TECHNICAL SUPPLY OF UKRAINIAN AGRICULTURAL ENTERPRISES AS A COMPETITIVENESS IMPROVEMENT FACTOR

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Abstract

State of technical resources in Ukrainian agriculture is critical nowadays and they directly impact quantity and quality of agricultural production Ukrainian agrarian sector makes, that influences economy as whole, because of huge part of agricultural produce (mostly grain) in Ukrainian export. So increasing competitiveness of agrarian enterprises through improvement of technical supply is absolutely necessary in modern conditions. The purpose of the article is to systematize the factors influencing formation and use of technical resources by Ukrainian agricultural enterprises and to determine effectiveness of state support for agricultural producers in technical re-equipment, as well as to substantiate strategic directions of technical modernization of agriculture in terms of providing innovation and efficiency of technical resources use.

Keywords: *agricultural commodity producers, competitiveness, resource-saving technologies, technical potential, technical upgrading*

JEL Classification: *O32, Q16, Q55*

1 Introduction

Increase in agricultural enterprises competitiveness is directly related to ensuring continuous reproduction of technical capacity and implementation of high-performance technical systems, machinery and equipment, use of modern

technologies for crops cultivation and animal breeding. Without a scientifically substantiated organization of reproduction of technical potential of agricultural enterprises based on identification of specific factors and features that affect the process of reproduction and improvement of technical potential elements, identification of sources to ensure expanded reproduction cannot ensure efficient functioning of business entities in agriculture.

2 Data and methods

Data from official statistics, annual and operational reports of agricultural enterprises were used. The main methods for processing economic information were the method of statistical groupings and correlation-regression analysis with the purpose of comprehensive study of factors that affect the level of technical supplies of agricultural production in Ukraine.

3 Results and Discussion

Technical resources in agricultural production provide an intensive type of development of the industry and promote its competitive development. The FAO approach to technical resources means use of tools and mechanisms in agricultural production that provide the process of mechanization (Clarke, 1997). In its essence, agricultural mechanization involves technological changes through the use of technical resources for agricultural operations. Obviously, prospective development of agriculture is closely connected with implementation of precision farming technology that have economic and environmental benefits, in particular, reduction of water use, fertilizers, herbicides and pesticides, minimizing their negative environmental impact (Banu, 2015) and robotizing technological processes in livestock and crop production (Emmi, 2014).

Therefore, for Ukrainian agricultural production, important issues are analyzing technical support of agricultural production and determining conditions for availability of innovative technology that will ensure competitiveness of the industry and the country. The main problems of deterioration of the material and technical condition of fixed assets in agriculture are: a low investment activity of agricultural producers due to their low level of solvency; insufficient volumes and flaws in targeting of state support for renewal of agricultural fixed assets for small and medium-sized farming in the countryside; low level of agro-leasing development; absence of indexation of book value of fixed assets of agricultural enterprises (Yashan, 2012).

The reasons for deterioration of general state of agricultural enterprises logistical support, especially small and medium businesses, are: low level of reproduction and renewal of basic productive assets of agriculture in comparison with national economy of Ukraine; lack of sufficient state support; disinterest of owners themselves.

Agriculture has practically suspended the processes of reproduction and updating of the material and technical base. Due to annual decrease in the number of machinery and tractor fleet and its book value in agricultural enterprises, the possibility of own traditional sources of updating and replenishing of the machine-technological park is lost.

Because of high level of wear and tear, each year, a quarter of tractors and combines do not go to immediate place of work, and expenses for repairs increase accordingly by 5-7%. The old system of service and maintenance has been destroyed, but the new one has not yet been created. The lack and low quality of technical equipment and a high level of wear and tear increase the annual load on the machine-tractor park. The term of mechanized work increases 2-5 times, the quality of work decreases, and consequently the loss of yield increases (Skotsik, 2014).

We found that the largest correlation index, and hence the largest impact on the receipt and purchase of agricultural machinery, was for investments in fixed assets (Table 1). Direct foreign investments did not affect this process due to their small volumes. The level of profitability of production, labor productivity, and the price index for the sale of agricultural products did not significantly affect the flow of technical resources to agricultural enterprises during this period. This means that the profit of agricultural enterprises on average in Ukraine is low and did not significantly affect the process of machinery updating. With regard to the impact of prices on agricultural machinery, the corresponding correlation index is significant and positive, which is caused by the purchase of a significant amount of expensive foreign machinery for the period under study.

Table 1 **Couple correlation indices between receipt and purchase of agricultural machinery and key macroeconomic indicators for 2010-2015**

Indicator	Machinery received	Machinery purchased				
	Tractors	Grain harvesters	Tractors and harvesters of all types	Tractors	Grain harvesters	Tractors and harvesters of all types
Investments in the main capital	0,939	0,829	0,917	0,761	0,795	0,804
Foreign investments	-0,636	-0,73	-0,665	-0,591	-0,838	-0,682
Level of profitability of production	0,149	-0,091	0,084	0,241	-0,13	0,151
Productivity of labor	0,245	0,098	0,21	0,056	-0,057	0,031
Price indices for tractors and agricultural machines	0,911	0,96	0,932	0,711	0,988	0,817
Indices of prices of agricultural products.	0,045	-0,201	-0,022	0,186	-0,226	0,083

Source: Compiled and calculated according to the data of State Statistics Service of Ukraine.

Each year in agricultural enterprises the number of waste equipment exceeds the number of purchased one more than 10 times. The possibilities of own sources of updating and replenishing of the machine-technological park, such as depreciation fund and profit, are rapidly decreasing. Almost all the funds that need to be invested in machinery and equipment are used mainly for financing of working capital, including purchase of seeds, lubricants, mineral fertilizers, payment of bank interest on a loan, etc.

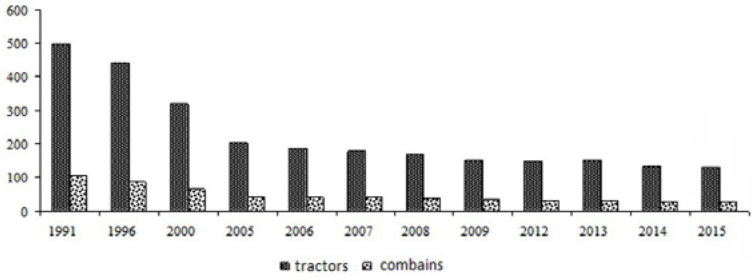
State support programs for technical support of the agrarian sector of the economy are not sufficiently effective. A small number of state-owned leasing companies while distributing funds for these programs are in unequal conditions with other entities in leasing market. The use of state funds by the latter puts them in a privileged position with regard to private leasing companies using credit funds. This situation hinders the development of a civilized leasing market based on fair competition, primarily in the agrarian sector of the economy.

In agrarian scientists' opinion, the decline in solvency was caused by a sharp decline in the investment activity of agricultural producers, a decrease in the

availability of funds, technical and energy equipment of agricultural production (Mogilova, 2012). As a result, the depreciation of fixed assets exceeds their renovation10-15 times, the level of mechanization of production of all types of agricultural products has decreased. A number of important technological operations provided by the regulations for growing crops are not carried out, which reduces yields and gross output and exacerbates economic crisis in the agricultural sector. The state of the machinery and tractor park of the agrarian sector was close to critical, which threatened the complete loss of machine technology of agricultural production.

Currently, the park of agricultural machinery used in the production process, has about 1 million units of machinery and equipment. According to the target segment of the research, the park numbers more than 500 thousand units. The dynamics of the availability of technical equipment in agricultural enterprises for the period 1991-2015 has a negative tendency. The number of tractors decreased accordingly by 369.4 thousand, and combines by 78.5 thousand units. (Figure 1).

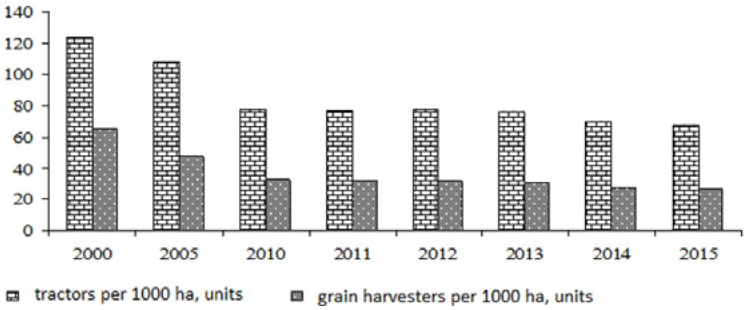
Figure 1 **The number of main types of agricultural machinery in Ukrainian agriculturalenterprises, units**



Source: Compiled and calculated according to the data of State Statistics Service of Ukraine.

Quantitative and qualitative reduction of the machine-tractor park has led to an increase in load on equipment. Thus, the number of tractors per 1000 hectares of arable land decreased from 124 units in 2000 to 68 in 2012, grain harvesters per 1000 hectares of grain sown area from 65.2 units to 26.7 (Figure 2).

Figure 2 **The number of tractors and grain harvesters per 1000 hectares of agricultural land, units**



Source: Compiled and calculated according to the data of State Statistics Service of Ukraine.

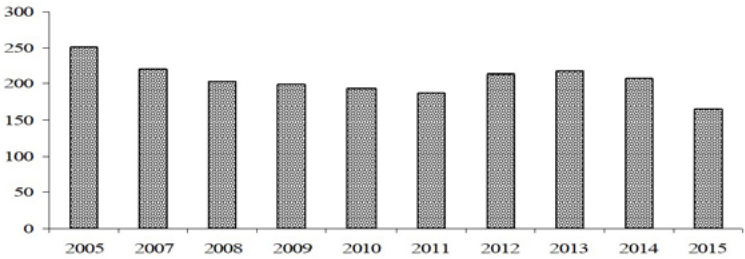
Seasonal load on grain and forage harvesting machinery and other equipment on farms is more than 2.5-3 times higher than normative. Low technical support leads to an extension of agricultural work terms, deterioration of work quality, a significant increase in crop losses and reduced agricultural crops yields. The energy supply of production and labor power are also reduced, which in Ukraine, respectively, are 3-4 and 4-6 times lower than in the USA and Germany.

So, grain harvesting is 100% provided by combines, but for 20 days or more, instead of 5-7 days. Agro-technical terms of basic soil cultivation, planting and care are violated everywhere due to the lack of technical means. It should be noted that from the total number of grain harvesters operating in fields of Ukraine, the share of domestic combine harvesters Slavutich is 2%, foreign combine harvesters 20%, constructively outdated combine harvesters of Soviet times 78%. Thus, the fleet of tractors is only 45% of agriculture needs, grain harvesters – 48%, forage harvesters 75%, lorries 66%, premachines 85%, harvester – 46%, plows 37%, seeders 66%. In other types of equipment, degree of supply need ranges from 35 to 60%. Annual losses of grain during harvesting are estimated at UAH 8-10 billion.

At the end of 2015, at agricultural enterprises, there were 127.9 thousand tractors in working condition (readiness 95% versus 96% in the corresponding period of the previous year), 310 thousand units of tillage equipment (96% vs. 96%), 65.5 thousand seedlings (95% versus 94%). If in Ukraine there are 68 tractors for a total of 1,000 ha of arable land, then in Poland 93,3, in Germany 87,4, in France 68,7, in Great Britain 84,7 units. There are 26,7 grain harvesters per 1000 hectares of grain crops in Ukraine (Antoshchenkov, 2012).

According to Figure 3 at the time of gaining independence of Ukraine (1990), the level of power supply was high (369 kW per 100 hectares of sown area) as a basic consequence of the post-socialist mode of management with planned system of equipment supplies. Thereafter, a sharp decline in power supply of agrarian enterprises was observed, which lasted until 2011, when the supply of power capacity amounted to 187 kW per 100 hectares of sown area.

Figure 3 **The level of power supply of agricultural enterprises per 100 hectares of sown area**



Source: Compiled and calculated according to the data of State Statistics Service of Ukraine.

From the end of 2011 to 2013 there is a slight tendency of growth of power facilities of agrarian enterprises. This process was promoted by the efficiency of agricultural production with an increase in volume of profits from sale of agricultural products by agrarian commodity producers. During 2014-2015, there is a decrease in energy supply of agricultural production due to unstable socio-economic situation in the country, which negatively affected the investment attractiveness of the agricultural sector of the economy.

According to calculations of scientists of NSC "Institute of Agrarian Economics", for stable increase of production of agricultural products, it is necessary to renew the park of agricultural machines, for this it is necessary to put into operation annually: grain harvesters 7,5 thousand; tractors 35 thousand; sowing complexes in the tractor unit more than 2,5 thousand; other agricultural machinery (Kravchuk, 2013). As domestic and foreign experience convinces, the basis of technical equipment of agricultural production remains tractor power at the rate of at least 1.2 hp per 1 hectare, as well as the structure and quality of tractors and trains of machines to them, in order to be able to provide a radical (2-3 times) increase in labor productivity and bringing the terms of work to the agro-technical optimum.

In the level of labor power, agricultural commodity producers in Ukraine are more than 5 times inferior to US farmers. If we compare the labor power of rural and industrial workers, we will see that for the rural ones it is 1.8 times lower. In developed countries this proportion is reverse, that is the farmer is equipped 1,5-2 times better than the industrial worker (Pidlisetskii, 2008).

At present there is an increase in the amount of agricultural machinery, including of foreign produce, in cash equivalent and its reduction in-kind terms. The structure of the tractor park composition was influenced by the following factors: peculiarities of Ukrainian agriculture according to natural and climatic conditions; a formed composition of categories of farms with different arable land area; use of different kinds of technology for soil cultivation and harvesting, solvency of enterprises and some others. In the structure of the tractor park in 2015, the largest percentage (32.5%) falls on tractors with a capacity of 55-80 hp, and 80-135; 29.8% powerful tractors with an engine of more than 135 hp. and only 5,2% falls on low-power tractors, with a capacity of up to 55 hp.

Table 2 **Availability of agricultural machinery in agricultural enterprises according to the organizational forms of economic entities in 2015 (end of the year, units)**

Indicators	Agricultural enterprises total	including:					
		Business partnerships	Private enterprises	Cooperatives	Farms	State-owned enterprises	Other forms
Tractors total	127852	59422	21179	5495	34528	2798	4430
including tractors with capacity:							
under 40 kW	6678	3190	931	367	1458	257	475
from 40 to 60 kW	41489	18501	6685	2237	11236	1249	1581
from 60 to 100 kW	41615	18245	7014	1475	13062	654	1165
over 100 kW	38070	19486	6549	1416	8772	638	1209
Of the total number of tractors:							
wheeled tractors	118178	55187	19508	4837	32437	2515	3694
crawler tractors	9674	4235	1671	658	2091	283	736
Combines and machines:							
grain harvesting	26735	10983	4569	1238	8774	419	752

Indicators	Agricultural enterprises total	including:					
		Business partnerships	Private enterprises	Cooperatives	Farms	State-owned enterprises	Other forms
corn-picking	1634	756	282	148	321	54	73

Source: Compiled and calculated according to the data of State Statistics Service of Ukraine.

Regarding the availability of agricultural machinery at enterprises, it is worth noting that the bulk of the tractors is registered in business partnerships and farms. The least number of tractors is involved in state-owned agricultural enterprises. Almost half of the seed equipment is in use of business partnerships. At the same time, only 2.3% of all seedlings are registered at state-owned enterprises. A similar situation exists in the segment of combine harvesters.

The analysis of the technology park of farms has shown that tractors are dominant in it. Owned by these farms, there is a significant amount of sowing equipment 21% of the total sowing park in Ukraine, and grain harvesters (23.6%), despite their annual withdrawal.

Machine-tractor park of the majority of agricultural enterprises, machine-technological stations and farms is physically and morally obsolete. However, 74% of respondents considered it to be satisfactory (including 74% of agricultural enterprises, 70% of machine-technology stations and 86% of farms), and 86% of all respondents consider the state of the repair base of their enterprises to be satisfactory.

The average indicator of machinery deterioration in domestic agriculture is 70%, in particular for tractors 77.57%, and for combines 70.56%. It has been established that the level of wear of tractors significantly depends on the area of agricultural land in use of the agricultural enterprise. Thus, on farms with an area of up to 200 hectares the degree of wear is 75-80%; 200,1-1000 ha 65-74; 1000,1-2000 hectares 50-64%, 2000,1-5000 hectares 25-50, over 5000 hectares up to 25%. The tractor park is considered to be more worn out if the number of machinery over 20 years old is 50.05% of the total, for combines 44.81% respectively. In this case, the fleet of tractors has a longer period of operation, as evidenced by a smaller share of newer technology in the overall structure.

Nowadays, the extension of equipment life allows us to determine the expediency of further exploitation of the means of production, in order to prevent the decline in production volumes. Heads of many agricultural enterprises are faced

with a choice: to buy one new machine or to repair 4-5 old ones for the same amount of money. Of two machines with the same specifications, it is more likely to be chosen the one the service life of which is less and, consequently, the price is lower.

To renew the machine-tractor park of agricultural enterprises to the level of technological need, it is necessary to buy machines and equipment worth more than 15 billion UAH every year. Of these, on the renewal of the park of tractors it is necessary to spend 3,0-3,5 billion UAH, grain harvesters 3,5-4,0, beet-harvesting machines 0,35-0,4, forage-harvesting 1,0, livestock machinery 1, 0, general purpose equipment 2-3 billion UAH. In addition, in order to maintain the machine-tractor park in working condition, it is necessary to spend 2,0-2,5 billion UAH for purchase of spare parts and repair materials.

The main source of the machine-tractor park formation is profit, which is aimed at its updating (Table 3). However, agricultural enterprises with the highest level of profitability occupy a small part in the structure of acquisition of major types of machinery and equipment, the purchase of agricultural machinery by loss-making and low-profit farms in large numbers is due to their orientation towards an intensive type of production.

Table 3 **Grouping the purchase of agricultural machinery and trucks according to the level of profitability of enterprises of the corporate sector of the agrarian economy in 2015**

Groups on profitability of agricultural products,%	Profitability level,%	Tractors of all types		Seeders		Grain-harvesting combines		Milking installations		Trucks	
		units	% to total	units	% to total	units	% to total	units	% to total	units	% to total
under -10	-23,6	202	7,3	156	6,7	24	4,7	28	7,6	29	7,2
from -10 to 0	-4,3	207	7,5	176	7,6	25	4,9	53	14,4	29	7,2
0,1-10	4,5	390	14,1	407	17,6	51	10,0	131	35,7	49	12,2
10,1-25	17,1	617	22,3	495	21,4	111	21,9	68	18,5	80	19,9
25,1-50	35,6	737	26,6	573	24,8	152	29,9	70	19,1	111	27,5

Groups on profitability of agricultural products,%	Profitability level,%	Tractors of all types		Seeders		Grain-harvesting combines		Milking installations		Trucks	
		units	% to total	units	% to total	units	% to total	units	% to total	units	% to total
50,1-75	60,0	340	12,3	261	11,3	87	17,1	13	3,5	63	15,6
over 75	133,1	280	10,1	247	10,7	58	11,4	4	1,1	42	10,4
Total	20,4	2773	100,0	2315	100,0	508	100,0	367	100,0	403	100,0

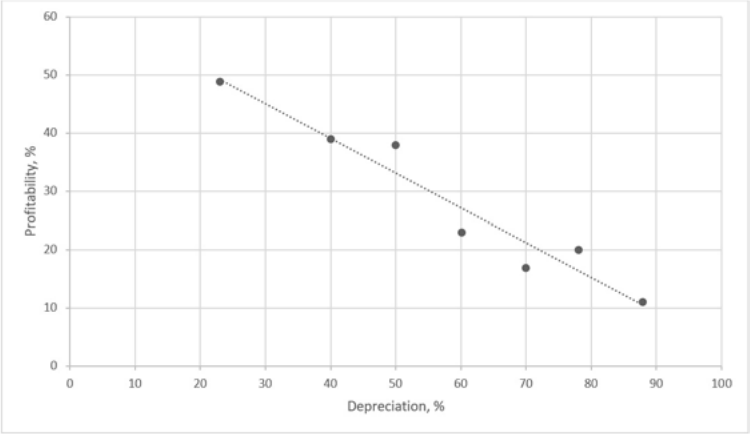
Source: Compiled and calculated according to the data of State Statistics Service of Ukraine.

We have found that the average group level of profitability of agricultural production of enterprises of the corporate sector of agrarian economy (Y_1), depending on the average group wear of ICC (x) for the period of 2008-2010, is well approximated by linear regression (Figure 4):

$$Y_1(x) = a_0 + a_1 * x, \quad (1)$$

where $a_0 = 65,964$; $a_1 = -0,678$. Couple correlation index $K_{xy} = -0,98$.

Figure 4 **Dependence of the average group level of profitability of agricultural production on the average group depreciation of ICP enterprises of the corporate sector of the agrarian sector of Ukraine for the 2010-2015 period.**



Agricultural service cooperatives (ASCs), which are focused on providing services for joint cultivation of soil, mainly to their members, whose number has almost doubled during 2008-2015, play an important role in the conditions of insufficient technical support of agricultural producers. However, most of them perform the functions of business entities for provision of services for land cultivation, due to inconsistency of legislation regarding them as non-profit organizations. In addition, most ASCs hold technical equipment only for execution of a limited list of technological operations for crop production (plowing, cultivation) and provision of transport services.

4 Conclusion

It has been established that the reduction in agricultural machinery quantity, and the reduction of machinery amount in kind in terms of unit per area of cultivation, as well as in assessing power availability, indicates a decrease in technical capacity and the need to implement resource-saving technology. On the one hand, high load of equipment increases physical deterioration and, on the other hand, accelerates return on capital investments required for purchase of fixed assets and reduces the risk of using moral depreciation of technical means, which actualizes measures to optimize loading of existing high-performance, modern machinery

and rational use of depreciation as a source of funding for reproduction of resources.

The age structure of the technology park, formed in the agriculture of Ukraine, does not allow to assert that technical resources are used within amortization period, which, first of all, reduces collateral base of enterprises, reduces the efficiency of resource use due to growth of expenses for repairs and maintenance, increase in timing of technological operations. The development of agricultural technical potential should be aimed at improving markets for agricultural machinery, repair and technical services, including market for used machinery; improvement of agricultural machinery leasing; concentration and centralized use of technology based on creation of a network of machine and technology stations.

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