METHOD OF DEMAND ASSESSMENT OF TECHNICAL SERVICE IN AGRICULTURAL FARMS

Aizhan Zhildikbayev, Toleubek Pentayev
Kazakh National Agrarian University

Abstract
The volume of demanded groups of farms is defined with the help of the developed method taking into account a type of farm machinery in accordance with their purpose and set of properties.
Key words: assessment of demand; regression analysis; technical services; farms; economics of farming

Introduction

The paper studies economic performance of tractors and agricultural machines. Effective agricultural production depends on minimum cost of agriculture machinery operations. It is necessary to harmonize the system of machinery management and technical services according to the purpose and organizational forms of production and the real demand for equipment. The demand for technical equipment is characterized by the potential annual payments for the purchase of machinery or payment to the third-party organizations for their repair work and maintenance. In this context, the demand is comparable to the actual operating costs which are an integral part of the cost of works on the mechanization of crop production and are characterized by the indicator of operating costs per one hectare (Seyfullin, 2001).

To determine the actual demand for the analysis of the effectiveness of the machinery, it is necessary to compare the use of forms of machines by customers with the performance of this work on their own, taking into account the capabilities of each customer and its ability to pay. The lack of finances often leads to the abandonment of maintenance services of the machinery, even if the need for them exists. The ability of paying for the required technical services by agricultural producers largely depends on trends in the economic situation in the agricultural sector.

The effectiveness of the technical system in general is characterized by the ratio of costs and results of Z, R. The analysis method is based on the allocation of the aggregate cost indicators (capital stock, labor, material and energy resources) and comparing them with the results that represent a set of final products or intermediate inputs.

Indicators highlight certain aspects of efficiency in the natural proportions of cost or cost-effectiveness. The ratio Z / R means specific material, energy and capital intensive and the cost per unit of output. It is possible to reduce the cost by efficient means and rational system of technical service for groups of farms with similar production and economic conditions of the use of agricultural machinery.

In view of the objectives of the study, the requirements for technical systems are formed taking into account natural production conditions of their operation. What matters is the formation of the requirements to quality indicators (machinery systems and technical service) within specific groups of agricultural enterprises.

Methodology of research and materials

A set of technological, technical and financial and economic indicators which characterize efficiency of production economic activity of organizations mentioned in the article were used. It is shown that statistical methods of multidimensional classification allow not only to minimize the quantity, but also to find correlation dependences on each indicator which are a basis of improvement of a technique of an integrated approach to an assessment of results of functioning of the organizations. We used the following basic research methods: abstract, logical, analytical, statistical, constructive, economics and mathematics.

Discussions and results

The aim of the article is to choose between available options for groups of farms taking into account the developed organizational and technical system of agricultural machinery, to find a rational option to provide performance of field mechanized works with the minimum operational expenses (Sabirova A.I. et.al., 2001).

The number of country individual farms have grown in recent years in Almaty area (Fig.1), however, the share of their cultivated areas gradually decreases (Fig.2). The share of products of country farms in production of grain has reduced from 27.4% in 2012 to 20.7% in 2016 over the last 5 years.

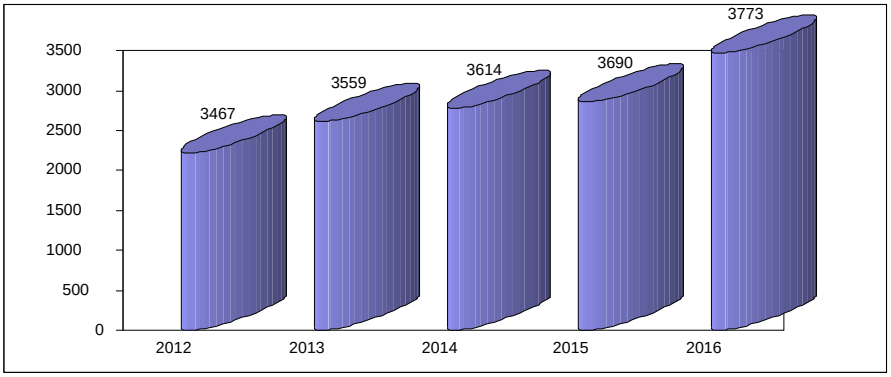


Fig.1. Dynamics of growth of country farms in Almaty region.

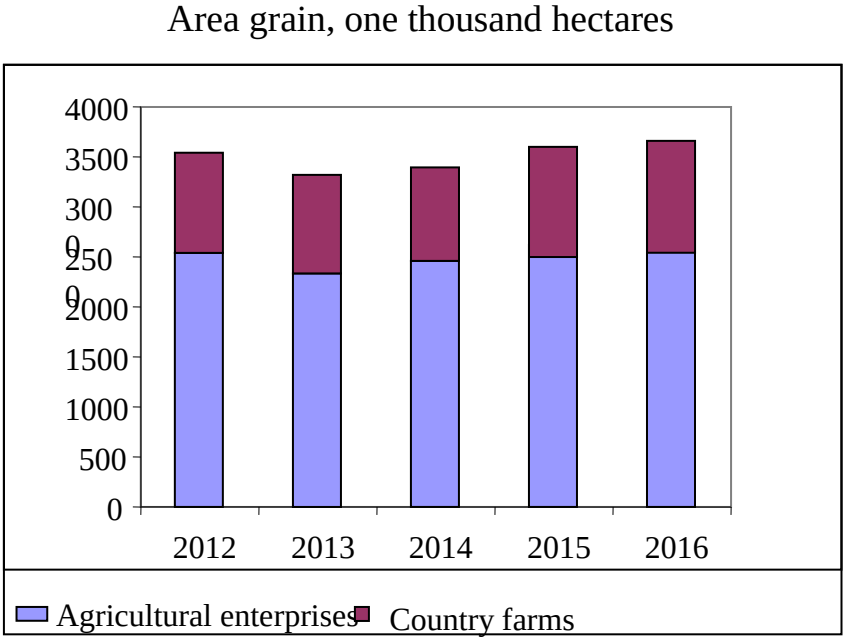


Fig.2. Dynamics of cultivated areas under grain crops in Almaty region.

It is explained by lower productivity for this category of farms in comparison with agricultural enterprises (Fig.3). One essential reason for this is insufficient amount of technical equipment and agricultural machines in small and average farms. The analysis of technical and economic indicators shows unevenness of technical equipment and agricultural machines both by categories of farms, and by their zone arrangement.

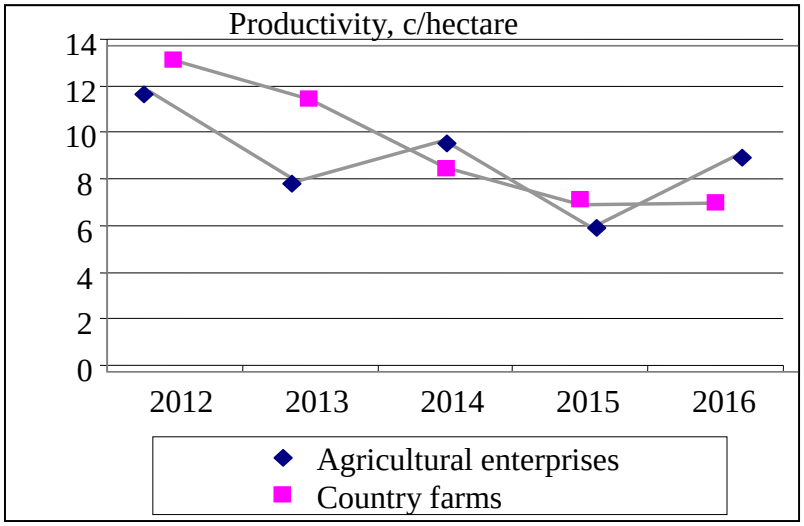


Fig.3. Productivity of grain crops in agro formations of Almaty region.

The comparative analysis of activity of farms of some profitable regions in Almaty region is provided in Table 1 (the general level of profitability is more than 12%, for grain - more than 43%) in 2016 depending on weather conditions.

Table 1

Technical and economic indicators of farms of Almaty region

Category farms	**Index**	**Regions**				
		The Enbekshikazakhsky	The Talgarsky	The Dzhambulsky	The Kerbulaksky	The Aksusky
Agricultural enterprises	Number of farms	14	21	19	14	22
	Average size of an arable land, hectare	8,127	9,890	10,891	14,591	11,213
	Average productivity, c/hectare	9	9.3	10.7	11.8	9.1
	Existence of tractors on 1,000 hectares	5.2	4.8	3.81	3.2	4.04
	Existence of combines on 1,000 hectares	3.8	3.1	2.6	2.4	3.4
Country farms	Number of farms	203	445	189	130	77
	Average size of an arable land, hectare	634	397	777	495	995
	Average productivity, c/hectare	8.2	8.9	10.1	12	8.8
	Existence of tractors on 1,000 hectares	1.8	3.7	3.4	6.5	2.7
	Existence of combines on 1,000 hectares	1.5	3.5	2.8	5.9	2.8
Note: Made on the basis of data of the Management of Statistics of Almaty region.						

The data on agricultural machines and equipment of agricultural enterprises are rather uniform and are within the limits of 2.8-3.4 for combine harvesters, 3.5-5.1 for tractors on 1,000 hectares of arable land; the same cannot be said about the category of country farms. The dispersion of values is obvious

for tractors and combines: the bottom and top borders differ in more than 5 times (Statistics Plus 2.0 software (2001).

The distribution of crop areas in Almaty region matches with normal law of distribution with variation coefficient ν = 0.462076, Pearson's matching criterion $\chi 2$ = 0.0321981, matching probability= 0.857594. For South Kazakhstan region the distribution of crop areas in the farms is described by the function of distribution by Veibul's law. Variation coefficient ν = 0.745431. The probability of matching was $\chi 2$ = 0.317085 by Pearson's criterion and P (λ) = 0.892512 by Kolmogorov-Smirnov criterion (which is above the value 0.05) (Saparbayev A.D.,1995).

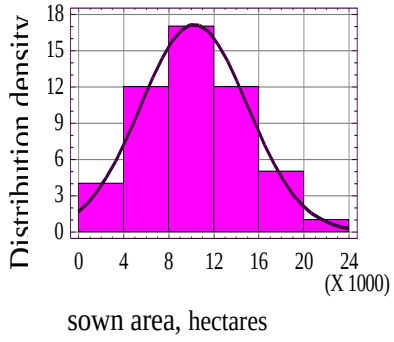
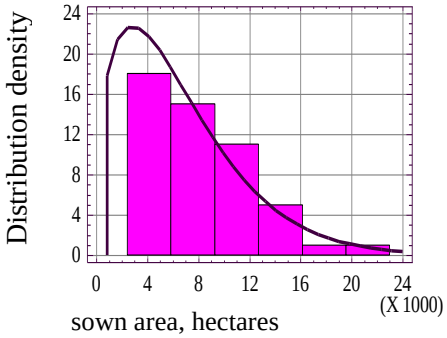
distribution parameters:	**distribution parameters:**
$f(F) = \frac{b}{a} \cdot S^{b-1} \exp(-\frac{F}{a})^b$, where a =1,32221 and b =7476,51	$f(F) = \frac{1}{\sigma\sqrt{2\pi}} \cdot \exp(-\frac{(F - \bar{f})^2}{2\sigma^2})$ where σ = 69,218 and $\bar{f}$ = 10305,6
	
a) Almaty region	b) Southern Kazakhstan region

Fig. 4. Histogram of distribution of cultivated areas of farms.

Some difference in laws of distribution of two areas is caused by distinction in zone conditions of plant growing. More favorable conditions in the Southern Kazakhstan area causes high productivity by the level of fallouts. Therefore in the analysis of distribution averages show that there are more average-sized farms which are the first intervals of distribution.

The regression analysis of dependence of loads of a tractor from the area of an arable land of farms showed that best of all it will be coordinated with logarithmic model and looks like:

$$Q_T = - 211.61 + 80.0787 \cdot \ln(S) \quad (1)$$

The coefficient of correlation is equal to R2 =0.430546.

The change of an average annual operating time of combine harvesters from a cultivated area is described by dependence (Fig. 2.5):

$$Qk = 1 / (0.00229615 + 1.84871/S),\ R2 = 0.899487 \quad (2)$$

where Q_T-load of a tractor, hectare,

Q_K-an average operating time on a combine, hectare,

S –cultivated area, hectare.

It is apparent from Fig.5, the operating time intensively increases with an increase in the area for farms with a cultivated area up to 5 thousand hectares, but further value of the operating time is stabilized and makes about Q = 400 hectares, limited to productivity of combine harvesters.

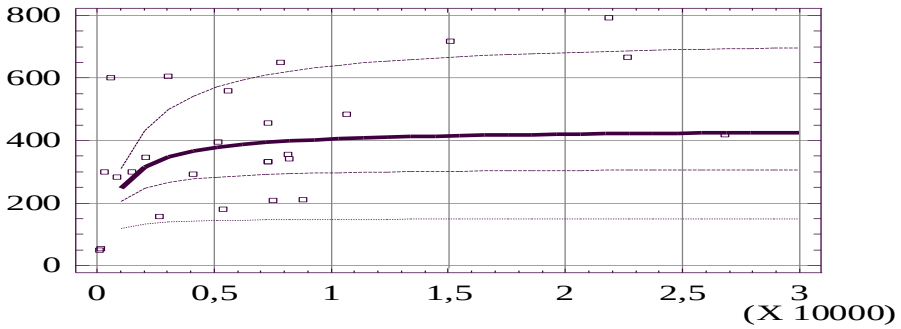


Fig.5. Dependence of an average annual operating time on the combine from a cultivated area of farms

Results of the research allowed to conclude that the need for agriculture machinery is higher in small and average farms than in the large ones. So, per 1,000 hectares of arable land the need for agriculture machinery at the average sizes of farms of 1,000 hectares is 1.4 times higher, per 4,000 hectares the need is 1.2 times higher.

In the regression analysis of dependence of specific expenses for maintenance and repair in relation to productivity and a cultivated area of farms, the following dependence is received:

$$3_{TOP} = 108{,}074 \bullet U + 4{,}42562 \bullet F \qquad (3)$$

where - specific expenses on TORAHS, tenge/hectare,

- productivity of grain crops, c/hectare,
- cultivated area, one thousand hectares.

Criterion of R2 = 86.6759%, standard statistical mistake δ = 364.406, and average absolute mistake Δ = 283.979.

Considering the above-stated dependences of requirement for agriculture machinery, costs of their service and repair in relation to the sizes of farms, it is possible to predict demand for agricultural machinery according to a share of the actual specific operational expenses in the income from production realization. Knowing efficiency (productivity) and the average prices of realization of grain, it is possible to construct the chart of change of the demand depending on the sizes of farms and their profitability at the fixed price of production.

Conclusions and proposals

This methodical approach to an assessment of the potential demand for main types of agriculture machines allows predicting the need for means of production and risks of investment in agricultural production of Kazakhstan in conditions of unstable efficiency of grain production and fluctuations of market prices of grain. The assessment of a potential demand can be used also for the choice of rational option of machinery in agro-industrial companies depending on production and organizational system of use of machinery.

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Information about authors

Aizhan Naskenovna Zhildikbayeva. PhD student, Department of Forest, Land Resources and Phytosanitary, Kazakh National Agrarian University. Address: Prosp. Abaya 8, Almaty, 050010, Republic of Kazakhstan. Tel. +7(727)264 68 55, e-mail: a.zhildikbaeva@mail.ru

Toleubek Pentayevich Pentayev. Professor, Department of Forest, Land resources and phytosanitary, Kazakh National Agrarian University. Address: Prosp. Abaya 8, Almaty, 050010, Republic of Kazakhstan. Tel. +7(727) 264 68 55, e-mail: t_p_12@mail.ru