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Problems Of Economic Efficiency Of Milking Robotics In The Middle Urals.

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ABSTRACT

This study is devoted to questions of robotics use in agriculture. The aim of this study is in research of agricultural organizations activity effectiveness at robotics use. In this work results comparison of traditional technology use and technology of automatic milking of animals in agricultural organizations of the Middle Urals is carried out. The study has shown that in the region economies at the farms using robotics, labor output ratio to milk production is substantially lower than at the farms using traditional technology, namely, pipeline milking. At that, labor efficiency at the first farms is much higher than at the second ones. By that reason at robotics implementation demand for personnel is decreased. At the same time at robotics use, capital productivity ratio in agricultural organizations is reduced due to high cost of this technology, amortization expenses increase. It leads to large terms of robotics payback of 5 – 7 years. Besides, at robotics implementation product cost is slightly increased. This should be taken into consideration at decision making about robotics implementation in agricultural organizations. Besides, effectiveness of this technology use should be increased.

Keywords: agriculture, milking robotics, cost of products production, production profitability, terms of robotics payback, effectiveness of robotics use.

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INTRODUCTION

Robotics use in agricultural organizations requires study of its influence on economic indices of these organizations activity [1,2,3].At present the following organizations have significant demand in it,

– agricultural organizations;
– governmental authorities, fulfilling their activity support;
– unions and associations, uniting agricultural products manufacturers.

At the same time, the robotization of agriculture faces difficulties due to the insufficient knowledge about the results of the use of robotics in animal husbandry in comparison to traditional agricultural technologies, and the lack of methodological recommendations for the use of this equipment. Thus, the study of this issue is relevant [4,5].

CHARACTERISTIC OF RESEARCH METHOD

In the process of research the results of this advanced technique and technology in agricultural organizations use were considered, which implemented it and brought it out to maximum production capacity, used it during definite period, received rather stable results and verified data. These are organizations, using traditional and automatic ways of milking simultaneously. We refer the following organizations to such enterprises in researched field:PAC «Kolos», APC «Glinskiy», KFKH «Shishkin A.A.», «Nikolskoe Ltd.» and «Rus VelikaiaLtd.»

Activity research of Sverdlovsk region organizations using milking robotics was carried out. At that, modern research methods were used: abstract-logical, monographic, economical and statistical, survey, expert questionary [6,7,8].

Other organizations have not shown stable results of this technique and technology use, which could have been used in the process of this research. They will reach estimated output only this year.

RESULTS

The most significant index of innovations use based on robotics in agricultural organizations is ratio of labor to products output [9,10,11]. In researched organizations at robotized farms it is significantly lower that at traditional farms. In this organizations group on the average, ratio of labor to this product output at the farms with pipeline milking is 1,89 person an hour for 1 centner of milk, at the farms with robots it is only0,97 person an hour, namely 1,95times less.

In connection with it labor efficiency at the farms with pipeline milking was 1042,6c, at the farms with automatic milking – 2036,0 c, or 1,95times higher.

By that reason in the group of researched organizations number of employees at the farm with robotics (in calculation for65 cows) is by 46,1%less than at the farm with traditional technology. That way, 17 employees of the farms were disengaged which gave significant reduction of expenses for labor payment.

The important group of indices, characterizing work of agricultural organizations, include indices of capital assets (funds) use effectiveness.

It should be noted that implementation and use of agricultural machinery is almost always very capital-intensive procedure for corresponding organization which influences significantly on capital assets (funds) use indices. It especially refers to robotics.

During the research, influence of robotics implementation on efficiency indices of capital funds use in considered organizations was determined (Figure 1).

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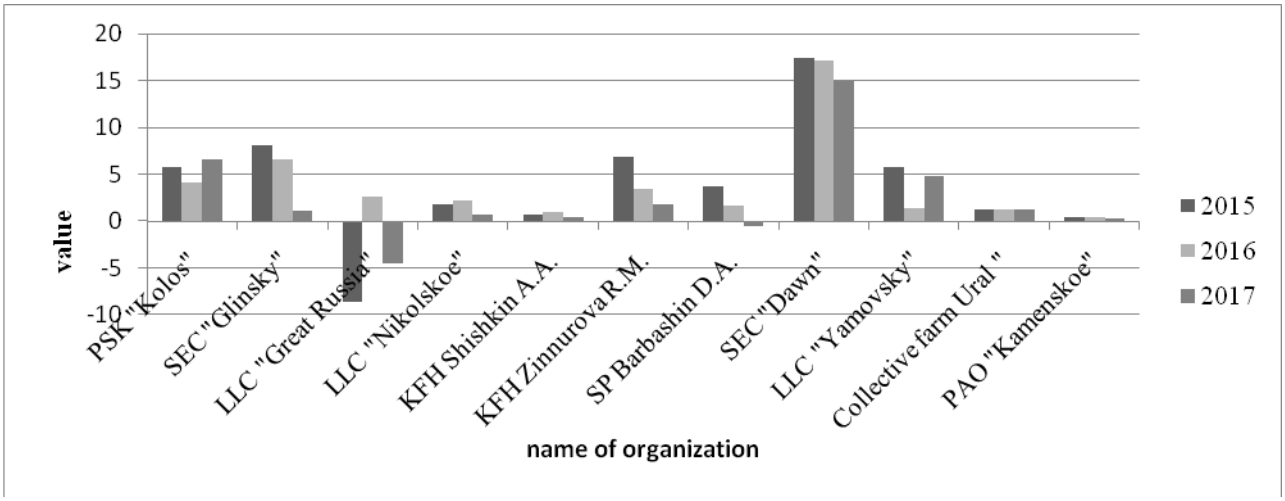


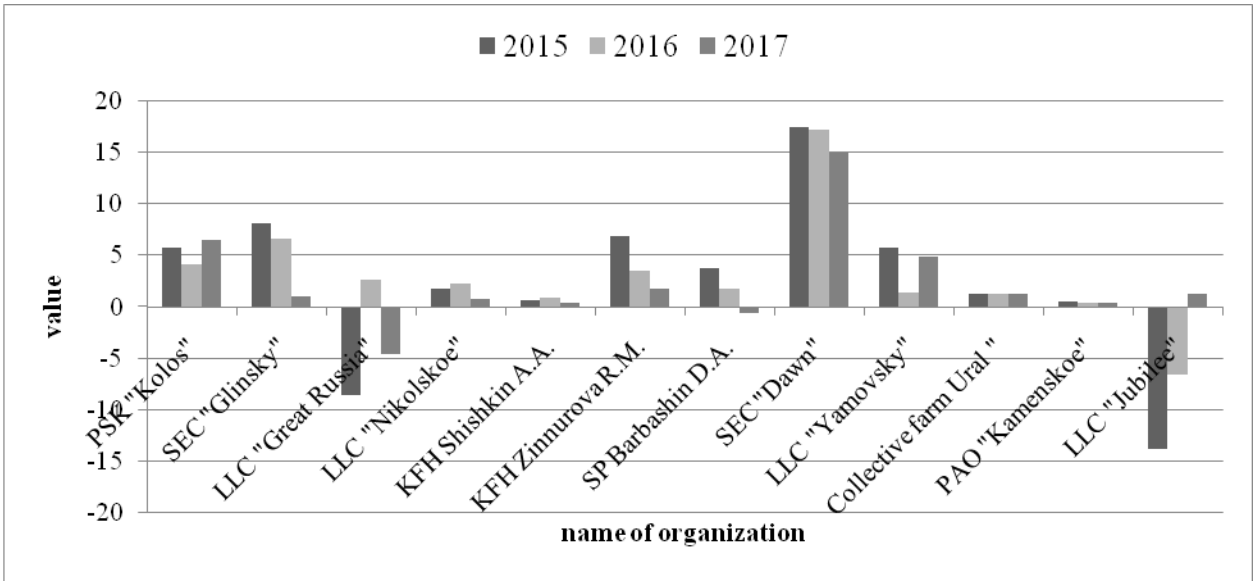
Prepared by the authors based on organizations data

Figure 1: Data on return on assets in organizations using robotics, rubles.

From represented data it follows that at this technology implementation in agricultural organizations return on assets has slightly decreased. It tells about reduction of these funds use effectiveness at robotics installation, because profit as additional revenue and profit from products sale fell behind cost increase of capital funds.

Besides, it is necessary to consider profit ratio, characterizing profit size from agricultural organizations activity, connected with products realization calculated for 100 rubles of capital funds (Figure2).

From the drawing data it is seen that this index has decreased during researched period in all organizations, with the exception of PAC «Kolos», where its slight increase by 13,2% can be seen. At that, the reduction was quite essential – from 15% to10 times.



Prepared by the authors

Figure 2: Profit ration in organizations using robotics, %

The most important index of technique and technology use in agricultural organizations is product cost, namely, expenditures complex, connected with its production and realization. In the process of the research we have carried out comparison of product cost at traditional technology and at robotics use.

On the average, on group of researched organizations, products cost at the farm using robotics accounted to 1807,1 rub./c, and at the farm with traditional technology - 1623,8rub/c, namely by 11,3%less.

At that, share of expenses for labor in products total cost was considered. On organization with traditional milking it constituted 22,2%, in organizations using robotics only12,6%, because here there is no necessity in operators of mechanical milking.

Share of expenses for electricity within milk cost at automatic farm is slightly higher –5,0 % against 4,8 % at the traditional farm.

Considerable proportion in product cost structure have so called miscellaneous expenditures, connected with water supply, artificial insemination, canalization, work clothes and so on. At the farms using robotics, besides specified expenses there are also expenses connected with these equipment maintenance by service organizations. They constitute 3,4% from product cost. This maintenance includes services on repair and after-sales service of robotics, works fulfillment on purchase and replacement of consumables (filters for milk and so on).

Nevertheless, total miscellaneous expenditures at automatic farms are slightly lower than at traditional farms, correspondently 21,8 and 22,8% from the cost.

Share of expenses for food items at traditional farms is37,7% from product cost, at automatic farms – 31,7%, namely by 6 % lower. The fact is that at the farms with robotics food items are used more rationally. Here, loose-housing of the cattle and mixed rations are used; expensive food items, concentrated feedstuff, are fed individually during the milking period, which allows using them better. At traditional farms, where tie-up housing is applied, so called small-group feeding of animals is practiced, depending on age and fatness of animals. Concentrated feedstuff use here is less rational.

If we consider expenses for operating costs contents, their share in product cost at the farms with robotics use will be 28,7%. It is significantly higher than analogous index at the farms with traditional technology (12,5% in milk cost).

Data on milk cost without taking into account expenses deprecation represents considerable interest. The fact is that these expenses influence directly on cash flows. The analysis has shown that milk cost without considering these expenses at the farms with robotics are lower than at the traditional farms. The exception is APC «Glinskiy», having much higher milk cost at automatic farm than at the farm with milking pipeline. It is explained by high cost of feed items, purchased by this organization from outside organizations.

At results comparison of farms activity with traditional equipment and with robotics we have taken into consideration that wildlife population differs sufficiently. Therefore, at the traditional farm using milking pipeline, there are 200 heads of livestock, and at the farm using robotics there are 65 heads. In connection with it, data on production and expenses were given by the farm with 65 heads of livestock.

At research of robotics implementation results, definition of animals' productivity has major importance, and this is essential at evaluation of this technology implementation effectiveness and analysis of factors, influencing on it.

In examined agricultural organizations, using robotics, during the period of research 22,2% animals were on automatic milking. At that, share of received milk amounted to 24,4% from the total volume of this product. This suggests that cows productivity at robotics use is by 5,2%higher than at the traditional technology use. One animal productivity has increased up to 5663,2 kg, gain in production amounted to 327,6 kg.

This circumstance is explained by larger times milked per day at this progressive technology use. So, times milked per day in the group of examined organizations at robotics use was 2,6 times a day, and at milking pipeline use 2 times, which allows speaking about animals productivity increase at their change to automatic milking. The fact is that other factors of cows' productivity (food items, animals' species and others)are analogous.

The results, received by us totally correspond to the data, quoted by native and foreign scientists. They note milk production volumes increase at change for robotics use by 2-2,4% [12,13.], which is explained by increase of times milked per day[14].

Productivity of one animal increased up to 5663,2 kg, gain in production constituted 327,6 kg.

The research has also shown that milk cost at robotics use is for 70 rub./c higher than at traditional technology use. The fact is that robotics provides stably the highest product quality, and traditional technique and technology provides significant part of milk only of the first and second sort.

The research has shown that by the group of researched agricultural organizations, amortization of fixed assets per one farm with milking to pipeline constituted 528,8 thousand rubles, per farm with automatic milking – 1million 744,9 thousand rubles, namely for 1 (one) million 216,1 thousand rubles more.

The most important indices of milking robotics use in organizations of the region are given in the table 1.

Table 1: Economic indices of milking robotics use*

Indices	Results, thousand rubles
Gross output increase, thousand, rub.	181,1
Effect from cost-cutting of salary budget, thousand, rub.	412,5
Effect from cost-cutting of food items, thousand, rub.	135,0
Effect from increase of products quality, thousand, rub.	745,6
General benefits, thousand, rub.	1474,2
Amortization charges change, thousand, rub	-1216,1
Cost of service organizations services, thousand, rub.	- 215,2
Total economic impact, thousand, rub.	42,9

*prepared by the authors.

The table data show that general positive effect from robotics use amounted to 1 million 474,2 thousand rubles. At the same time, several factors gave definite negative effect, causing increase of product production cost for 1 million 431,3 thousand rubles. Therefore, total effect from robotics use is only 42,9 thousand rubles. In many cases it is evidently little for decision making about this equipment purchase and use.

The research and expert survey of the chiefs and agriculture specialists certify that at decision making on purchase and installation of this progressive technology they had taken into consideration economic, social, demographic, ecological and other factors.

Economic indicators of milk production at traditional and automatic technology use are represented in the table 2.

The table data show that milk net cost owing to specified factors (effects) at robotics implementation has increased from 1624 to 1807 rub./c. After that the level of profitability decreased from 24,57 to 23,39%. Both technologies had extremely high efficiency indexes values. At that, automatic technology has not given significant advantages in comparison with traditional technology, mainly because of large amortization charges (though they don't also influence on direct cash flow), to some extent because of payment for service organizations services, providing equipment maintenance.

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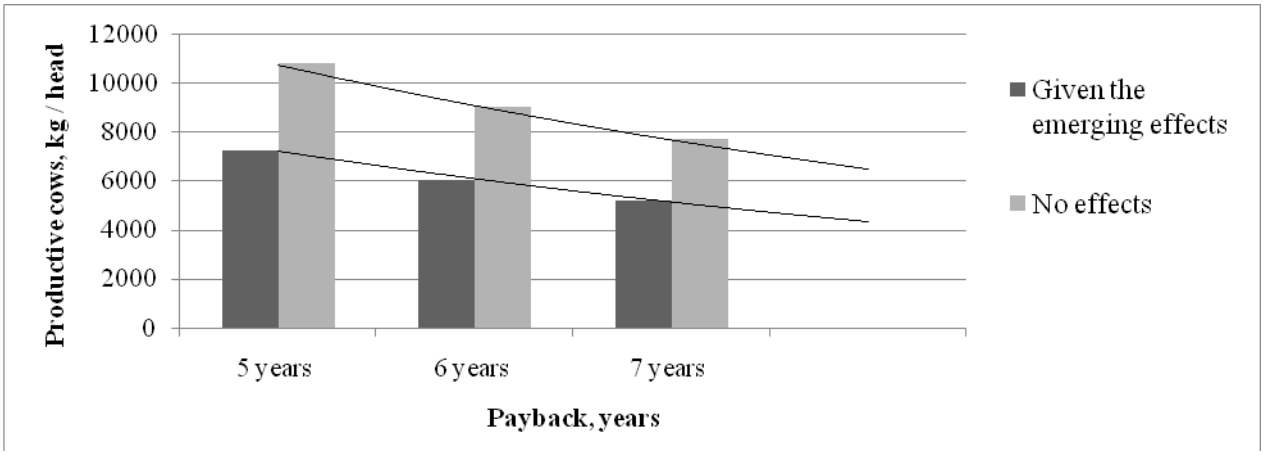
Table 2: Profitability calculation of milk production at traditional and automatic technologies*

Index	Traditional technology	Robotics
Animals livestock	65	65
Milk yield per cow, kg	5384,6	5663,2
Gross volume of production, c	3500,0	3681
Offset product weight, c	3303	3735
Price of product realization, rub/c.	2000	2070
Gain at products realization, thousand rub.	6606	7732
Product cost, rub. /c.	1624	1807
Profitability, %	24,57	23,39

*Calculated by the authors.

Taking into account effects from robotics use allows revealing some dependence of payback terms of this equipment from animals' productivity (Figure3).



Calculated by the authors

Figure 3: Payback of robotics and animals productivity

From this drawing, one can see that payback terms of milking robotics constitute from 5 to 7 years because of its high cost. Payback term of this equipment at effects neglect of quality increase and product marketability occurs at animals productivity of 7708 kg, and at taking these effects into account -5172 kg.

CONCLUSION

Research of agricultural organizations activity using automatic milking has allowed finding out that at the farms using this technology in contrast to traditional farms, labor-output ratio of products manufacture is lower and labor efficiency is higher. However, effectiveness of fixed assets use is slightly lower(as a result of high cost of milking robots) and by that reason net product cost is higher. Total effect from milking robotics implementation constitutes very low value, terms of its payback is high – about 7 years. It should be taken into account at decisions taking about robotics implementation in agricultural organizations. Besides, it requires effective use of this equipment, creation of native robotics, reasonable (by price) for agricultural organizations.

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