

ECONOMIC INDICATORS OF PRODUCTION OF SEMI-HARD AND HARD CHEESES IN SMALL CAPACITY DAIRIES IN SERBIA

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Abstract: Animal husbandry has a longstanding tradition in Serbia, and the production of milk and dairy products has a rich legacy. Cow's milk is used in the manufacture of all kinds of dairy products. Annual global cheese production is about 20 million tons, with cattle milk cheeses produced in large-scale processing plants constituting about 80% of that production. In Serbia, leaders of milk production are small family dairy farms, which contribute 92% of total production, while dairies with large capacity dominate in milk processing. There are 211 milk processing plants of varying capacities in Serbia. The largest amounts of milk are processed by dairy plants 'Imlek' and 'Subotica', while 188 small-scale dairies process 20% of total milk. The subject of this paper is the analysis of the economic indicators of production of semi-hard and hard cheeses in small-capacity dairies in Serbia. To determine the level and structure of production costs of dairy products, the analytical calculation method of per unit processing costs has been used. The study has revealed that the cost price of semi-hard and hard cheeses in small-capacity dairies amounts to 3.33 €/kg. With 90.83% in the structure of total costs of processing the milk into cheese, the cost of raw materials has the largest share, followed by labor costs with 6.54%. For small-capacity dairies to be able to compete with larger dairies, both in product quality and price, it is crucial to continuously monitor and minimize production costs.

Key words: hard cheese, semi-hard cheese, economic indicators of production, small-capacity dairy, competitiveness.

Introduction

Animal husbandry has a longstanding tradition in Serbia, and the production of milk and dairy products has a rich legacy. The potential growth of animal husbandry is dependent on several variables, the main ones being natural conditions, population, the acreage of agricultural land and the structure of the soil,

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the organization of agricultural production, the type of technology, breed of cattle and the overall level of economic development. As Steinfeld et al. (2006) state, animal production is changing rapidly in the world adapting to global requirements for the high quality of food products and continually adapting at the level of resource utilization and marketing activities. One of the trends is specialization in production. The specialization in production defines not only the structure of assortment of final products but also the revenues and expenses generated in production, which is reflected in the economic effects (Nedić et al., 2019). The development of the dairy industry in Serbia rests on its historical legacy and tradition of the use of milk and dairy products for domestic consumption. Milk has over time become a market commodity from a product of subsistence farming. Biotechnical factors such as animal selection, feeding and breeding technology, to name a few, have contributed significantly to the growth of the dairy industry. In addition, the development and manufacture of traditional products with protected geographical indication have improved their market visibility and positioning and ensured an enormous profit (Zekić et al., 2012). Also, the dairy sector generates employment and business opportunities, particularly in the rural and peri-urban areas. Many people in urban areas are also involved in the dairy-based business (Sekovska et al., 2015). From an economic point of view, milk production is interesting as it is a daily production which presupposes faster marketing, which accelerates capital movement in agriculture, which in turn enhances liquidity (Rosman et al., 2016).

Milk is used for the manufacture of a number of products: sour milk, yoghurt, cheeses, cream, butter, etc. Some dairy products can be prepared in elementary technical conditions while others require suitable technical equipment, usually of big capacity, found only in large-scale dairy plants. To be sold to final customers, milk has to be subjected to specific methods of control, processing and packaging.

In terms of quantity, cow's milk dominates in the market. On the other hand, even though despite the fact that goats produce only 2% of world milk production, health benefits of goat's milk have increasingly been highlighted, resulting in its increasing production over the past 20 years. There are 270 million milking cows in the world (FAO, 2019), and most of them are raised in Asia, with India's share of 45 million, which makes 16% of the total number of milking cows in the world. The global average for milk production is still very humble, amounting to 2.300 litres per cow (IFCN, 2019). Milk yields vary across the world, with animals having far higher yields in developed than in developing countries. One of the reasons why developed countries have higher milk yields is to be found in the fact that specialized dairy breeds such as Holstein dominate in their milk production whereas beef breeds with lower milk yields are prevalent in developing countries.

Cattle milk yield is the highest in North America, amounting to 9,700 litres, whereas Europe has 6 thousand litres per milking cow. High milk yield per head is

present in the USA, Canada, Holland and Denmark, and the highest milk yield per head, amounting to just over 11 thousand liters, is achieved in Israel with a relatively small number of cattle (FAO, 2019).

Global milk production is 635 million tons, and Europe is the largest producer, constituting over 40 percent of the total milk production in the world (FAO, 2019). The world's leading milk producer is the USA, producing 92 million tons, and the largest milk processing companies, in addition to the USA, are located in New Zealand, France, Switzerland and Holland (FAO, 2019). A tiny amount of 12 million tons reaches the international trade of cattle consumer milk, which constitutes about 2% of global production. The value of milk exports is over \$9 billion a year, and the export price varies due to a number of factors. The leading global exporter of consumer milk is Germany, followed by Italy, Belgium and Holland. The consumption of milk and dairy products is chiefly determined by factors such as the volume of production, level of market prices, and level of income (Veljković et al., 2015). With growing incomes, people typically increase their consumption of meat, milk and eggs until these products become fully integrated into the daily diet (Steinfeld et al., 2006). In developed countries, consumers buy more animal and dairy products.

Annual global cheese production is about 20 million tons (FAO, 2019), with cattle milk cheeses produced in large-scale processing plants constituting about 80% of that production. The remaining share is produced in households, of cattle, goat, sheep and buffalo milks. About 80% of global cheese production is made in Europe and North America. Average annual cheese trade is over 5 million tons, which constitutes about 26% of total global cheese production. The largest cheese exporters in the world are: Germany, France, Holland, Italy, Denmark, Australia, New Zealand, Belgium, Ireland and England. The USA is the largest producer of cheese but a small exporter, with 4.4% of the total output, because most of it is sold in the country. Leading world importers of cheese are: Germany, England and Italy. The largest cheese consumption is in France, Luxembourg, Germany and Iceland, above 24 kilograms per capita, while the smallest one is in China, with only 0.1 kilogram annually per capita. In the structure of cheese consumption, soft cheeses dominate over semi-hard and hard ones, mainly because of their lower retail price.

In Serbia, there are about 450 thousand milking cows and heifers (SORS, 2019). Regionally, the largest number of cows is raised in the Zlatibor region, which contributes about 10% of the total number of cows in Serbia. Compared to earlier periods, the number is decreasing. Milk is the second most important livestock product and accounts for about 30% of the total value of livestock production (Jakšić et al., 2015). The output of cattle milk per milking cow in Serbia is unsatisfactory and very low (Popović-Vranješ, 2015), amounting to an average of 3,200 litres, which is below the European average. Milk production is 1.5 billion

litres, which is 207 litres per capita (SORS, 2019). Serbia is the regional leader in milk production, compared to other members of the former Yugoslavia. Its geographic location ensures favorable possibilities for the development of trade in milk and dairy products (Popović-Vranješ, 2015). The dairy industry in Serbia is more profitable than the Slovenian and Croatian dairy industry, despite comparatively worse conditions of the business environment. The profitability of the dairy industry in Serbia is a consequence of high prices, lower production costs and lack of EU legislation regarding competition and the free market (Muminović and Pavlović, 2012). Despite this, livestock products are not present in the top ten major agro-food products exported from Serbia (Đukić et al., 2017).

Further improvement of the structure of Serbian exports of agro-food products from Serbia should be based on greater participation of livestock products, as well as other agro-food products with a higher degree of processing (Đukić et al., 2017). A dual production structure characterizes Serbian agriculture. On the one hand, there is a large agricultural sector, and on the other hand, an individual production sector. The large agricultural sector represents the modern part of Serbian agriculture with a higher level of production intensity. Agricultural companies are highly market-oriented, and they are responsible for the food security of the country, but they also create significant surpluses which made Serbia a net exporter of agricultural products for the last ten years (Milić et al., 2018). Leaders of milk production, however, are small family dairy farms, which contribute 92% of total production. The supply of milk to processing plants is subject to seasonal variation. Uneven milk supply is due to several reasons, mainly that of food source during winter months. Variations in milk quality (seasonal variation of milk fat and protein) have a considerable influence on the amount of milk per product, and the final price of the product, which could lead to difficulties in the sale (Popović-Vranješ et al., 2017). There are 211 milk processing plants of varying capacity in Serbia. Research shows that large-scale companies in the milk industry in Serbia make a larger profit than small-scale companies (Milošević Avdalović, 2018). The largest amounts of milk are processed by dairy plants 'Imlek' and 'Subotica', with 'Imlek' having the largest milk processing capacity of over 500 thousand litres a day. 'Imlek' is followed by 188 small-scale dairies, which process 20% of milk, and 15 larger dairies with the share of 17%, the Šabac dairy plant processes 5.8%, the Somboled dairy plant from Sombor participates with 5.4% and 'Mlekoprodukt' from Zrenjanin with the share of 3.9%. According to data from Eurostat (2019), cheese production in Serbia is on the average of about 55 thousand tons with a slight increase. The most important export market is the Russian Federation, with an average annual sales of 6.8 thousand tons, or 63.5% of total exports (Vlahović et al., 2018). Serbia's share in the global cheese exports and imports is symbolic: only 0.07% and 0.02% respectively. Serbia has a modest export of cheeses to the market of EU countries primarily due to high demands in terms of production standards,

quality of cheese and specific assortment (Vlahović et al., 2018). Dairy products from Serbia are not always competitive in terms of production costs, prices and quality, which creates additional difficulties for their positioning in foreign markets. The most promising group of products is the production and export of cheese (Veljković et al., 2015). Currently, the export is dominated by fresh and soft cheeses that have a lower price than hard cheeses (Vlahović et al., 2018). Small-scale dairies have a small processing capacity while with respect to other functions, they are competitive to commercial dairy plants. For small-capacity dairies to be able to compete with larger dairies, both in product quality and price, it is crucial to monitor and minimize production costs continuously.

Based on the financial analysis of a representative small-scale dairy producer in Serbia, this paper aims to investigate economic indicators of processing the milk into semi-hard and hard cheeses in small-scale processors. The paper also aims to calculate the cost price taking into account milk processing costs required to produce two prevalent dairy products, semi-hard and hard cheeses, and to discover how and to what extent these costs affect the operation of small-scale processors.

Materials and Methods

The analytical calculation method of per unit processing costs has been used (Marko et al., 1998) for the identification of production costs (total costs, costs structure). These costs were included in the analysis: the direct material costs (the cost of raw materials, packaging and labelling), depreciation costs, labor costs (wages) and transport costs. Total costs are calculated by summarizing fixed and variable costs and calculating total and individual costs per unit.

The representative small-scale dairy producer keeps 100 Simmental and Holstein dairy cattle in freestall barns with a deep bedding system. The range of milk products is about 25, and it includes pasteurized milk, fermented products, kashkaval, plastic-curd cheeses, processed cheeses, fresh cheeses and semi-hard cheeses. Based on its production capacity and annual results, this dairy is taken as a representative one in Serbia for this study.

The period of analysis ranges from 2014 to 2016. The data are based on field research and the official data and publications of The Statistical Office of the Republic of Serbia, Euro and FAO statistics.

Results and Discussion

Processing Milk into Dairy Products

Today, the market increasingly offers new and enriched dairy products, thus resulting in the development of a new generation of dairy products with different

properties and improved nutritional values and health benefits. As a staple food, cheese is a fresh or ripened product which is a result of coagulation of proteins in milk, with whey remaining after the separation of curd. Cheeses can be classified according to various criteria such as the type of milk used in cheese production, fat in dry matter, consistency, texture, methods of production, etc. There are fresh soft and cottage cheeses, brined cheeses, which are typically found in the Balkans, etc. Semi-hard cheeses like Gouda and Edamer are the most widespread group of cheeses in the world, and they are produced in all countries by using both traditional and modern methods (Popović – Vranješ et al., 2017).

Production costs and cost price structure

Manufacturers of milk products have no control over selling prices of their products because prices are determined at the market and are subject to supply and demand, but they have control over production costs and cost price of their products. Since production costs are a segment that manufacturers can directly control, it is necessary to analyze their level, structure and impact on the total production. Reducing unnecessary costs increases profit. In this study, the following costs have been analyzed: direct material costs, labor costs, transport costs, depreciation costs and other overhead costs.

The direct material cost is the monetary value of physical amounts of materials used to make certain products. Milk and other raw materials, packaging and labelling material are the main raw materials used for cheese production.

The prices of analyzed products are calculated based on their purchase price in 2016 (Table 1). The total cost of raw materials of semi-hard cheese with a minimum of 45% fat amounts to 3.02 € per one kilogram of the product. The study has revealed that the total cost of hard cheese with a minimum of 35% fat amounts to 3.02 € per one kilogram of the product, which is the same as in the production of semi-hard cheese.

Table 1. Prices of milk and cheese in the period 2014–2016 (€).

Year	2014		2015		2016	
Product name	Product price (€/kg)	Average milk price (€/l)	Product price (€/kg)	Average milk price (€/l)	Product price (€/kg)	Average milk price (€/l)
Semi-hard cheese with a minimum of 45% fat	3.10	0.233	3.04	0.229	3.02	0.227
Hard cheese with a minimum of 35% fat	3.10	0.233	3.04	0.229	3.02	0.227

Source: Authors' calculation.

The share of the cost of raw materials in the total cost of the production of semi-hard cheese with a minimum of 45% fat and hard cheese with a minimum of 35% fat is shown in Figure 1.

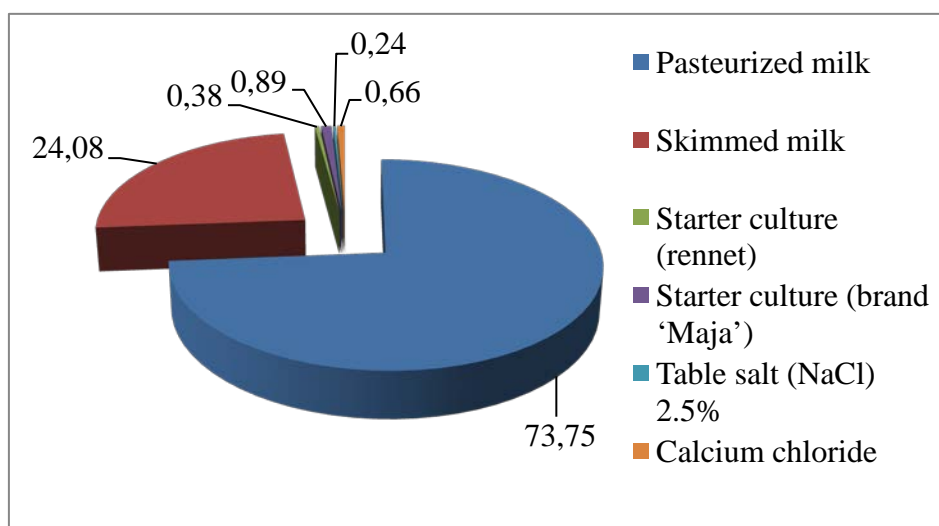


Figure 1. The structure of raw material costs in cheese production.

As shown above, the largest share in total raw material costs is found in pasteurized milk (73.75%), skimmed milk (24.08%) and starter cultures (1.27% and 1.87%). The production of semi-hard and hard cheeses requires 13 litres of milk, whereas yogurt and sour milk require smaller amounts (1 litre and 0.7 litre). The same raw materials at the same prices are used for the production of both semi-hard and hard cheeses, but the manufacturing method and technology are different. Milk has the largest share in total costs of production and its price impacts the price of the final product. The change in the cost of raw materials used to manufacture the product will have an impact on the final cost of the product, and therein lies the particularity of the production and costs, because every product consists of a number of components all of which have their market value (Milić et al., 2019b). In the analyzed period, the price of dairy products remains the same, which is a result of the steady average price of milk. Differences in milk collection cause slight differences in the average prices of milk in the observed three years.

As shown above, prices of milk have not changed dramatically in the analyzed period and have not influenced the cost price and selling price of the final product.

The previous table shows that the price of semi-hard and hard cheeses increases by 0.11 € per kilogram, which is a 3.5% increase. Every price increase leads to an increase of the final product price. An increase of 3.57% (for 1 RSD or

0.008 € of the price of any other raw material does not lead to a significant increase in the price of final products.

Table 2. The influence of the milk price on the price of semi-hard and hard cheeses.

The name of a dairy product	The amount of milk in dairy products (l)	The price of dairy products in 2016 (€/kg)	The price of dairy products after the price of milk increased by 3.57% (€/kg)	The difference in the price after the increase (€)
Semi-hard cheese with a minimum of 45% fat	13	0.229	3.13	0.11
Hard cheese with a minimum of 35% fat	13	0.229	3.13	0.11

Source: Authors' calculation.

Packaging materials and conditions of packaging are important factors which have an impact on the quality of the product in storage (Milić et al., 2019a). Bags which are in direct contact with the product have to observe food safety standards and regulations, which entails not allowing their substances to migrate into the product or to migrate in allowed amounts and enter into chemical reactions with the product. Materials used in food bags today are polymeric materials, and materials most commonly used for milk and dairy product bags and containers are polyethylene, polyethylene terephthalate, polypropylene, polyvinyl chloride and others. Although it is generally required for bags to be inert and not to interact with the packed dairy product, current trends are focused on the development of bags that include certain interactions in order to extend the shelf life. This provides the so-called active, smart or intelligent packaging concept (Ščetar et al., 2018).

The bags and labels are different for different products and influence the cost price. Semi-hard cheese comes in pieces of 600g and 1.2kg, and it is packaged in cheese bags. Hard cheese comes in pieces of 300g and 600g and blocks of 1.2kg, and it is also packaged in cheese bags.

The price of cheese bags ranges from 0.014 to 0.016 € which constitutes 0.30% to 1.11% of the final price of the product. The purchase price of the label ranges from 0.014 to 0.015 €, depending on what is emphasized on the label, quantity and color, which constitutes 0.29% to 1.04% of the final price of the product. For analyzed products, the highest costs are in the production of cheese in 300g bags.

Transport costs can vary depending on many factors (types of vehicles, products, transport distances, locations, etc). In the analyzed small-capacity dairies, their own transport vehicles with a capacity of 3.5 tones were taken into account. Transport costs amount to about 0.68% or 0.023 € per kilogram of produced

cheese. It can be concluded that transport costs depend mostly on the transport destination, the quantity and price of fuel and can significantly affect the price of the final product.

Table 3. The cost of bags and labels of semi-hard and hard cheeses.

Item	Purchase price [€]	Share in the total product price [%]
Semi-hard cheese – 600 g		
Bag	0.015	0.57
Label	0.014	0.54
Semi-hard cheese – 1.2 kg		
Bag	0.016	0.32
Label	0.015	0.30
Hard cheese – 300 g		
Bag	0.015	1.11
Label	0.014	1.04
Hard cheese – 600 g		
Bag	0.015	0.55
Label	0.014	0.52
Hard cheese – 1.2 kg		
Bag	0.016	0.30
Label	0.015	0.29

Source: Authors' calculation.

Depreciation costs are calculated for buildings, machinery and equipment. The analysis assumes that the dairy is comprised of the following buildings: an administration building, a processing plant, a warehouse for finished products, a warehouse for intermediate goods, a collection centre, a collection point in the dairy and a laboratory. Machinery and equipment consist of the milk processing line, vehicles for transportation of milk and finished dairy products, milk processing equipment, and fillers.

Labor costs refer to gross wages, which means the amount before any obligatory deductions are made from employee paychecks. To calculate labor costs of the observed dairy, it is taken that it has 90 employees, with 16 of them employed in administrative tasks and 74 in the hands-on production and transportation of dairy products. In the analyzed period, an average share of gross wages is 0.30 €/l or 0.22 €/kg of the dairy product.

Overhead costs amount to about 1% of total costs and cannot be taken as significant in the analysis compared with other costs. These costs include: electricity costs, telecommunication costs, indirect material costs, depreciation costs and other costs. In this case, overhead costs amount to 0.033 € annually and per kilogram. Overhead costs indirectly affect the cost price of the final product, through the costs of the entire production line. Labor costs and overhead costs are relatively constant, and they do not fluctuate considerably (Milić et al., 2019a).

Table 4 shows the structure of the cost price of two types of cheese.

Table 4. The structure of the cost price of semi-hard and hard cheeses.

Costs	Semi-hard cheese with a minimum of 45% fat (€/kg)	Hard cheese with a minimum of 35% fat (€/kg)	Share (%)
1 Raw materials	3.02	3.02	90.83
2 Transportation	0.023	0.023	0.68
3 Packaging	0.034	0.034	0.95
4 Labor costs	0.22	0.22	6.54
5 Overhead costs	0.033	0.033	1.00
Total:	3.33	3.33	100

Source: Authors' calculation.

As shown above, costs of 1 kilogram of semi-hard and hard cheeses are 3.33 €/kg without the VAT.

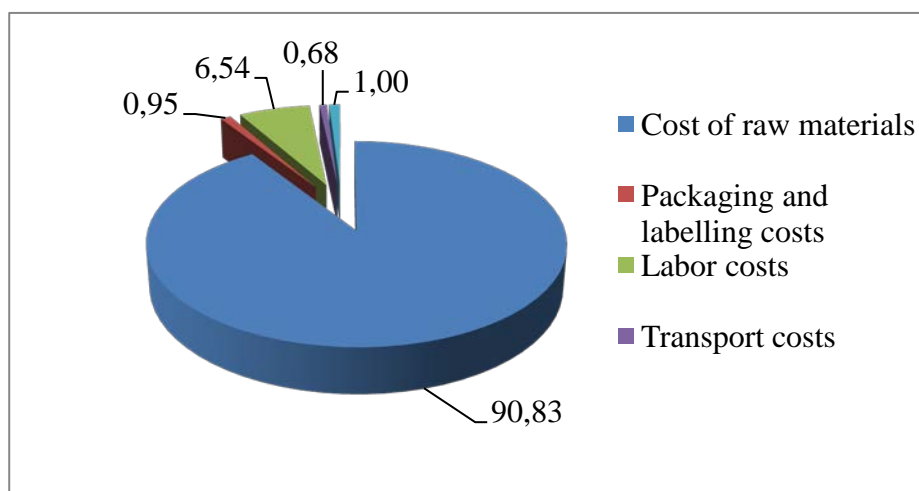


Figure 2. The structure of individual costs in total costs of cheese production.

The costs of raw materials for the production of both types of cheese have the largest share and amount to 90.83% because raw materials are the main ingredients of the final product. In terms of the share and importance, the cost of raw materials is followed by labor costs of 6.53%, overhead costs of 1% and transport costs of 0.68%.

In order to achieve a higher market share than the competition, small-capacity dairies should pay special attention to the level of each production cost (especially costs of raw material) without compromising the quality of the final product.

Conclusion

The production of milk and its processing into dairy products is one of the significant areas of agricultural development in Serbia. There are 211 dairy processing plants in Serbia, and most milk is processed by large-scale dairies 'Imlek' and 'Subotica'. On the other hand, the number of small-scale dairies is growing, and currently, they are manufacturing 20% of all dairy products, with an increasing tendency. Among all dairy products, the production of semi-hard and hard cheeses requires an extended period of production and ripening, and these two types of cheese have a higher selling price than other dairy products, but also a longer realization period and durability in the market. In the structure of cheese consumption, soft cheeses are more dominant than semi-hard and hard cheeses, mainly due to their lower retail price. There is a fierce rivalry among producers of milk and dairy products in the market. In order to be competitive, all producers should continuously monitor production costs and strive to minimize them.

The analysis has shown that the cost price of semi-hard and hard cheeses in a small-capacity dairies amounts to 3.33 € per kilogram. As the calculations show, processing milk into semi-hard and hard cheeses is reasonable, when compared with the sales of raw milk, but the structure of production costs which determine the cost price of the finished product should be scrutinized in order to keep these costs low. The costs of raw materials for the production of both types of cheese have the largest share and amount to 90.83% because they are the main ingredients of the final product. In terms of the share and importance, the cost of raw materials is followed by labor costs of 6.53% (0.22 € per kilogram of cheese), overhead costs of 1% and transport costs of 0.68%. Labour cost could be lowered by modern techniques, number of workers, hours of work, production volumes, etc.

It has been ascertained that an increase of 3.57% (1 RSD or 0.008 €) of the milk price results in a 3.5% increase in the production price of semi-hard and hard cheeses. In the analyzed period, the price of dairy products remains constant due to the steady average price of milk. Small differences in the average milk prices in the analyzed period are a consequence of differences in milk collection.

The costs of bags and labels participate with 0.95% in the cost price of semi-hard and hard cheeses. These costs have the largest share in the bags of 300g of hard cheese. Transport costs participate with 0.68% or 0.23 € per kilogram of cheese. Manufacturing overhead costs of semi-hard and hard cheese constitute 1% of total costs or 0.033 € per kilogram of the product. Overhead costs indirectly affect the cost price of the final product, through the costs of the entire production line.

Since the production of milk and its processing into dairy products have significant potential, it can be concluded that dairy producers should work to improve quality, reduce prices, widen the range of products, and intensify

marketing activities which will help them retain existing customers and attract new ones, be competitive and be profitable. This is of utmost importance, especially when viewed in the light of future European integration, because only the most competitive dairy farms and plants are expected to survive. For small capacity dairies to be able to compete with larger dairies, both in product quality and price, it is crucial to monitor and minimize production costs continuously.

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EKONOMSKI POKAZATELJI PROIZVODNJE POLUTVRDOG I TVRDOG
SIRA U MLEKARAMA MALOG KAPACITETA U SRBIJI

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R e z i m e

Stočarstvo u Srbiji ima dugu tradiciju, a proizvodnja mleka i mlečnih proizvoda bogato nasleđe. Kravlje konzumno mleko koristi se u proizvodnji svih vrsta mlečnih proizvoda. Svetska proizvodnja sira je oko 20 miliona tona godišnje, od čega je 80% sireva od kravljeg mleka proizvedenih u industrijskim mlekarama. U Srbiji su glavni proizvođači mleka mala porodična gazdinstva, dok u preradi mleka i mlečnih proizvoda dominiraju mlekare sa velikim kapacitetom. U Srbiji ima 211 kapaciteta za preradu mleka, većina mleka se prerađuje u mlekarama „Imlek” i „Subotica”, dok 188 mlekara malog kapaciteta prerade 20% ukupnog mleka. Predmet istraživanja u ovom radu su ekonomski pokazatelji prerade mleka u polutvrđi i tvrdi sir u mlekarama malog kapaciteta u Srbiji. Istraživanje je pokazalo da cena koštanja polutvrđog i tvrdog sira iznosi 3,33 evra po kilogramu. Najveći udeo u ukupnim troškovima imaju troškovi sirovina sa 90,83%, a potom slede troškovi rada sa 6,54%. Da bi mlekare malog kapaciteta mogle da konkurišu većim mlekarama kako u pogledu kvaliteta proizvoda tako i u pogledu njihove cene, neophodno je pre svega u kontinuitetu pratiti i u što većoj meri minimalizovati troškove proizvodnje.

Ključne reči: tvrdi sir, polutvrđi sir, ekonomski pokazatelji proizvodnje, mlekare malog kapaciteta, konkurentnost.

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