

FACTORS THAT INFLUENCE THE SELLING OF MILK THROUGH MILK VENDING MACHINES

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Abstract

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The aim of this paper is to assess the current situation in the sale of milk through vending machines in the context of the previous period of the decline in milk consumption, the transition of the Czech Republic towards the market economy, the transformation of agriculture, the entry into the EU and the concentration in the milk market and to define the basic motivational factors and barriers of the development of this distribution path. Technical problems with sales, intent to diversify milk selling and aiming the high profitability of the sale are the reasons for operating vending machines that are correlated with the share of this selling channel on producers' total sales of milk. Vending machines are inhibited by misinformation from state authorities; other problems are weak support by media and low consumer awareness. The expectations of the operators concerning the development of the situation of the milk vending machines are rather optimistic: 36% of them expect an increase in sales, 48% expect the stagnation and only 16% expect the decrease.

Keywords: sale of milk, milk vending machines, buying price, expectation

INTRODUCTION

The world production of the milk continually increases (Tab. I). The EU milk production rather stagnates already since 1985, after a period of the strong growth (1961–1985 – Ostojić *et al.*, 2012). The share of the EU in the world animal production generally decreased and especially the position of the European milk producers worsens (Bečvářová, 2009). The milk consumption has showed a long lasting decline in developed countries (Robb, Reynolds and Abdel-Ghany, 2007). The contrary situation has been in developing countries, where milk consumption is on the rise (Delgado, 2003; Knips, 2005).

Milk has become one of the most volatile agricultural commodities in the world. The increase in price volatility is now perceived as the new trend of global markets (Acosta, Ihle and Robles, 2014).

With the growth of the power of processors and retailers, farmers in the European Union are generally moved to the position of higher dependence on the conditions being set by their clients downstream the supply chain (Veselská, 2006). Generally, agricultural and food markets have changed. The crucial relation that determines the volume, quality of the agricultural products, as well as the price-cost conditions in the market is now represented by the demand (Bečvářová, 2005). Those facts, together with the two already mentioned (increasing production, decline of the consumption in developed countries) let the farmers face to the problem of looking for the most secure ways of selling their products. Anyway, the situation of the small farmers gets worse even in other countries out of the EU (Ricz *et al.*, 2011). How

I: *The Evolution of World Milk Production*

2007	2008	2009	2010	2011	2012estim
677.7	694.2	701.4	722.9	737.9	759.6

Compiled from FAO (2008), FAO (2010), FAO (2011), FAO (2012)

the general situation in the European Union will change after the the cancellation of the milk quota system in 2015, it is hard to anticipate (as perceptible e.g. in Schönhart *et al.*, 2012; Lelyon, Chatellier, and Daniel, 2012).

Milk production is still one of the major areas of the Czech agriculture (Věžník, Král and Svobodová, 2013). The milk market in the Czech Republic (after 1989) was affected by the decline of the milk consumption (Dofková *et al.*, 2001; Kovářová, Ledvinka and Samek, 2005; Turčínková and Stávková, 2009) and the gradual concentration food retail (Gebeltová, 2010) and of the milk processors as well (Erbes, Pošváv and Žufan, 1997; Havel, 2002). Thus, that concentration led many producers to the co-operation in selling and then almost 70% of raw milk produced is negotiated by milk producers' organizations (Bošková, 2014) and they negotiate also with dairies in abroad (Ratinger and Bošková, 2013). That concentration caused also a problem for small milk producers, among other matters. As the milk collection by milk processors from their suppliers is driven directly by the economic point of view, many small suppliers get out of the collection lines (Línková, 2009). Then, those suppliers lose their clients. The Czech government also underestimated the potential impact of the import of agricultural products when it opened the Czech market. Agricultural producers started to feel problems in competition and to realize their production in the market rather soon (Hošková, 2006). The situation of particularly the smaller milk producers became critical.

The problem of the Czech milk producers has deepened even more in 2008 and 2009 where the milk purchase price decreased from 10.08 Czech Crowns per liter in January 2008 by more than three crowns at the end of that year and it further decreased to a historic minimum of 5.90 Czech Crowns per liter in July 2009 (Gebeltová, 2010), hand in hand with the steep drop in world price of milk (Hemme, 2013). Surprisingly, the retail price of milk had often a very different evolution – there was no significant decrease (BEUC, 2010) or only a slight decrease (Gebeltová, 2010). Another problem was, of course, the decrease of the purchasing power of the consumers and the change of the structure of their expenditures (especially the switch to the cheaper and low quality food) due to the factor of the financial crisis in both the Czech Republic and other developed countries (e.g. Brinkman *et al.*, 2010; Urbonavicius and Pikturniene, 2010; Kubicová *et al.*, 2011; Kubicová and Kádeková, 2012; Pícha, Skořepa and Navrátil, 2013) as well as in the developing countries (e.g. Grófová and Srnec, 2012).

They are some of the reasons why many milk producers in the Czech Republic are looking for the ways of how to sell their milk.

Vending Machines

Vending generally seems to be a dynamically developing sector of economics. A strong competition is present in this market (Hampel, Jůzová and Matulíková, 2012), especially in coffee and other hot drinks, cold drinks and sweets.

The idea of selling milk through vending machines faced objections in many countries, but the legislation has moved step by step. For instance, in Italy, the direct sale by farmers of raw milk for human consumption has been allowed since 2004 (Giacometti *et al.*, 2004).

The introduction of the milk vending machine itself reflects the drive towards higher profitability through investments in technology (Mincyte and Maximilians, 2009)

As for farmers, direct selling can be interpreted as a diversification strategy that can lead to higher profits and better farm household incomes (Aguglia, De Santis and Salvioni, 2009).

The impact of the nearby urban centres seems to play an important role in determining the direct sale of produce. (Meert *et al.*, 2005)

Farmers prefer the direct sale of milk to consumers for a number of reasons (Bohra, Singh, Kumar and Singh, 2004): a) consumers pay more remunerative prices (the willingness to pay is influenced by perceiving the local origin of milk – e.g. Lefèvre, 2014; Tempesta and Vecchiato, 2013; Burchardi, Schröder, and Thiele, 2005); b) co-operatives or dairies purchase milk on the basis of fat content and therefore milk prices fluctuate on daily basis; c) co-operatives and dairies do not provide money as and when needed by the producer suppliers, who, sometimes would also provide money in advance; d) co-operatives often impose other conditions on their members (the milk producers) such as supply of costly feed the cost of which is deducted from the producers' dues. In the process of using the milk vending machines, milk producers could also exploit the current tendency of the Czech consumers to prefer local products (Pícha, Skořepa and Navrátil, 2013) and use this fact when promoting their milk.

MATERIALS AND METHODS

Data were collected during a questionnaire survey among the operators of milk vending machines. The list of those operators was created based on the registry of entities that sell the raw milk through milk vending machines. This register is administered by the National Veterinary Administration and the register reflected the situation at the end of October 2011.

As the used database did not include any contact, their addressess, e-mail address and phone numbers were found on the Internet. The respondents were first addressed via-email and then by post. Those who had not responded were approached by phone. All registered operators of milk vending machines were addressed by the questionnaire

(i.e. 88 operators of 162 registered machines). Seven of them showed themselves as no longer operating milk vending machines. The return rate of the questionnaires sent was 40.7%. 31 questionnaires entered into the analysis after the control of the fulfilled questionnaires. Those 31 respondents have operated 52 milk vending machines. The analyzed sample comprised a varied structure with regard to the number of the operated milk vending machines (up to 7). The questionnaire comprised, above all, those questions looking for information on the number and character of the milk vending machines and for the reasons for selling milk through the vending machines, the barriers of the development of this way of selling milk and on the promotion activities of the operators of milk vending machines and communication with their clients.

The identification of the character of the milk vending machines was done according to the type of milk being sold (conventional vs. bio), the process category (heat treated vs. non-heat treated) and the type of vending machine (mobile vs. stationary). The particular reasons for selling the milk through vending machines were measured by the 5-point scale, where 1 = this reason is unimportant for us and 5 = it is a main reason for us. The possible reasons were: financial problems with selling milk (low buying price); technical problems with the sale (organization of the collection of the milk); diversification of the sale (insecure conditions of the purchase by the dairies); the high profitability of the sales through milk vending machines; the financial subsidy for purchasing a milk vending machine; the interest of a partner to locate a milk vending machine. Barriers towards development of the milk vending machines were also surveyed by means of the 5-point scale, where 1 = no importance and 5 = principal importance. The respondents were allowed to select from the following lists of barriers: low sales; problems with profitability; a higher buying price offered by dairies; technical problems with the operation of the vending machines (susceptibility to failure); low support by media; consumer awareness; misinformation by the national and state administration authorities; problems with renting a place to install a vending machine; highly demanding technics and the organization of selling milk. The same scale was employed to assess the importance of the promotional tools; the list was as follows: promotion pricing; leaflets and other publications; advertisements; design of the point of the sale (design of the vending machine, 3-D decorations...); complementary selling of other products; presentation and tasting. The questionnaire was completed with a question for the general degree of satisfaction with the volume of milk sold through the vending machines. That satisfaction was again assessed by means of the 5-point scale (1 = definitely unsatisfied; 2 = rather unsatisfied; 3 = neutral attitude the question

of satisfaction; 4 = rather satisfied; 5 = completely satisfied). Data were processed from the point of the frequency with the employment of the main characteristics of location (the mean and standard deviation); comparative statistics – the Pearson Correlation Coefficient (Palmer and Hofmann, 2001) was employed as well as the Multiple Linear Regression (Meloun and Militký, 2006; Nusair and Hua, 2010) using the Forward Selection Method for Independent Variables in the case of the analysis of relation between the reasons for selling milk through vending machines and the satisfaction with the results of the operation of the milk vending machines.

The data were digitized and processed in the environment of Statistica 10 (STATSOFT, 2011).

The aim of the paper is to assess the current situation in the sale of milk through vending machines and to define the basic motivation factors and barriers of the development of this distribution path.

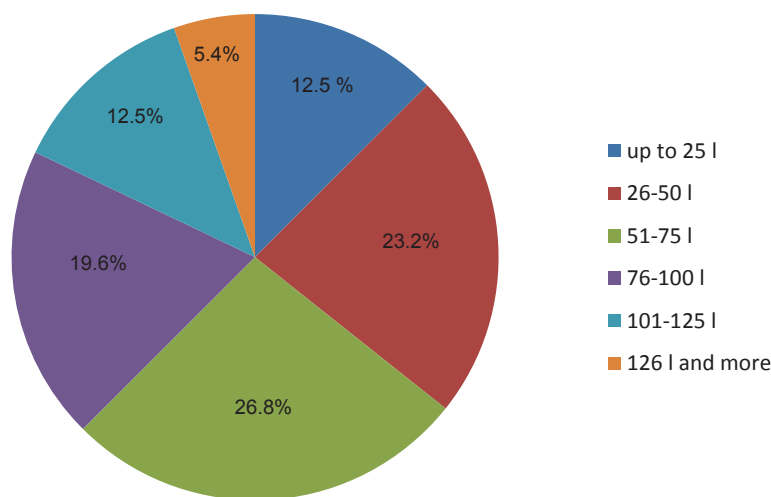
RESULTS AND DISCUSSION

Character of the Supply

The milk vending machines are certainly important for sales of the questioned milk producers. Some of them sell a very unimportant part of their production in this way (less than 1%). Those producers perceive the operating of a vending machine as a public service. However, there is also a group of respondents who sell more than 50% or even 100% of the produced milk in this way. Almost all of them operate stationary milk vending machines (except one) with the conventional milk (except one) that was not heat treated (except two). The daily sales of the milk vary from 15 to 200l (see Fig. 1). Only four surveyed operators received a financial subsidy related to the operation of the milk vending machines.

Reasons for Selling Milk Through Milk Vending Machines

Financial problems with selling milk related with the low buying prices (see Tab. III) were identified to be the most important reason for employment of the milk vending machines. It is necessary to point out that the price below 8 Czech Crowns is generally considered as liquidation (Hovorka, 2008), which is also confirmed by the economic analysis (e.g. Kovářová and Samek, 2006). Unfortunately, the average buying price for milk is rather below those 8 Czech Crowns over a long period (Tab. II). Moreover, fears of decreasing buying price in future prevail in context of the CAP reform. At the same time, farmers could not count on selling their milk even at the low price because of a frequent reconsideration of the collection lines by dairies. Farmers could only accept the lower milk price if



1: Average daily sales of surveyed milk vending machines

II: The Average Milk Prices in the Qualitative Level Q (CZK per liter) – Annual Averages

2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	II/2013
7.76	8.05	7.75	7.99	8.22	7.82	8.22	8.76	6.20	7.35	8.27	7.79	8.20

Source: CZSO

III: Paired correlation between the factors leading to the sale of milk through milk vending machines and the character of the importance of the milk vending machines with the total sales of a farmer (Marked correlations are significant at $p < .05000$, $N = 31$)

	Means	Std.Dev.	Technical problems with sales	Diversification of selling	High rentability of vending	Financial problems with sales	Subventions	Interest of an entrepreneur to locate a vending machine	Number of vending machines	Share of vending on total sales
Technical problems with sales	1.355	1.112								
Diversification of selling	1.323	1.045	0.701							
High rentability of vending	1.839	1.241	0.309	0.453						
Financial problems with sales	2.710	1.575	0.232	0.180	0.061					
Subventions	1.452	1.207	0.100	0.409	0.295	-0.087				
Interest of an entrepreneur to locate a vending machine	1.903	1.491	-0.0188	0.063	-0.153	0.002	0.099			
Number of vending machines	1.677	1.166	-0.192	-0.185	0.032	-0.089	-0.154	0.269		
Share of vending on total sales	7.137	18.336	0.591	0.582	0.444	0.226	-0.102	-0.148	-0.081	
Total milk sold	116.742	123.937	-0.165	-0.110	0.121	-0.222	-0.192	0.275	0.797	-0.061

they feel the financial security of their distribution path (Franks, 2001).

The other alternatives of selling milk for the small farm producers are: direct selling in the farm, shipment to the farm stores, milk distribution to consumers (e.g. within the so called box system) or processing milk within a farm dairy.

The repeatedly emerging problem in the Czech Republic is the revision of the collection lines by milk processors in this year (2013) – for example the Madeta Company (Czech Television, 2013), as the collection of milk from small producers is more expensive. That is a one more reason for small farmers to look for alternative ways to sell their milk. The National Veterinary Authority

(National, 2013a; National, 2013b) currently register 317 entities directly selling their milk on the farm (33 of them have also registered a vending machine), 145 vending machines and 70 entities producing and directly selling dairy products (farm dairies) and their number is still increasing.

Another important factor is also the activity of the retailers and shopkeepers. In fact, the declared interest of a commercial entity is the second most important reason stated by surveyed operators. The most frequent call for the installation of milk vending machines comes from retail chains, other interested entities are also bakeries (traditionally together consumed commodities) and butcher shops or slaughterhouses; (it could be related to the joint selling of the farm production). On the other hand, the potential technical difficulties related to the collection of milk are not cited among the reasons for starting the operation of these milk vending machines. A similar situation exists in the case of the use of vending machine as a way of diversifying the sale of milk (uncertain conditions from the off take

from the part of the dairies). However, the analysis showed the closest relation right among those latter two factors. Thus, we can suppose that only a low number of the operators deal with the problem of selling the milk to the dairies, but the unreliability of the purchaser implies the effort of the milk producers to search for another distribution path.

Neither the number of these operated milk vending machines nor the total sales of the milk through this distribution path has a relationship with the declared reasons for operating these milk vending machines. On the other hand, there is a relation between those reasons and the share of the milk vending machines on the total sales of the milk. It concerns, namely, the technical problems with sales, the diversification of selling and also the high profitability of the sale.

It is possible to suppose that it concerns the small producers who are not a part of a collection line. This means that the vending machine is less costly than direct selling on the farm or through other distribution paths.

IV: *The Paired Correlation between the Factors Leading to the Run-down of the Milk Vending Machines and the Character of the Importance of the Milk Vending Machines with the Total Sales of a Farmer (Marked correlations are significant at $p < .05000$, $N = 21$)*

	Means	Std.Dev.	Low sales	Bad rentability	Higher price paid by processors	Problem with maintenance of machines	Low support by media	Disinformation	Problem of renting	Demanding organization of vending	Daily sales	Satisfaction with the sales ^a	Number of vending
Low sales	2.57	2.227											
Bad rentability	1.524	2.015	0.665										
Higher price paid by processors	1.429	1.805	0.309	0.705									
Problem with maintenance of machines	1.048	1.596	0.597	0.707	0.374								
Low support by media/low acquaintance of consumers	2.810	2.205	0.410	0.282	0.072	0.145							
Disinformation by state administration	3.762	1.998	0.010	0.144	-0.220	0.208	0.364						
Problem of renting a location	0.857	1.315	0.268	0.086	-0.015	0.075	0.370	0.253					
Demanding organization of vending	1.333	1.770	0.317	0.621	0.470	0.454	0.222	0.349	-0.043				
Total milk sold	94.571	94.296	-0.023	-0.139	-0.215	0.044	0.196	0.212	0.280	-0.090			
Satisfaction with the sales	2.355	1.396	-0.224	-0.351	0.055	-0.108	-0.287	-0.265	0.029	-0.185	-0.154		
Number of vending machines	1.571	1.076	0.295	0.063	-0.056	0.362	0.259	0.206	0.379	0.131	0.637	-0.090	
Share	4.762	7.325	-0.137	-0.229	-0.210	-0.256	-0.125	0.032	-0.004	0.384	-0.052	-0.037	-0.058

The satisfaction with the volume of the milk being sold is particular among those operators whose motivation to sell milk through these milk vending machines consists in low buying prices ($F = 3.54$, $p < 0.05$, adjusted $R^2 = 0.25$, $b = 0.34$, $t = 2.31$, $p < 0.05$) – then the value of the degree of the importance of the low buying prices explains a quarter of the variability in the degree of the satisfaction with the volume of the milk sold through the milk vending machines.

Problems of Further Development of the Sale of Milk Through Vending Machines

It is the misinformation given by the national and state administration authorities, what was identified as a most important problem. Specifically, it is the matter of the statement of the main of the Chief Hygienist of the Czech Republic in February 2010, when he warned against the risk of the transmission of the bacterial and viral infectious agents through the unpasteurized milk (MZCR, 2010). This statement caused the consumers to be afraid and the subsequent decline of demand for milk sold through the vending machines (see e.g. Žáček, 2011; Růžička, 2013). However, the follow-up controls by the veterinary administration did not confirm such a high risk. The recommendation stated obligatorily on the milk vending machines “boil raw milk before use” ensures its completely safe consumption. Still that warning caused a drop in daily sales in tens of percent to the surveyed operators. Some farmers started considering the pasteurization of the milk to be sold through vending machines. The potential risks of consuming the raw milk from vending machines are discussed in many countries (e.g. Baars, 2013; Medvedová *et al.*, 2013; Bianchi *et al.*, 2014) but mostly only a warning against direct consumption without boiling appears. Other important barriers for further development of the use of these milk vending machines are the low sales, weak support from the media and the low awareness of consumers. Many surveyed operators stated that the minimum daily sale to achieve the profitability is 300 liters. Unfortunately, the sales from many milk vending machines have dropped to the only tens of liters per day, due to the negative publicity, the worsening economic situation and other factors. According to the survey from 2010 (Dema, 2010), 69% of consumers got information about milk vending machines from media. However, the interest of the media for the problems of selling milk through these vending machines increased only when the warning of the main hygienic authority was issued by the Ministry of Health.

On the contrary, the rental of a location is not felt as a problem. The results of the survey show that they are often the store keepers who intend to locate a milk vending machine next to or within their stores. In other cases, the milk vending machines are located on the operators' own land or the location is provided by the municipality free of charge.

Likewise, no relationship was identified between the stated problems and the number of operated vending machines or daily sales.

Communication With the Customers

The operators of these milk vending machines consider the information leaflets and other publications to be the most important communication tools in relation to their customers. Other important tools are advertising and design of the point of the sale. All of the surveyed operators have assigned some importance to the information leaflets and other publications, the advertising and the articles in press. This finding partially corresponds with one of results of a consumer survey (DEMA, 2010) on the printed materials as the important way of getting aware on vending machines. This communication channel should then be used for explaining consumers the safe way of consuming the milk from vending machines. An important positive relationship was identified between the use of the advertising and the number of the operated milk vending machines.

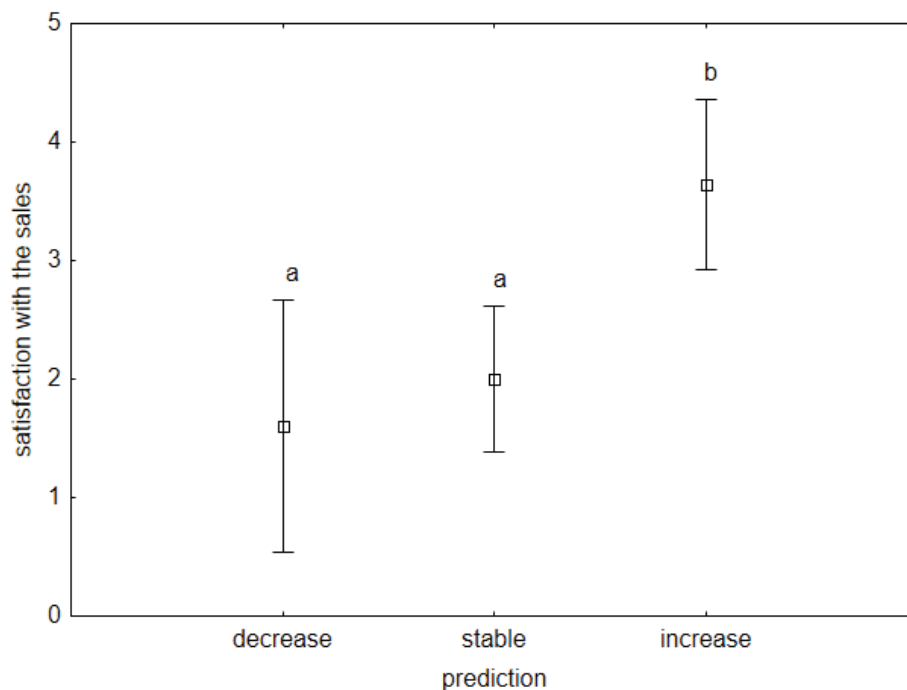
The Operators' Expectations Concerning the Development of the Situation of the Milk Vending Machines

The expectations of the operators are rather optimistic: 36% of them expect an increase in sales, 48% expect the stagnation and only 16% expect the decrease. However, there is a relationship between the satisfaction of the operators with the sales of the milk and their opinion on the further development (Fig. 2). Those who are more satisfied with the sales of the milk are much more positive in their future expectation than those less satisfied. The comparison of the database of the National Veterinary Administration shows that by July 2013, 43 vending machines existing in the time of the survey is no more registered. On the contrary, 30 new milk vending machines are added to the database. What has changed is the distribution of the vending machines. They have rather disappeared from smaller towns and the situation also varies in particular regions in the Czech Republic.

CONCLUSION

The sale of milk through milk vending machines is an interesting form of the diversification of milk distribution. Only a minimum amount of attention has been paid to that form until now.

The results of the survey done among the operators of these milk vending machines identified the low buying price of the milk to be the main reason for operating a milk vending machines. However, the other factors are also important, particularly the interest of a commercial entity in the installation of a milk vending machine and the reliability of the partner (problem of the poor organization of the milk collection) linked with the effort to find another distribution path. Another proven



2: The Mean values of satisfaction (measured on 5-point scale, where 1 denotes absolutely unsatisfied and 5 absolutely satisfied) for three types of predicted sales different types of visitors. Results of one way ANOVA ($F = 8.159$, $p < .01$). The means with the same letter do not differ significantly (Tukey HSD for unequal N test, $p > 0.05$, $N = 31$).

fact is the existence of the mutual links among the particular existing reasons for operating these milk vending machines. The strongest relationship was found among the technical problems with the sales, the diversification of selling and high return on investment of the vending machines. This group of reasons is typical for those entrepreneurs who state a higher share of the selling the milk through the vending machines in the total sales of milk. As for the factors having negatively influenced the sale of milk through these vending machines, those are, above all, the proclamation of misinformation by the representative of the public administration, the generally low support by the media (which means also a low or poor awareness of the consumers). Then all of those factors imply the drop in daily sales of milk under the limit of the profitability. The expectations of the operators are rather optimistic: 36% of them expect an increase in sales, 48% expect the stagnation and only 16% expect the decrease. However, that optimism is particularly based on the current situation of their own sales. Some of the asked operators who did not participate

on our survey are no more registered in the list of the operated milk vending machines.

The operators of these vending machines communicate with the customers, particularly by means of the information leaflets and other publications, then through the advertising and using a design of the point of the sale. The important positive relationship was identified between the advertising and the number of the milk vending machines.

The sale of milk through these vending machines became the indispensable part of the distribution of the milk from farms. This form of sale became profitable for many farms in the Czech Republic (or at least more advantageous) option of selling milk (especially for the small farms with the problematic collection of the milk to the dairies; those vending machines located immediately next to the farm are also highly profitable). Other farms use these vending machines as a form of making themselves more visible within the market. Farmers also perceive this activity as a form of the service to the public: the sale of quality fresh untreated milk.

SUMMARY

While the world production of milk continually increases (a fact that is obvious when looking at Tab. I), this subject seems to be an issue for farmers in many countries so that they can sell their production. Many milk producers in the Czech Republic are looking for the ways of how to sell their milk. Direct selling can be interpreted as a diversification strategy that can lead to higher profits and better farm household incomes. The aim of the paper is to assess the current situation in the sale of milk through vending machines and to define the basic motivation factors and barriers

of the development of this distribution path. All registered operators of milk vending machines were addressed by the questionnaire (i.e. 88 operators of 162 registered machines). Seven of them showed themselves as no longer operating milk vending machines. The return rate of the questionnaires sent was 40.7%. The data were processed from the point of the frequency with the employment of the main characteristics of location; comparative statistics was employed as well as the Multiple Linear Regression using the Forward Selection Method for Independent Variables. The results of the survey done among the operators of these milk vending machines identified the low buying price of the milk to be the main reason for operating a milk vending machines. Other important factors are the interest of a commercial entity in the installation of a milk vending machine and the reliability of the partner linked with the effort to find another distribution path. As for the factors having negatively influenced the sale of milk through these vending machines, those are, above all, the proclamation of misinformation by the representative of the public administration, the generally low support by the media. The sale of milk through the vending machines became the indispensable part of the distribution of the milk from farms. This form of sale became a profitable option of selling milk for many farms in the Czech Republic (or at least more advantageous) – especially for the small farms with the problematic collection of the milk to the dairies. Other farms use these vending machines as a form of making themselves more visible within the market.

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