	7,520	HUF
Net income per 1 working hour	3,800	HUF
Obsolescence of assets	50	%
Unit cost of milk (according to production value)	101	HUF/litre

Source: own calculation

Conclusions

As it is clearly supported by the creation of the first model, with the sales price of HUF 176/litre milk reported by Central Statistical Office, the operation of the family farm is in deficit. The evolution of the indicators characterizing the economy prompted us to come up with some kind of plan modification in order to increase profitability.

In the second draft, most of the produced raw milk was sold as processed products (cottage cheese, cheese), a smaller part locally, while a larger part was sold to other regions of the country with the help of the postal service. Increasing the added value led to the changes authors expected, the new model already represents a significant step forward, it is clear from the results that it is sustainable in the long term, and there is even room for improvements. Authors are working on improving the profitability of small farms by creating additional plans.

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