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ECONOMIC EFFECTS OF INVESTMENT IN DAIRY FARMING¹

Jonel Subić², Lana Nastić³, Svetlana Roljević Nikolić⁴

Abstract

Dairy farming is the most significant part of cattle raising. During the previous several years the volume of milk production has been maintained at a stable level, while there came to fall in number of dairy cows and number of farms engaged in dairy farming. Although the farms that own just a few heads of dairy cows usually step out the milk production, there are still a small number of farms specialized in dairy farming. The main paper objective is to present the economic effects of investment in the construction and equipping of dairy farm adequate for raising of 12 dairy cows. Economic analysis was based on the use of static and dynamic methods for investment assessment. Besides, there is also conducted the analysis of investment under the risk conditions (use of the break-even analysis). According to gained results (e.g. Internal rate of return, 11.98%, positive value of the Net present value, Payback period shorter than 5 years) the investment implementation is economically justified.

Key words: milk production, economic effects of investment, NPV, Republic of Serbia.

JEL⁵: Q12, Q14

Introduction

The milk production sector in the Republic of Serbia involves over 116 thousand agricultural farms. During the last decade it has been achieving the stable production in volume of around 1.5 million tons of raw milk per year (SORS, 2020). Within the structure of total milk production in the Republic of Serbia, cow's milk is dominating, with the share of 96-98%, while sheep's milk participates with around 1% and goat's

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 - 2 Jonel Subić, Ph.D., Principal Research Fellow, Institute of Agricultural Economics, Volgina Street no. 15, 11060 Belgrade, Serbia, Phone: +381 11 697 28 58, E-mail: jonel_s@iep.bg.ac.rs
 - 3 Lana Nastić, Ph.D., Research Associate, Institute of Agricultural Economics, Volgina Street no. 15, 11060 Belgrade, Serbia, Phone: +381 11 697 28 52, E-mail: lane_n@iep.bg.ac.rs
 - 4 Svetlana Roljević Nikolić, Ph.D., Research Associate, Institute of Agricultural Economics, Volgina Street no. 15, 11060 Belgrade, Serbia, Phone: +381 11 697 28 42, E-mail: svetlana_r@iep.bg.ac.rs
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milk with the share of 1-2%. However, given that more than half of the total number of dairy cows are settled at the farms that own less than 10 ha of utilized agricultural area (SORS, 2018), recent dairy market research (SEDEDEV, 2020) indicates that stability in milk production in upcoming period cannot be guaranteed, as the market is largely supplied by small farms (farms limited by small estates and number of heads of livestock), which number is decreasing under the impact of migration and adverse demographic trends.

During the period 2012-2018 (Table 1.), there was a slight decrease in the number of dairy cows (by 1.7%), as well as rapid decrease in the total number of farms with dairy cows (by 25.4%). Meanwhile, there was an increase in the average number of dairy cows per farm for 28.6% (from 2.8 heads per farm in 2012 to 3.6 head per farm in 2018).

Table 1. Number of farms with dairy cows and number of dairy cows in the Republic of Serbia (in 2012 and 2018)

2012			2018			Number of farms with dairy cows (indices 2018/2012)	Number of dairy cows (indices 2018/2012)	Average number of dairy cows per farm (indices 2018/2012)
Number of farms with dairy cows	Number of dairy cows	Average number of dairy cows per farm	Number of farms with dairy cows	Number of dairy cows	Average number of dairy cows per farm			
155,859	431,290	2.8	116,291	424,155	3.6	74.6	98.3	128.6

Source: SORS, 2012; SORS, 2018.

Table 2. Number of farms involved (specialized) in dairy farming and combined production of milk and fattening in the Republic of Serbia (in 2012 and 2018)

Element	2012	2018	Indices 2018/2012
Farms specialized for dairy farming (number)	18,071	19,556	108.2
Farms specialized for combined production (milk production and fattening), (number)	7,963	3,567	44.8
Total	26,034	23,123	88.8

Source: SORS, 2012; SORS, 2018.

Despite the increase in number of dairy cows per farm, the specialization of production in this sector is still quite a low. In the Republic of Serbia there are 23,123 farms specialized in dairy farming, or combined milk production and fattening, what is only 4% of the total number of active farms (SORS, 2018). Although within the period 2012-2018, it has been come to increase in number of farms specialized in milk production (for 8.2%), the number of farms specialized in cattle fattening and dairy farming (combined production) was decreased for more than 50% (Table 2.).

According to SORS (2020), the average annual milk production per dairy cow in the Republic of Serbia in 2019 was 3,535 litres. The issues toward the developmental possibilities in livestock production in the Republic of Serbia was researched by Petrović et al. (2013), who reconsiders the possibilities in cattle's breeding, where as a primary goal for the Simmental breed was set the average milk production per one lactation of over 6,000 kg, or for the Holstein-Friesian breed over the 8,000 kg of milk per one lactation.

Veljković et al. (2017) were analysed the results gained in milk production on farms. Specifically, they have been calculated the contribution margin at two type of farms (specialized in milk or combined production with capacity of 5-8 dairy cows) during three years (2013-2015). They found that in both types of farms, during the observed period was achieved the positive values for the contribution margin, while better results were gained at farms specialized in milk production that have available modern equipment.

According to Milić et al. (2020), unlike the milk production, where the most production has been performed at farms of individual producers, the dominant part of milk processing in the Republic of Serbia is performed by large processors, as are dairies "Imlek" and "Subotica". Besides, out of the overall milk production, only 20% of milk is processed in dairies with small capacity (there are 188 small dairies in the Republic of Serbia).

Although some authors consider that investments in development are vital and that without it "the company would fall behind its rivals" (Zsoter, 2018), there are also other possibilities, especially in risky circumstances. For example, Schulte et al. (2018) used risk-adjusted discount rate for evaluation of investments in milk production in the EU conditions and determined that "it is still reasonable for an average German dairy farmer to invest in a parlor system" comparing to a more advanced automated milking system. There are also some more advanced solutions which are increasingly used for evaluation of investments in milk production and specific equipment, such as Monte Carlo simulation which is discussed by number of authors (Hyde, Engel, 2002; Bewley et al., 2010; Junior et al., 2019).

This paper methodologically relies to many articles that evaluate the economic effects of investing in a dairy cow farm by the use of dynamic methods for investment evaluation (Ivanović, 2006; Ivanović et al., 2007; Ivanović et al., 2008b; Subić, 2010; Ivanović et al., 2011; Gogić et al., 2012), and similar research (Ivanović et al., 2008a). Static analysis and break-even point analysis were based on methodology presented by Andrić (1998), Subić (2010) and Gogić (2014).

Methodological Framework

During 2020, there was conducted the survey related to milk production and processing as a part of the project of the Ministry of Agriculture, Forestry and Water Management. Survey involved the in-depth interview with the members of representative small family farm oriented to dairy production from the territory of Serbia (specifically Eastern part of Serbia, or closer, territory of the city of Smederevo). Results gained in mentioned research served as a data source for this analysis. In order to determine the economic effectiveness of investment in paper were used static (Economical-efficiency coefficient, Net profit margin ratio, or Accounting rate of return) and dynamic (Net present value, Internal rate of return, or Dynamic payback period) methods of investment analysis. The risk analysis of the observed investment was done by the use of break-even point analysis.

In order to improve farms' business, farmer is planning to purchase 12 high-quality dairy cows of the Simmental breed. As the farm has been already producing crops used as feed (corn and alfalfa), plan is to use the significant quantities to feed the newly purchased heads of cattle. By realization of crops through the livestock nutrition, farm is planning to improve its business results. Besides it expects to achieve continuous cash inflow by the sale of raw milk throughout the entire year.

So as the feed will be used corn silage and alfalfa hay produced at the farm. Besides, at the farm will be also produced the corn groats, while other components for concentrated feed will be purchased in the local agri-pharmacy. Regardless the fact that a large part of animal feed is produced at the farm, its value is calculated at market prices (avoiding the subjectivity).

In order to form the basic herd, farmer is buying quality pregnant heifers of the Simmental breed. They will be used for 6 years (six lactations). During their introduction into the production (after the first calving), the dairy cows are weighting around 400 kg, while in moment of their exclusion from the production process they have up to 630 kg. Assessment of purchased value of the dairy cows is based on average market prices for the high quality heifers of known breeds, while excluded cows were valued by average market prices (purchase prices of slaughterhouses). Same starting assumptions had Subić and Tomić (2020) while researching the production of cow's milk and its processing into the cheese.

Farmer is planning to sell the milk to local dairy, what will initiate additional right for milk premium per each litter of delivered milk (7 RSD). Besides, in line to fact that the hi-quality dairy cows are purchased, farmer also plans to exercise the right to premium for keeping the quality breeding heads in amount of 25,000 RSD per

head annually, as well as the incentive for the purchase of heads of quality breeds in amount of 75,000 RSD per head (after purchasing of heifers).

Total investment involves construction of a modern stable of adequate capacity that can be settled with 12 dairy cows. Besides, it will be built auxiliary facilities required in milk production activities, as are hay shed, silo trench, corn barn, building for manure disposal and facility where will be installed milk freezer.

Constructed stable will assume keeping of dairy cows in tie-stall housing system, with the medium-length beds. The planned facility is classic type stable that will be built of solid material. The milking of cows will be done in the stable. Installed milking system will involve three milking units and pipeline for a direct milk flow into the milk freezer. Purchased milk freezer will have capacity of 300 litters. Build facilities and installed equipment will enable gaining of high quality milk without additional impurities. Production process will involve engagement of two farm members, as well as one occasionally hired external employee.

Results and Discussion

The total investment amounts around 11.4 million RSD (Table 3.). In the investment structure, fixed assets participate with over 83% (facilities and equipment are dominating, primarily the investment in stable and silo trench, with the share in total investments of 44.24%), while the share of current assets is almost 17%.

Table 3. Estimated value of the investment

No.	Item	Value (in RSD)	Share (%)
1	Total investment (2 + 3)	11,359,278.60	100.00
2.	Investment in fixed assets:	9,466,065.50	83.33
2.1.	- in facilities	5,025,602.41	44.24
2.2.	- in equipment	2,280,463.09	20.08
2.3.	- in basic herd (12 dairy cows)	2,160,000.00	19.02
3.	Investment in current assets	1,893,213.10	16.67

Source: IAE, 2020.

Investment will be financed with farms' and borrowed assets (loan gained from the commercial bank). The share of farms' assets in overall value of investment is 47.96%, while the external assets participate with 52.04%. The interest paid on external assets is 6% with one-year grace period for loan repayment (Table 4.).

Table 4. Source of financing

No.	Item	Value (in RSD)	Share (%)
1.	Total investment (2+3)	11,359,278.60	100.00
2.	Farm sources	5,447,772.57	47.96
3.	External sources (commercial bank loan)	5,911,506.03	52.04
4.	Interest rate for the five years commercial bank loan	6.00%	-
5.	Weighted discount rate*	4.28%	-

* weighted discount rate is calculated on the basis of two elements, the share of financing sources in total investment and the level of interest rate for each financing source.

Source: IAE, 2020.

Income formation involves incomes gained after sale of products (milk and calves), excluded cows, manure and premiums (for delivered milk and subsidies for dairy cows). In milk production has been achieving a positive financial result (Table 5.). Based on achieved total incomes and made expenditures, it was determined the economic flow linked to the observed investment (Table 6.).

Table 5. Profit and loss statement (in RSD)

No.	Element	Year				
		I	II	III	IV	V
I	Total incomes	4,609,000.00	4,035,500.00	4,227,000.00	4,274,000.00	4,341,500.00
1.	Sale incomes	2,954,000.00	3,235,000.00	3,381,000.00	3,428,000.00	3,541,000.00
2.	Subsidies	1,655,000.00	800,500.00	846,000.00	846,000.00	800,500.00
II	Total expenditures	2,683,288.89	3,182,004.62	3,238,772.07	3,146,349.96	2,904,415.17
1.	Business expenditures	2,683,288.89	2,827,173.05	2,971,057.21	2,971,057.21	2,827,173.05
1.1.	Material costs	1,604,721.62	1,748,605.79	1,892,489.95	1,892,489.95	1,748,605.79
1.2.	Non-material costs without depreciation and interest	376,318.98	376,318.98	376,318.98	376,318.98	376,318.98
1.3.	Depreciation	702,248.29	702,248.29	702,248.29	702,248.29	702,248.29
2.	Financial expenditures	0.00	354,831.57	267,714.86	175,292.74	77,242.12
2.1.	Interest	0.00	354,831.57	267,714.86	175,292.74	77,242.12
III	Gross profit (I-II)	1,925,711.11	853,495.38	988,227.93	1,127,650.04	1,437,084.83
IV	Tax*	192,571.11	85,349.54	98,822.79	112,765.00	143,708.48
V	Net profit (III-IV)	1,733,140.00	768,145.84	889,405.13	1,014,885.04	1,293,376.35

* Tax rate is 10% as the tax payer is family farm.

Source: IAE, 2020.

Table 6. Economic flow (in RSD)

No.	Element	Zero point	Year				
			1	2	3	4	5
I	Cash inflow (1+2)	0.00	4,609,000.00	4,035,500.00	4,227,000.00	4,274,000.00	10,611,859.57
1.	Incomes	0.00	4,609,000.00	4,035,500.00	4,227,000.00	4,274,000.00	4,341,500.00
	Salvage value	0.00	0.00	0.00	0.00	0.00	6,270,359.57
2.	2.1. Fixed assets	0.00					4,377,146.47
	2.2. Permanent working capital	0.00					1,893,213.10
II	Cash outflow (3+4+5)	11,359,278.60	1,981,040.60	2,124,924.76	2,268,808.93	2,268,808.93	2,124,924.76
	Investments' value	11,359,278.60					
3.	3.1. In fixed assets	9,466,065.50					
	3.2. In current assets	1,893,213.10					
4.	Costs without depreciation and interest	0.00	1,981,040.60	2,124,924.76	2,268,808.93	2,268,808.93	2,124,924.76
5.	Tax	0.00	192,571.11	85,349.54	98,822.79	112,765.00	143,708.48
III	Net cash flow (I-II)	-11,359,278.60	2,627,959.40	1,910,575.24	1,958,191.07	2,005,191.07	8,486,934.81

Source: IAE, 2020.

In Table 7. are shown the results obtained by the use of static and dynamic methods towards the determination whether the planned investment is economically justified. Static assessment considers the fifth year of investment use as a representative year. According to all analyzed indicators (Economical-efficiency coefficient higher than one, Net profit margin and Accounting rate of return higher than weighted interest rate) the investment could be considered economically justified.

Table 7. Expected investment effects

No.	Expected investment effects:*	Value
1.	Economical-efficiency coefficient*	1.22
2.	Net profit margin*	36.53
3.	Accounting rate of return*	11.39
4.	Net present value	3,222,824.03 RSD
5.	Internal rate of return	11.98%
6.	Dynamic payback period	4 years and 6.38 months
7.	Break-even point (the lowest level of the volume of production)	4.96%
8.	Margin of safety (allowed fall in production volume)	95.04%

* Representative year (use of full production capacity and last year of loan repayment)

Source: IAE, 2020.

The Net present value, determined by dynamic method, has the value of over the 3.2 million RSD. The Internal rate of return is 11.98% and it is higher than the weighted interest rate (4.28%), so according to this indicator investment could be considered economically justified. The Dynamic payback period is slightly longer than 4.5 years, what is shorter than the previously defined life of the investment (period of credit arrangement), so by this indicator investment is also economically justified. Based on the break-even point of investment profitability and Margin of safety, it could be concluded that investment shows low risks' level.

Conclusion

Dairy farming in the Republic of Serbia is generally characterized by small number of dairy cows per farm and low milk production per dairy cow. In order to improve milk production, urgent issues involve enlargement of average herd of dairy cows per farm, improvement of breed composition toward the increase in milk yielding, as well as modernization of used dairy farming facilities and equipment, or conducted activities that will derive higher incomes per dairy farm.

In line to fact that the average number of dairy cows per one farm in the Republic of Serbia is 3.6, paper analyzes the investment in farm involved in dairy farming

with production capacity of more than 10 high-quality cows that is applying the contemporary cattle breeding systems. According to gained results of economic analysis, it was determined that the investment in defined size and type of dairy farm in given circumstances could be considered economically justified.

Besides, as one of main paper limitation should be considered that the use of some other breed of dairy cows, some other model of their rising, use of different facilities and equipment, or focus to different region (e.g. differences in line to availability and market prices of used animal feed), etc., could certainly derived in some extent different economic results. Additionally, it has to be mentioned that currently in the Republic of Serbia there is a problem with the sale of fattened cattle, what also affects the decrease in farmers' interest for milk production.

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