



IDENTIFICATION OF THE NEEDS OF PRIMARY MILK PRODUCERS IN THE NEW COMMON AGRICULTURAL POLICY 2021 – 2027

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ABSTRACT

Although Slovakia belongs to the smallest milk producers in the EU, we have to bear in mind the importance of the milk industry for the economy of Slovakia. Current expectations in Slovakia are that primary milk producers are able to produce milk at the lowest possible price, with state support on the same level as in other EU states, processing companies have a good purchasing price for the raw materials, retailers are able to share margins and to increase the market share of Slovak dairy products and last but not least that consumers buy milk and dairy products produced in Slovakia. Milk production in primary production has a profound ecological and social benefit for our countryside but the most important is the contribution of milk and dairy products to human health. The Slovak dairy sector has experienced three dairy crises and one butter crisis in the last ten years, what caused that up to 37% of milk producers in Slovakia cease their production. Currently, there are 401 approved primary milk producers in Slovakia. This sector is in long-term condition weakened by market fluctuation and by previous crises. Slovakia has a large investment debt in this sector. That is why in order of food security and maintaining employment it should be in the interest of the new government to do everything possible to stabilize this sector. Therefore, the primary objective of this scientific paper is to identify the needs of primary milk producers in Slovakia in relation to the strategic objective – to increase the competitiveness of the milk producers. The research aims to transform the voice of primary milk producers into the new programming documents for the upcoming period of the Common Agricultural Policy (CAP) for the years 2021 – 2027.

Keywords: milk; primary milk producers; dairy sector; common agricultural policy

INTRODUCTION

The importance of milk and dairy products to human nutrition has been repeatedly confirmed by nutritionists around the world. Milk, as the most complex food, has been one of the main foods since ancient times. The existence of human society cannot be imagined without the milk. Its composition makes milk irreplaceable for a healthy diet.

Milk is a highly nutritious food containing many macro- and micronutrients that are essential for the growth and maintenance of human health (Iqbal et al., 2015). The main biological components of milk include protein, fat, lactose, minerals (calcium, phosphorus, potassium, magnesium) as well as essential nutritional substances, vitamins and other important substances, which form a comprehensive balanced food for all age categories of the population (De la Fuente and Juárez, 2015; Šimo, Mura, and Buleca, 2016).

Milk proteins present in the milk are made of casein and whey proteins which are nutritionally and technologically essential and represent an irreplaceable amino acid intake for humans (Bartošovičová, 2011). Milk proteins contain

18 out of 22 essential amino acids that cannot be created by the human body itself and that are inevitable for running of the human body; and are divided into two basic groups, i.e. caseins and whey proteins. Milk is rich in vitamins, namely vitamin A, B (especially B1, B2, B3, B6, and B12), C, D, E, and K (Gonda, 2009).

Other essential nutrition components of milk are carbohydrates (especially lactose) and fats. Lactose is a hydrocarbon that can only be found in milk and has a significant role in energy production. Lactose is simply a certain kind of sugar presented in milk (Kurajdova and Táborecká-Petrovičová, 2015). Milk fat, representing an easily digestible emulsion containing lecithin and a relatively low level of cholesterol, is another important ingredient in milk (Kubicová, Predanociová and Kádeková, 2019).

Besides the fact that milk has a notable positive nutritional impact on the human body, it is characterized by a pleasurable effect on health and disease prevention. Although a lot of various researches and studies on health aspects and disease prevention effects of drinking milk and consuming milk products are still in progress, there are

several interesting conclusions and findings which came to light.

The most recent scientific evidence supports the consumption of cow's milk and dairy products as part of a balanced diet. Current scientific literature suggests that appropriate consumption of milk and its derivatives may be beneficial at all ages, except specific medical conditions such as lactose intolerance or milk protein allergy (Marangoni et al., 2019).

Scientific hypothesis

This research paper aims to identify the needs of primary milk producers in Slovakia in relation to two strategic objectives (to increase the competitiveness of the milk producers and their position in value chains) and transform their voice into the new programming documents for the upcoming period of the Common Agricultural Policy for the years 2021 – 2027.

Several hypotheses were formulated:

Hypothesis 1: There exists a dependence between the legal form of business and land area.

Hypothesis 2: There exists a dependence between the legal form of business and the number of dairy cows.

Hypothesis 3: There exists a dependence between the legal form of business and number of employees.

Hypothesis 4: There exists a dependence between the region and average milk yield per cow.

MATERIAL AND METHODOLOGY

In order to fulfill the stated objectives, we chose a questionnaire survey as the main method. This method was chosen mainly because the questionnaire generally represents a series of different types of questions that are answered by respondents. The content, number, and type of questions are determined by the purpose of the survey and the target group for which the questionnaire is intended. The questionnaire is suitable for obtaining data from many people. Due to the uniformity of the formulations, the data can be processed, and the responses of different groups can be easily compared. In general, the questionnaire is an "economical" tool in terms of data collection and processing (depending on the type of questions).

The questionnaire survey aimed to gather information from primary milk producers, to analyse the current situation and identify the needs of primary milk producers in the new CAP 2021 – 2027. For this purpose, the questionnaire consisted of two parts:

- 1) The current state of the primary milk producers.
- 2) Identification of the needs in the new CAP 2021 – 2027 concerning the strategic objective – to increase the competitiveness of the milk producers

The survey was carried out in September – November 2019 by sending a link to an electronic questionnaire by e-mail but mainly by personal inquiry of the Slovak primary milk producers.

The criteria for determining the survey sample were all primary milk producers in Slovakia. Out of a total of 401 primary milk producers in Slovakia, we managed to reach 104 primary milk producers, who represent 27% of the total number of respondents surveyed. In Figure 1 below, we can see the legal form of the respondents surveyed.

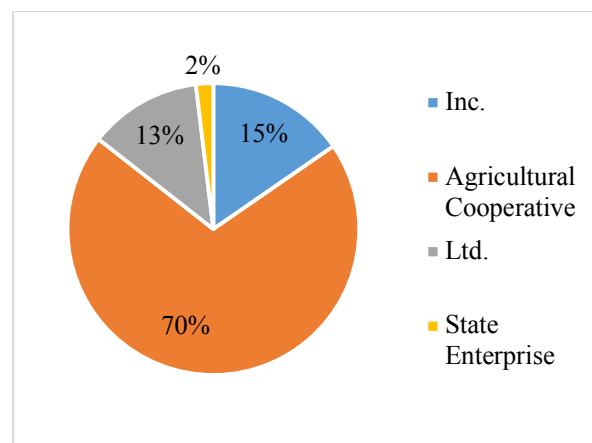


Figure 1 The legal form of the respondents surveyed. Note: Own processing based on questionnaire survey.

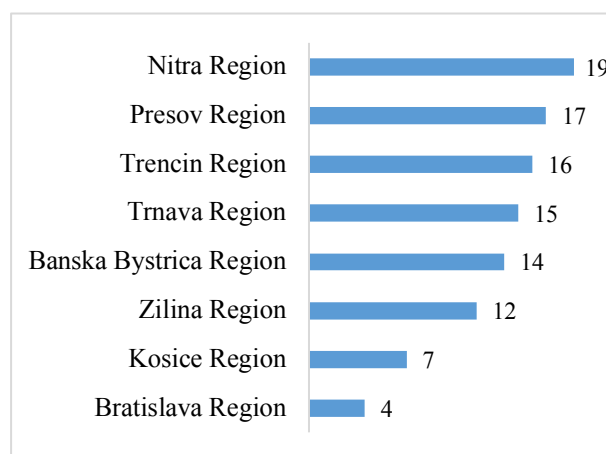


Figure 2 Regional representation of enterprises. Note: Own processing based on questionnaire survey.

Table 1 Number of dairy cows as of 31/08/2019 in Slovakia.

Indicator	Total SR (pc)	Analyzed (pc)	Share in SR (%)
Number of dairy cows as of (31/08/2019)	124 030	40 713	33%

Note: Own processing based on Statistical Office of Slovak Republic.

The largest share of respondents was represented by agricultural cooperatives (70%).

Figure 2 shows the regional representation of the respondents surveyed. The largest share of respondents was from the Nitra region.

In Table 1 below the number of dairy cows can be seen. In Slovakia, there are registered in a total of 124 030 dairy cows as of 31/08/2019. Together our analysed sample had 82 303 all cattle categories and out of this number, our analysed sample had in total 40 713 dairy cows which represent 33% share in Slovakia. The smallest enterprise had just 103 dairy cows and the largest enterprise had 3 146 dairy cows.

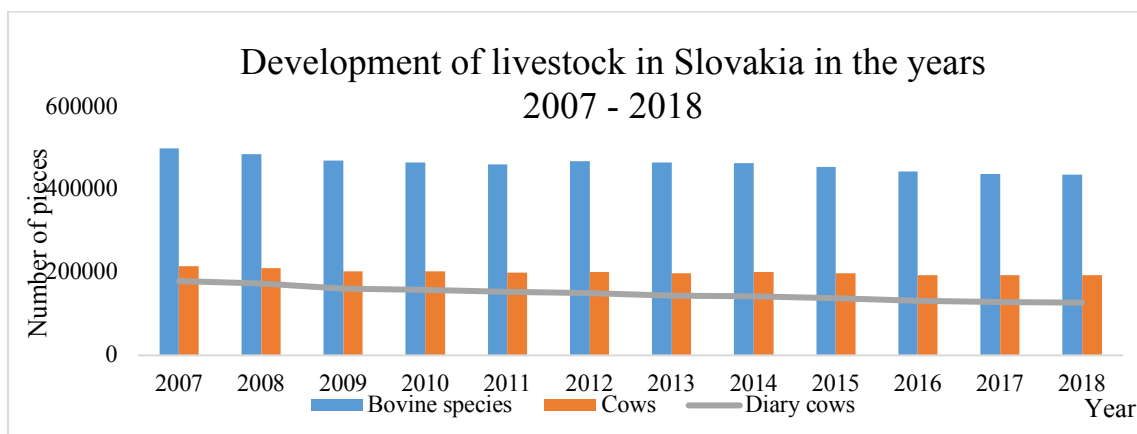


Figure 3 Development of livestock in Slovakia in the years 2007-2018. Note: Own processing based on Statistical Office of Slovak Republic.

Table 2 Development of the Consumption of Milk and Dairy Products in kg per capita in the SR (2007 – 2017).

	Year										
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Milk and dairy products (kg)	153.4	153.0	153.8	162.8	156.9	158.6	158.5	166.8	169,2	176,2	174,6
Milk (kg)	52.4	48.3	49.5	54.5	53.1	54.3	49.3	48.3	48.1	46.5	46.4

Note: Own processing based on Statistical Office of Slovak Republic.

After analysing the number of dairy cows we also decided to analyse milk deliveries of our analysed sample.

In Table 2 the share of analysed enterprises in the milk deliveries in Slovakia can be seen. In our survey, we analysed 40% of the whole milk deliveries in the Slovak Republic.

Statistical analysis

The selection of tests is designed particularly because of variables in research. The attention is paid to the formulation of hypotheses (null and alternative) and to determine the level of significance. The collected data were processed by using Microsoft Excel and subsequently evaluated in the statistical program XL Stat. The formulated hypotheses were tested by applying the following statistical tests:

- 1) Shapiro–Wilk test
- 2) Chi-square contingency test
- 3) ANOVA test
- 4) Kruskal Wallis test

In hypothesis testing, if the p-value is lower than a significant level, in the case of XL Stat software by Addinsoft (version 2019.3.2), it is 0.05, the null hypothesis was rejected and the alternative hypothesis was confirmed.

RESULTS AND DISCUSSION

Raw cow milk represents one of the most important commodities in the agricultural market. The Slovak agro-food foreign trade is characterized by a substantial increase in the commodity trade, monitoring of competitiveness is therefore very important (Šimo, Mura, and Buleca, 2016). The major part of the milk production is represented by the cow milk. Other milk types such as the sheep, goat, and milk of other species have specific properties as well as the use in human and animal consumption (Matić et al., 2014; Gavurová et al., 2014).

In Slovakia, there are currently approved 401 primary milk producers that process milk. The Slovak dairy sector has experienced three dairy crises in the last ten years. The Slovak dairy sector is weakened and financially undersized due to large fluctuations in the market. In the interests of food security and maintaining employment, it is important to do everything possible to stabilize the dairy sector.

Cows’ breeding can be considered as strategic, especially concerning other categories of cattle and its connectivity to arable land and permanent grass-land. Cattle breeding represents a crucial condition to maintain a balance between the plant production and breeding processes of agricultural business activities (Siničáková, 2012).

In the reporting period, we can observe a decline in livestock in Slovakia (Figure 3). Likewise, the decreasing character can be observed in the number of cows together as well as in the number of dairy cows. It is interesting to note that on the 1st April 2015, when milk quotas were abolished, the number of cows in Slovakia did not increase. However, in recent years Slovakia has had an annual milk production quota of 1 billion liters, which has not been fulfilled.

Table 3 Milk deliveries for the year 2018 (kg) of the analyzed sample.

Indicator	Total SR (kg)	Total Analysis (kg)	Share in SR (%)
Milk deliveries	817 000	326 352 835	40%

Note: Own processing based on Statistical Office of Slovak Republic.

The decline in livestock in Slovakia may also be due to a decline in the reproduction and reproductive characteristics of cattle (the indicators of reproduction of the basic herd and reproductive characteristics of cattle decline year-on-year).

By applying the Chi-square contingency test, hypothesis 2 was confirmed that there exists a statistically significant dependency between the legal form of business and the number of dairy cows ($p = 0.05$). The testing criteria F is higher than the table value χ^2 , therefore we reject the null hypothesis.

In the last year in the reported period, the percentage of heifers and cows fertilized and the proportion of heifers transferred to cows decreased.

On the other hand, the percentage of cows culled as a result of cow mortality has decreased. Deaths of calves were slightly increasing year-on-year. Similarly, fertility indicators deteriorated year-on-year. The number of calves born per 100 cows and the number of calves raised per 100 cows decreased by up to 2.71. The average daily weight gain of fattening cattle increased year-on-year by 0.019 kg/KD, reaching 0.765 kg per head per day per year.

In general, the dairy sector is very labour intensive and people are not interested in working there. According to our analysis, on average one employee takes care of 48 dairy cattle. Hypothesis 3 assumed dependency between the legal form of business and the number of employees. By applying the Chi-square contingency test, hypothesis 3 was not confirmed and there is no statistically significant dependency between the legal form of business and the number of employees ($p = 0.05$). This means that we do not reject the null hypothesis.

Milk, as one category of dairy products, belongs to the group of basic daily-consumed products characterized by relatively high purchase frequency (Kurajdova, Táborecká-Petrovičová, 2015). Based on their nutritional values, milk and dairy products have an irreplaceable role in daily consumption. On the other hand, the consumption of milk and dairy products is experiencing a certain negative trend in Slovakia compared to other countries in Central Europe.

In Table 3, we can see the development of milk and dairy products consumption in 2007 – 2017 (per capita/year). The consumption of milk and dairy products in Slovakia is increasing from year to year but we are still below the recommended consumption by the World Health Organization (WHO).

According to the WHO, the recommended consumption of milk and dairy products is at least 220 kg per person per year. However, the actual average consumption in Slovakia is currently significantly lower. On average it is only 178 kg per person per year. The average consumption in Europe is over 320 kg per person per year. This means that according to the WHO recommendation, each person should consume at least a glass of milk or a cup of sour milk products such as yogurt or acidophilic milk, plus a portion of butter and 100 g of cheese or cheese products daily.

Even though Slovakia belongs to the smallest milk producers in the EU, we have to keep in mind the importance of the milk industry for the economy of Slovakia. Application of the Chi-square contingency test, as well the hypothesis 1 was not confirmed and there is no statistically significant dependency between the legal form

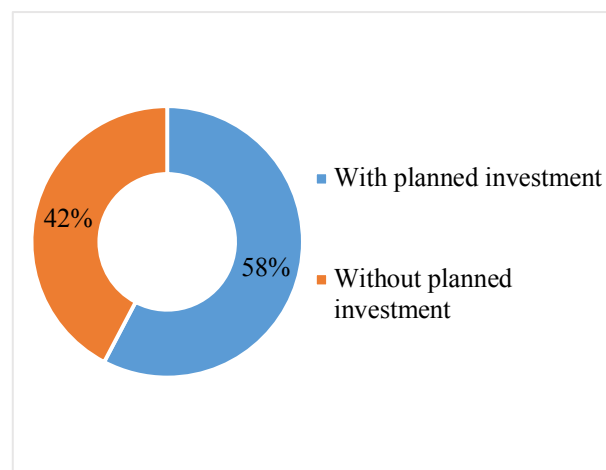


Figure 4 Investments into the housing. Note: Own processing based on questionnaire survey.

of business and land area ($p = 0.05$). This means, that we do not reject the null hypothesis.

The current situation in Slovakia is complicated. We expect:

- 1) milk producers to be able to produce milk at the lowest possible price,
- 2) state support at the same level as in other EU states,
- 3) processing companies to have a good purchase price for the raw material,
- 4) retailers to be able to share margins and to increase the market share of Slovak dairy products, and
- 5) consumers to buy milk and dairy products originating in Slovakia.

One of the most important issues within the CAP is the support of milk production (Folmer, et al., 2013). The present experience with the CAP that was introduced into the milk market did not result in the anticipated effects. The price of milk is highly volatile, and the production is changing. The demand for milk has been changing with people consuming less milk per capita worldwide. The success of any future policy affecting the milk market depends on communication between policy makers and farmers (Alpmann and Bitsch, 2017).

Dairy farmers need to invest in keeping their farms in good condition, maintain competitiveness on the market, increase the rate of technology adoption, and improve labour productivity (Pouch and Trouvé, 2018).

For this reason, we decided to identify the needs of primary milk producers and transform their voice in the new CAP 2021 – 2027. Investments realized in dairy farms allow the implementation of new technologies and involve benefits associated with an increase in efficiency, a reduction in costs, an improvement in the quality of products and a reduction in the adverse impact on the environment, and an improvement in animal welfare (Bewley, 2010).

Based on this, in this paper, we focused on analysing the investments of dairy farmers into housing, milking, feeding, water feeding and water supply, storage capacity, pasture system, waste management, and welfare. Firstly, we analysed the investments into the housing – objects for cattle. In Figure 4 it can be seen that 58% of respondents plan the investments into the housing of cattle in the next year. These investments were divided into two main

categories, the reconstruction of the old objects and the construction of the new ones.

Up to 68% of respondents are planning the reconstruction of existing buildings and just 32% of respondents plan to build a new stable for cattle.

Respondents with planning investments into the reconstruction mostly plan the complete reconstruction of the building such as the reconstruction of the roof, electricity, water, replacement of windows, reconstruction of sanitary facilities, isolation), some of them plan just small construction work such as demolition of the side walls to increase the volume of fresh air, to build ventilation slots or to install or replace stall ventilation. In terms of animal

housing responders plan to replace fences, bed mattresses, drinkers.

As shown in Figure 5 above, our respondents plan housing in total for 31 545 different categories of bovine species in 2020. These animals are planned for both stables, for the new ones as well as for the reconstructed ones. The highest number of planned animals is represented by cows (17 700 pc.) followed by heifers (5 830 pc.), young cattle (4 850 pc.), and the smallest number is represented by calves (3 165 pc.).

The planned volume of investment for housing by our respondents is approx. 75 million €. Our estimated volume

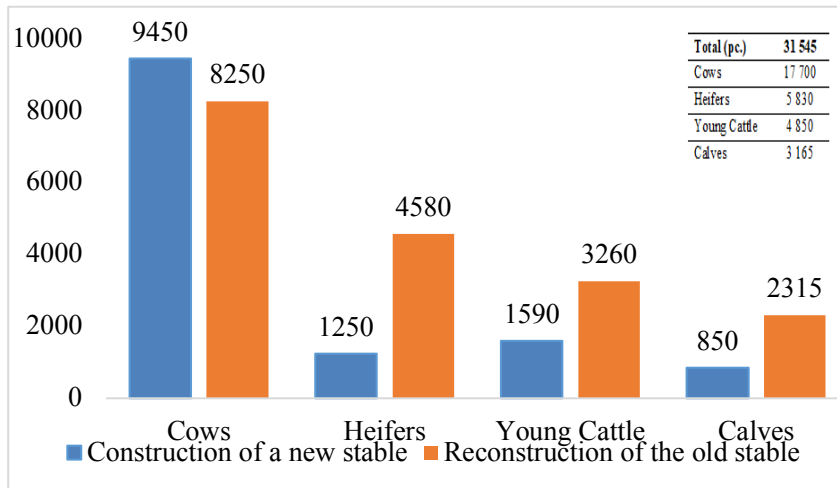


Figure 5 Planned capacity for different categories of bovine species. Note: Own processing based on questionnaire survey.

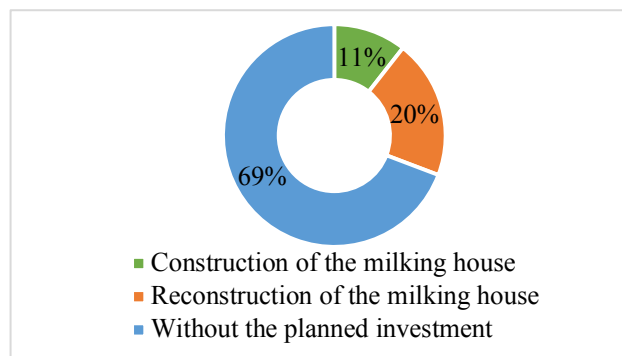


Figure 6 Objects for milking technology. Note: Own processing based on questionnaire survey.

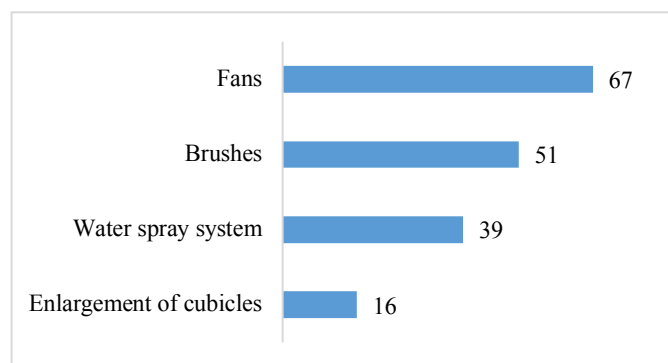


Figure 7 Planned welfare investments of primary milk producers in 2020. Note: Own processing based on questionnaire survey.

of housing investments in Slovakia is approx. 200 million €.

The investment in housing is really necessary for Slovakia because stables in which milk is produced are often in a bad condition. During our research, we found out that up to 77% of all stables were built between the years 1950 – 1990. These objects often do not fulfil the conditions for sufficient animal welfare, which may cause lower milk yields and thus affect milk deliveries.

Talking about Milking - objects for milking technology up to 69% of the respondents in 2020 do not plan investments, 20% of respondents plan to do some reconstruction and just 11% of respondents plan to build a new one (Figure 6).

Based on the survey, we found out that primary milk producers plan to invest in the purchase of milking robots (up to 10% of the respondents) in a total of 46 pieces in 2020. Milking robots are automatic milking systems where milking is performed without the direct participation of an operator (**Andrews, Davison and Pereira, 2016**). It seems that milking robots are becoming popular systems also among Slovak farmers. This system relies on the use of the computers and the special herd management software, which means reducing labour cost from the partially manual milking.

However, according to **Shortall et al. (2016)** any decision to invest in automatic milking should consider several factors, such as the availability of skilled labour, lifestyle sought by the farmer, the interest in technology, and the initial capital investment requirement by the milking system.

The planned volume of investment for milking by our respondents is approx. 14 million €. Our estimated volume of objects for milking technology in Slovakia is approx. 35 million €.

Talking about investments in feeding and water feeding, we found out that most primary milk producers plan to invest in the fodder mixing wagon in 2020. On the contrary, the least interest is in investment into feeding robots. In recent years, great success has been made in the field of autonomous robotics. To date, autonomous robots have already been widely used in dairy farming that is a labour-intensive industry involving many tasks such as feeding, milking, livestock management, etc. Gradually, these robots appear to become huge advantages especially in aspects of increasing productivity, improving accuracy and decreasing labour costs (**Cheng, 2016**). In Slovakia, feeding robots are not popular among Slovak primary milk producers yet.

The planned volume of investment for feeding by our respondents is approx. 9 million €. Our estimated volume of feeding investments in Slovakia is approx. 25 million €.

In terms of the type of investments in technology and equipment to provide water for animals, our responders mainly utilize the water pumped from bored or dug wells or from free-flowing natural groundwater springs so their planned investment is primarily into water well drilling, reconstruction of hydro-globes (water towers), extension or construction of water distribution from an existing well or construction of a public water connection.

The planned volume of investment for water security by our respondents is approx. 1 million €. The estimated amount of investment for water security in Slovakia is 3 million €.

Regarding storage capacity, our analysed sample plans to invest in the reconstruction or construction of forage warehouses, feeding troughs, and hay-lofts. The estimated volume of investment of the analysed sample in the storage capacity is 9 million €. Our estimated amount of investment in the storage capacity in Slovakia is 20 million €.

Last but not least part of our research was animal welfare. In recent years, the animal welfare debate in livestock farming has continued to grow, including dairy cattle farming (**Koik, Thiele and Enneking, 2019**).

According to **Buller and Morris (2003)**, discussions about animal welfare generally begin with an often-unarticulated ethical assumption that it is morally acceptable for humans to use animals so long as they ensure that animals are free of physical and mental stress and able to experience positive feelings. On the other hand, animal rights movements consider any use of animals to be morally objectionable and argue for the development of dairy and meat alternatives (**Garner, 2016**).

Understanding of animal welfare tends to include consideration of three aspects: (1) that welfare comprises animals' essential health and functioning (i.e. absence of disease and injury); (2) the need to consider animals' 'affective states' (such as pain, distress, and pleasure) and how positives and negatives add up to a quantitative indicator of well-being; and (3) animals' freedom to pursue 'natural' behaviours (e.g. grazing in the open air), including their ability to exercise control in a given situation to remove themselves from 'poor' situations and place themselves in more positive mental and physical states (**Fraser 2008; Ohl and Van der Staay 2012; Arnott, Ferris and O'Connell, 2017**).

In literature about the welfare of animals, different authors have tended to emphasize different concerns. Given the complexity to understand the concept of animal welfare we understand it as a summary of three key points:

- 1) welfare comprises animals' essential health and functioning (i.e. absence of disease and injury);
- 2) the need to consider animals' 'affective states' – states like pain, distress, and pleasure as positive or negative add up to a quantitative indicator of well-being; and
- 3) the ability of animals to live reasonably natural lives by carrying out natural behaviour and having natural elements in their environment (e.g. grazing in the open air) (**Fraser 2008; Ohl and Van der Staay 2012**).

An inadequate environment and breeding techniques mean that a significant proportion of livestock is in a state of chronic stress which greatly reduces the resilience, viability, longevity, production, and reproduction of genetically high-value animals. We must, therefore, respect the demands of animals to create the conditions for them to live and produce.

The number of days with extremely high temperatures in Slovakia is constantly increasing and according to the forecast, it is going to increase. Global warming significantly affects the animal's life which also affects how they are bred. Most breeders in Slovakia are not prepared for this. Therefore, they plan investment into modern technologies to reduce this negative impact of climate extremes. Appropriate ventilation is one such solution.

As you can see in Figure 7 primary milk producers plan to invest in different combinations of methods and practices of welfare in 2020. Respondents are most interested in fans. In

extreme summer conditions, when the air flow in the stables decreases and the air exchange is inadequate, breeders use fans to support the air flow. The second of planned welfare investment were brushes which improve the health of cows and have a very beneficial effect on blood circulation. At the same time, they increase the comfort and convenience of the cows, which affect milk production. Many responders also plan to invest in the water spray system to form an aerosol substance that cools the air. There were many answers with a combination of water spraying systems with fans which is a suitable solution to enhance the effect of air cooling. The responders are not certainly interested in the enlargement of cubicles (Figure 7).

The dairy sector is undergoing major structural changes in the EU. Current changes in the dairy sector affect farm efficiency, profitability, and long-term economic sustainability (Cabrera, Solis, and Del Corral, 2010).

Dairy farmers need to invest to keep their farms in a good condition, maintain competitiveness in the market, increase the rate of technology adoption, and improve labour productivity (Schick and Hartmann, 2005; Pouch and Trouvé, 2018).

In our research, we also identified the other forms of support to increase the competitiveness of Slovak milk producers such as:

- 1) Support investment in livestock production and new technologies of livestock production. Farm investment support is one of the EU Rural Development Programme policy instruments provided to enhance farm productivity, agricultural production efficiency and thus farm competitiveness (Hurňáková, Bartová, and Fandel, 2016).
- 2) Create the same conditions for all EU milk producers. We believe that the new programming documents of the new CAP 2021 – 2027 will reflect this requirement. A new CAP delivery model should lead to a more results-based policy and greater flexibility in its implementation while preserving its common dimension (Rossi, 2018; Matthews, 2018).
- 3) Linking science with practice and better cooperation with universities (educational and consulting activities, analyses, benchmarking). Many respondents would be interested in collaboration with

universities. The biggest advantage of cooperation they see in the preparation of project documentation as well as in the analysis of various data.

- 4) Assistance in natural disasters. Natural conditions are one of the important factors affecting the economic competitiveness of dairy farming in relation to other agricultural activities (Bórawski et al., 2020).
- 5) To raise awareness regarding the importance of milk production and milk consumption in the Slovak Republic. Milk production is important for society as a whole, both in terms of the economy of the state and the employment of the rural population. It is a traditional economic sector that due to its very favourable conditions promises a very viable future (Gurčík, et al., 2016).

Finally, we would like to look at the last tested hypothesis, hypothesis 4. In Error! Reference source not found. below, we can see that the F-value is lower than the F-critical value for the alpha level selected ($p = 0.05$). Therefore, the null hypothesis is valid and sample means are equal, or they do not have any significant difference. Based on the One- way ANOVA we can say with a probability of 95% that the average milk yield per cow does not depend on the region.

Even though nonparametric methods show less power compared to parametric methods, we have decided to use the Kruskal-Wallis test for testing the last hypothesis. Similarly, the Kruskal-Wallis test did not confirm the existing differences between a region and an average milk yield per cow.

Within the individual regions of Slovakia, there is a different level in the development of the average milk yield per cow. Based on available data from previous years, Bratislava and Nitra regions significantly influence the achieved level of milk yield in Slovakia. On the contrary, in the east of Slovakia, the number of dairy cows is increasing every year.

On the member-farm level, the abolition of the EU milk quota system opened up new entrepreneurial options for farm growth. At times when milk prices were relatively high, such as in the years 2011 – 2014, many farmers invested in the expansion of their milk production.

Table 4 Anova:Single Factor.

Source of Variation	SS	df	MS	F	p-value	F crit
Between Groups	38035074.27	7	5433582	1.957673	0.068965	2.107506
Within Groups	263675400.6	95	2775531			
Total	301710474.8	102				

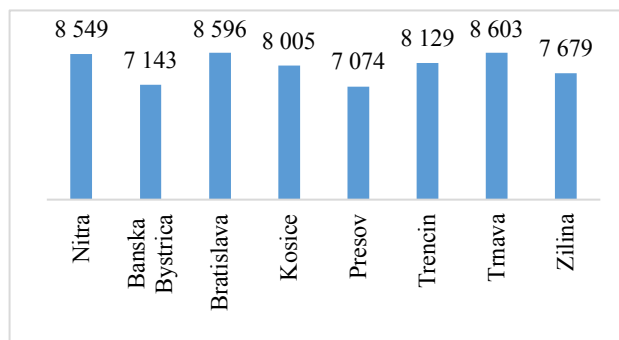


Figure 8 Anova: Single factor. Note: Own processing based on questionnaire survey.

However, when prices steeply declined in 2015 and 2016, the same farmers were not ready to accept the low prices offered to them by their cooperatives (Nagy and Jámbo, 2019). The Slovak dairy market has been in an unfavourable situation in recent years. Long-term low prices of raw cow milk led to the liquidation of primary milk producers (Váryová et al., 2019). The year 2019 was one of the better years for primary milk producers. After some time, the situation has improved, mainly thanks to the recovery of milk purchasing prices (32.6 cents per kilogram over the year) but also thanks to some support (Štefániková, 2020).

CONCLUSION

Although the situation in the milk sector is improving, not all primary milk producers achieve the balanced cost of milk production. No one is producing milk at the same cost. Several factors affect milk production. It is different to produce milk in mountainous areas and the flat south, so natural conditions also affect it.

In our research, we pointed out the current situation and needs of milk producers in Slovakia in relation to the strategic objective – to increase the competitiveness of the milk producers. The sample we examined plans to increase the number of milk deliveries by 2.6% in 2020. This fact is very positive for the sector. On the other hand, costs have risen again, either because of rising energy prices or because of rising labour costs caused by the government measures and the conditions in which the milk is produced are insufficient. The oldest stables in which dairy cattle are kept exist on average 50 years. We certainly need to make our primary milk producers more competitive. In the upcoming period, we need a government that will prioritise and support the development of the dairy sector.

REFERENCES

Alpmann, J., Bitsch, V. 2017. Dynamics of asymmetric conflict: The case of the German Milk Conflict. *Food Policy*, vol. 66, p. 62-72. <https://doi.org/10.1016/j.foodpol.2016.12.002>

Andrews, J., Davison, T., Pereira, J. 2016. Dairy Farm Layout and Design: Building and Yard Design, Warm Climates. *Reference Module in Food Science*. UK : Elsevier, p. 13-28. <https://doi.org/10.1016/B978-0-08-100596-5.00705-8>

Arnott, G., Ferris, C. P., O'Connell, N. E. 2017. Review: welfare of dairy cows in continuously housed and pasture-based production systems. *Animal*, vol. 11, no. 2, p. 261-273. <https://doi.org/10.1017/S1751731116001336>

Bartošovičová, M. 2011. Mliečne výrobky. Prečo sú zdravé a niektoré aj zdravšie? (Milk products. Why are they healthy and some healthier?) Available at: <https://www.vedatechnika.sk/SK/VedaASpolocnost/NCPVaT/Stranky/Mliecne-vyrobyky-Precosu-zdrave-a-niektore-aj-zdravsie.aspx>. (In Slovak)

Bewley, J. 2010. Precision dairy farming: advanced analysis solutions for future profitability. In *Proceedings of the first North American conference on precision dairy management*, Toronto, Canada. p. 2-5.

Bórawski, P., Pawlewicz, A., Parzonko, A., Harper, J. and Holden, L. 2020. Factors Shaping Cow's Milk Production in the EU. *Sustainability*, vol. 12, no. 1, p. 420. <https://doi.org/10.3390/su12010420>

Buller, H., Morris, C. 2003. Farm animal welfare: a new repertoire of nature-society relations or modernism re-

embedded? *Sociologia Ruralis*, vol. 43, no. 3, p. 216-237. <https://doi.org/10.1111/1467-9523.00242>

Cabrera, V. E., Solis, D., Del Corral, J. 2010. Determinants of technical efficiency among dairy farms in Wisconsin. *Journal of dairy science*, vol. 93 no. 1, p. 387-393. <https://doi.org/10.3168/jds.2009-2307>

De la Fuente, M. A., Juárez, M. 2015. Milk and dairy products. In De la Guardia, M., Garrigues, S. *Handbook of Mineral Elements in Food*. New Jersey, USA : John Wiley & Sons, p. 645-668. ISBN 9781118654330. <https://doi.org/10.1002/9781118654331.ch28>

Folmer, C., Keyzer, M. A., Merbis, M. D., Stolwijk, H. J., Veenendaal, P. J. 2013. The common agricultural policy beyond the MacSharry reform. UK : Elsevier, 360 p. ISBN 9781483290539

Fraser, D. 2008. Understanding animal welfare. *Acta Veterinaria Scandinavica*, vol. 50, no. 1, p. 1-7. <https://doi.org/10.1186/1751-0147-50-S1-S1>

Garner, R. 2016. *Animal rights: The changing debate*. Berlin, Germany : Springer, 218 p. ISBN 9781349251766

Gavurová, B., Soltes, M., Balloni, A. J. 2014. Ekonomický význam využívania informačno-komunikačných technológií v systéme zdravotníctva. (The economic importance of using of ICT in the health system). *Ekonomický časopis (Journal of Economics)*, vol. 62, p. 83-104. (In Slovak)

Gonda, M. 2009. *Nutričný význam mlieka (Nutritional significance of milk)*. (In Slovak) Available at: <https://polnoinfo.sk/nutricny-vyznam-mlieka/>.

Gurčík, E., Richter, M., Kubicová, E., Dobák, D. 2016. Controlling as a management system of milk production and consumption in Slovakia and the Czech Republic. In *International Scientific Days 2016 proceeding. The Agri-Food Value Chain: Challenges for Natural Resources Management and Society*, p. 329-338. <https://doi.org/10.15414/isd2016.s5.03>

Hurňáková, J., Bartová, L., Fandel, P. 2016. Efficiency and productivity of the Slovak agricultural investment support beneficiaries. In *International Scientific Days 2016 proceeding. The Agri-Food Value Chain: Challenges for Natural Resources Management and Society*, p. 923-930. <https://doi.org/10.15414/isd2016.s12.03>

Cheng, H. 2016. *Hybrid Navigation System for Lely Mixing and Feeding Robot*. Available at: <http://resolver.tudelft.nl/uuid:75478ab5-9622-4e46-b020-96de95687307>.

Iqbal, S. Z., Jinap, S., Pirouz, A. A., Faizal, A. A. 2015. Aflatoxin M1 in milk and dairy products, occurrence and recent challenges: A review. *Trends in Food Science & Technology*, vol. 46 no. 1, p. 110-119. <https://doi.org/10.1016/j.tifs.2015.08.005>

Koik, Y. L., Thiele, H. D., Enneking, U. 2019. Animal welfare attributes in dairy production in Europe: Lessons learned from representative German consumer panel data and discrete choice analysis. In *Agricultural and Applied Economics Association (AAEA) > 2019 Annual Meeting, July 21-23, Atlanta, Georgia*, 15 p. <https://doi.org/10.22004/ag.econ.290787>

Kubicová, E., Predanociová, K., Kádeková, Z. 2019. The importance of milk and dairy products consumption as a part of rational nutrition. *Potravinárstvo Slovak Journal of Food Sciences*, vol. 13, no. 1, p. 234-243. <https://doi.org/10.5219/1050>

Kurajdova, K., Tábořecká-Petrovičová, J. 2015. Literature review on factors influencing milk purchase behaviour. *International review of management and marketing*, vol. 5 no. 1, p. 9-25.

- Marangoni, F., Pellegrino, L., Verduci, E., Ghiselli, A., Bernabei, R., Calvani, R., Cetin, I., Giampietro, M., Perticone, F., Piretta, L., Giacco, R., La Vecchia, C., Brandi, M. L., Ballardini, D., Banderali, G., Bellentani, S., Canzone, G., Cricelli, C., Faggiano, P., Ferrara, N., Flachi, E., Gonnelli, S., Macca, C., Magni, P., Marelli, G., Marrocco, W., Miniello, V. L., Origo, C., Pietrantonio, F., Silvestri, P., Stella, R., Strazzullo, P., Troiano, E., Poli, A. 2019. Cow's milk consumption and health: a health professional's guide. *Journal of the American College of Nutrition*, vol. 38 no. 3, p. 197-208. <https://doi.org/10.1080/07315724.2018.1491016>
- Matić, A., Kalit, S., Salajpal, K., Ivanković, S., Sarić, Z. . 2014. Consumers' preferences and composition of Livanjski cheese in relation to its sensory characteristics. *Mljekarstvo*, vol. 64, no. 3, p. 170-177. <https://doi.org/10.15567/mljekarstvo.2014.0304>
- Matthews, A. 2018. The CAP in the 2021 – 2027 MFF Negotiations. *Intereconomics*, vol. 53 no. 6, p. 306-311. <https://doi.org/10.1007/s10272-018-0773-0>
- Nagy, J., Jámbo, Z. 2019. Competitiveness in Dairy Trade-the Case of EU and the Visegrad Group Countries. *Agris On-Line Papers in Economics & Informatics*, vol. 11, no. 4, p. 61-74. <https://doi.org/10.7160/aol.2019.110406>
- Ohl, F., Van der Staay, F. J. 2012. Animal welfare: At the interface between science and society. *The Veterinary Journal*, vol. 192, no. 1, p. 13-19. <https://doi.org/10.1016/j.tvjl.2011.05.019>
- Pouch, T., Trouvé, A. 2018. Deregulation and the crisis of dairy markets in Europe: facts for economic interpretation. *Studies in Political Economy*, vol. 99, no. 2, p. 194-212. <https://doi.org/10.1080/07078552.2018.1492216>
- Rossi, R. 2018. CAP horizontal regulation. Financing, management and monitoring of the common agricultural policy for 2021 – 2027. 1st. ed. *The 'EU Legislation in Progress'* Available at: <https://pdfs.semanticscholar.org/ddf6/3a4f1ac671848ef47c013ef6adec450fbab8.pdf>.
- Shortall, J., Shalloo, A., Foley, C., Sleator, R. D., O'Brien, B. 2016. Investment appraisal of automatic milking and conventional milking technologies in a pasture-based dairy system. *Journal of dairy science*, vol. 99, no. 9, p. 7700-7713. <https://doi.org/10.3168/jds.2016-11256>
- Schick, M., Hartmann, W. 2005. Arbeitszeitbedarfswerte in der Milchviehhaltung (Working Time Requirements in Dairy Farming). *Landtechnik*, vol. 60, no. 4, p. 226-227. <https://doi.org/10.1515/lt.2005.1224> (In German)
- Siničáková, M. 2012. Environmental protection expenditures in the European Union: The case of the Visegrad countries. *Proceeding 12th International Multidisciplinary Scientific Geoconference SGEM*, p.17-23. <https://doi.org/10.5593/sgem2012/s22.v4017>
- Šimo, D., Mura, L., Buleca, J. 2016. Assessment of milk production competitiveness of the Slovak Republic within the EU-27 countries. *Agricultural Economics*, vol. 62, no. 10, p. 482-492. <https://doi.org/10.17221/270/2015-AGRICECON>
- Štefániková, M. 2020. *Požiadali sme, aby sa prehodnotil hlavne normatív na dojniciu. (We asked to reconsider normative mainly on dairy cow)*. Available at: <https://polnoinfo.sk/margita-stefanikova-poziadali-sme-aby-sa-prehodnotil-hlavne-normativ-na-dojnicu/>. (In Slovak)
- Váryová, I., Poláková, Z., Košovská, I., Vaňová, A. F., & Krajčírová, R. 2019. Analysis of development of raw cow milk prices in the conditions of the Slovak Republic. *Potravinárstvo Slovak Journal of Food Sciences*, vol. 13, no. 1, p. 906-914. <https://doi.org/10.5219/1196>

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