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# INVESTMENT OF AGRICULTURAL MACHINERY IN AGRICULTURAL PRODUCTION OF UKRAINE

## ИНВЕСТИРОВАНИЕ ТЕХНИЧЕСКОГО ОСНАЩЕНИЯ АГРАРНОГО ПРОИЗВОДСТВА УКРАИНЫ

Prof. doc. eng. Didur V. PhD, Doc. eng. Gritsaienko H. PhD, Doc. eng. Gritsaienko I. PhD  
Tavria State Agrotechnological University  
18, Khmelnytskyi av., Melitopol, 72312, Zaporozhye region, Ukraine  
E-mail: didurva@mail.ru

**Abstract.** The article examines the current state and investment of supplying the agriculture with the main types of agricultural machinery. The availability and capacity of combine harvesters and tractors of all brands at agricultural enterprises and households has been analyzed. The issues of agricultural machinery renovation, including the expense of imports, are considered. In order to justify the most effective external funding the investments in agricultural machinery, a comparative analysis of financial leasing conditions and bank lending for purchasing a new tractor and a combine harvester. The prospects for further research have identified the justification for the rational composition and structure of the material and technical basis for the intensification of agriculture in the region.

**KEYWORDS:** LOGISTICS, FINANCE INVESTMENTS, FINANCIAL LEASING, BANK CREDIT, TRACTORS OF ALL BRANDS, COMBINE HARVESTERS

### 1. Introduction

Overcoming the crisis in agriculture, the development of market economy, food security is not possible without a corresponding development of logistics and effective investment in technical equipment of agricultural production.

### 2. Analysis of recent researches and publications

The issue of technical equipment of agricultural production covered in the scientific work of scholars such as Y.K. Bilousko [1, 11] O.V. Vishnevetska [1], A.S. Danilenko [2] O.V. Zaharchuk [4] A.M. Karpenko [2], V.E. Skotsyk [7-9], and many others. However, the complexity and diversity of the mentioned problems requires further comprehensive study of what is due relevance of the chosen topic.

### 3. Formulation of the problem

The object of the article is to study the current state of agriculture equipment agricultural machinery and to identify effective ways to invest.

### 4. Results and discussion

Among the factors intensifying agricultural mechanization is a priority. According to the World Bank [6], in terms of provision of agricultural machinery, tractors per 100 square km of arable land Ukraine lags far behind the developed European countries. Thus, among the considered 31 European countries in 2000 (the most comprehensive data analysis) together with Bulgaria Ukraine with the index 98 units occupied 28-29 position, just ahead of the Russian Federation (60 units) and Croatia (27 units). At the same time the three leaders entered Slovenia, Switzerland and Italy with indicators respectively 6600, 2654 and 1938 units, exceeding the national average, respectively 67, 27 and 20 times. During 2000-2008 in Bulgaria the number of agricultural machinery and tractors per 100 square km of arable land increased by 75.5% to 172 units, but in Ukraine during the same period it increased only by 5.1%.

According to the State Statistics Service of Ukraine, the dynamics of the current number of agricultural machinery at agricultural enterprises and households in 2000-2015 has shown a negative trend (Table 1).

So, for 2000-2015 years the number of tractors of all brands (excluding tractors, are mounted on the machine) as a whole declined by nearly one fifth of and made in 2015 309.7 thousand. Units combine harvesters - under 16, 4% to 56.3 thousand units. Based on the analysis of the trend can be concluded that over the period the number of tractors decreased annually on average by 3.8 thousand. Units combine harvesters - by 1.0 thousand Units (Table 2).

**Table 1.** Dynamics of agricultural machinery availability at agricultural enterprises and households of Ukraine

Years	Tractors of all brands (excluding tractors, are mounted on the machine), total units	including		Combine harvesters, total units	including	
		agricultural enterprises	households		agricultural enterprises	households
2000	382628	281650	100978	67366	65240	2126
2005	331457	196080	135377	59937	47150	12787
2006	325505	182552	142953	59174	44252	14922
2007	320034	169953	150081	57503	41032	16471
2008	319872	161800	158072	57435	39091	18344
2009	318788	153791	164997	56580	36783	19797
2010	310248	137757	172491	53531	32750	20781
2011	313480	134554	178926	54074	32062	22012
2012	322209	137958	184251	54651	31997	22654
2013	315261	129341	185920	52065	29364	22701
2014	309111	120638	188473	50019	27196	22823
2015	309716	127852	181864	56328	37537	18791
2015 in % by 2000	80,9	45,4	180,1	83,6	57,5	by 8,8x

Source: compiled according to the State Statistics Service of Ukraine

In the provision of equipment and farm households observed the opposite trend (Table. 1, 2). So, for 2000-2015 years the total number of tractors of all brands (excluding tractors, which are mounted on the machine) in agricultural enterprises decreased by 54.6%, while in households by contrast, increased by 80.1%. Accordingly, the number of harvesters at agricultural enterprises has decreased by 42.5% and at households - increased by 8.8 times.

**Table 2. Trends in the availability of agricultural machinery in agricultural enterprises and farms Ukraine in 2000-2015**

Indexes	The equation of the trend line	Ratios of correlation (R), determination (D)
Tractors of all brands (excluding tractors, are mounted on the machine), total units	$y = -3817,1x + 348004$	R = 0,6919 D = 0,4787
including: agricultural enterprises	$y = -10493x + 229365$	R = 0,8482 D = 0,7194
households	$y = 6675,8x + 118639$	R = 0,9205 D = 0,8474
Combine harvesters, total units	$y = -1006,4x + 63097$	R = 0,8138 D = 0,6623
including: agricultural enterprises	$y = -2303,6x + 53678$	R = 0,8084 D = 0,6535
households	$y = 1297,2x + 9419$	R = 0,79 D = 0,6241

Source: compiled according to the State Statistics Service of Ukraine

With settlements established inverse relationship between the number of tractors of all brands (excluding tractors, which are mounted on the machine) in agricultural enterprises (in) and farms (x):

$$y = -1,6656x + 431036; R = 0,9764; D = 0,9534.$$

That is, increasing the number of tractors in farms 10 units accompanied by a decrease in their agricultural enterprises by 17 units. The correlation coefficient R indicates a close relationship, close to the function.

A similar situation is observed for combine harvesters:

$$y = -1,7222x + 69448; R = 0,9924; D = 0,9848.$$

Increasing the number of tractors at households by 10 units is accompanied by their reduction at agricultural enterprises by 17 units. Impact factors are not taken into account in the model - 1.52% (coefficient of determination equal to 0.9848).

Loading agricultural machinery in Ukraine (tab. 3) times higher than corresponding figures in developed countries, hindering the necessary process operations on time and leads to yield losses.

The load on the tractor in the whole Ukraine with 82 hectares of arable land in 2000 increased by almost a third, amounting in 2015 105 hectares (for comparison: in the US - 28 hectares in France - 14 ha per tractor [9]). In this figure farms of 69 hectares in 2000 increased to 152 hectares, or 2.2 times, while in farms from 104 hectares in 2000 it was reduced to 64 hectares in 2015, or at 38.6%.

The load on the combine harvester in general in Ukraine with 203 hectares of grain and leguminous crops in 2000 increased to 262 hectares in 2015, or 29.2% (for comparison: in the US, France and Germany to combine load of about 55 hectares [9]). In the farms, the figure of 184 ha in 2000 increased by 55.6% and amounted to 286 hectares of private households - according to 786 hectares in 2000 decreased by 72.8% and amounted to 214 ha in 2015.

**Table 3. Dynamics of load indicators at agricultural enterprises and farms of Ukraine**

Years	The area of arable land per tractor 1, hectares	including		Area grains and legumes per 1 processor, ha	including	
		agricultural enterprises	households		agricultural enterprises	households
2000	82	69	104	203	184	786
2005	98	102	80	250	244	273
2006	100	106	80	245	252	225
2007	101	114	76	263	285	207
2008	102	121	72	272	310	192
2009	102	126	70	280	330	186
2010	105	140	68	282	344	183
2011	104	143	66	291	366	181
2012	101	141	63	283	358	177
2013	103	148	64	301	394	181
2014	105	160	62	296	391	183
2015	105	152	64	262	286	214
2015 in % to 2000	127,9	221,6	61,4	129,2	155,6	27,2

Source: compiled according to the State Statistics Service of Ukraine

Analysis of trends in the burden on the technique proves (Table 4), for 2000-2015 arable land area per 1 tractor average in Ukraine increased annually by 1.2 hectares. In the agricultural enterprises of the increase annually by 6.8 hectares, while at households - on the contrary, decreased by 2.8 hectares respectively. Area grains and legumes per 1 combine harvester on average in Ukraine for 2000-2015 increased annually by 5.6 hectares, including households 13.9 ha. Increasing the number of harvesters in households led to an annual reduction of the burden on them in accordance with an average of 26.6 hectares.

**Table 4. Trends stress on technique in agricultural enterprises and farms of Ukraine in 2000-2015.**

Indexes	Trend equation	Ratios of correlation (R), determination (D)
The area of arable land per 1 tractor, hectares	$y = 1,2227x + 92,655$	R = 0,7085 D = 0,502
including: agricultural enterprises	$y = 6,8156x + 82,476$	R = 0,945 D = 0,893
households	$y = -2,822x + 90,861$	R = 0,8525 D = 0,7267
Area grains and legumes per 1 combine, total, ha	$y = 5,6222x + 232,4$	R = 0,7456 D = 0,5559
including: agricultural enterprises	$y = 13,922x + 221,56$	R = 0,7806 D = 0,6094
households	$y = -26,586x + 421,77$	R = 0,5593 D = 0,3128

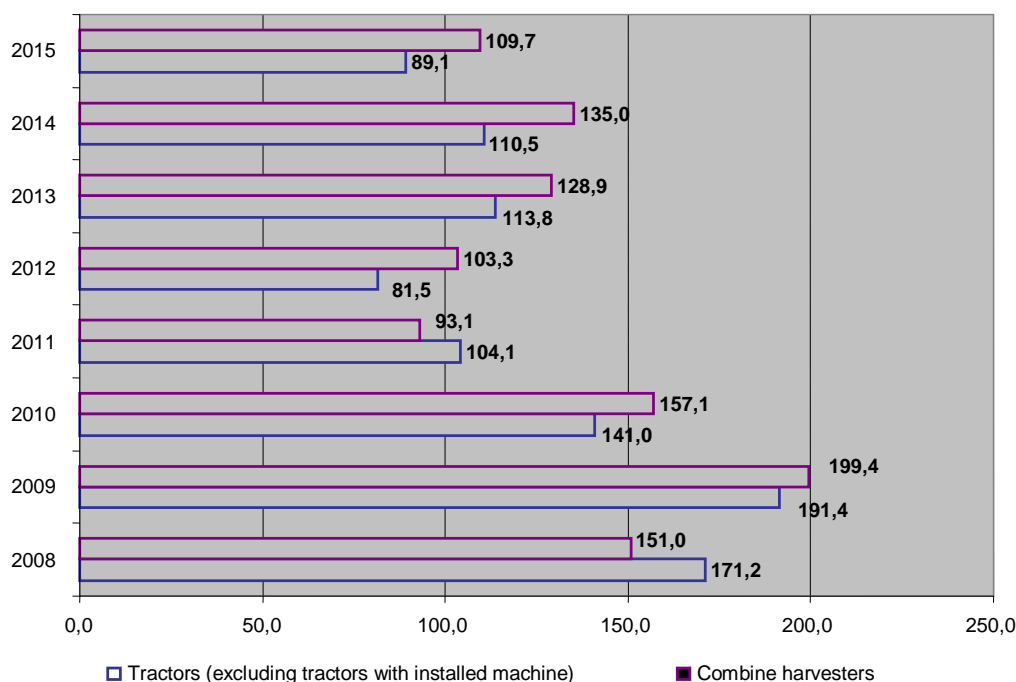
Source: compiled according to the State Statistics Service of Ukraine

The analysis of the movement of agricultural equipment indicates that negative trend observed excess of that which is left out during the year to that received (Fig. 1).

Thus, in 2008-2010. Number of tractors and combine harvesters, who dropped out for a year and a half to two times higher than that which came respectively. Lowest in years 2008-2015. This ratio was in 2011-2012. (104.1% and 81.5% for tractors, 93.1% and 103.3% for combine harvesters, respectively). State Program realization of technical policy in the agricultural sector for the period up to 2015 [3] included in the 2015 production of competitive tractors at 9.5 thousand units, combines - 1.5 thousand units. Total state support for agricultural production

technical support provided funding in the amount of 134.23 billion UAH. Increased technical support of agricultural production in 2015 was 7.6% help reduce the losses of agricultural production as a result of timely and quality of the mechanized operations by 30%. Unfortunately, starting from 2012 funding of this program is not the

case. According to calculations [8], a garden tractor is now 45% of the needs of agriculture, combine harvesters - 48%, other types of equipment - from 35 to 60%.



**Fig.1.** Ratio of technology in agricultural enterprises, which for the year dropped to one that came, in %  
(Source: compiled according to the State Statistics Service of Ukraine)

Average rate of deterioration of agricultural machinery is 70%, including 78% of tractors, harvesters - 71%.

Dynamics buying farms Ukraine new tractors and combine harvesters for 2011-2015 presented in Table 5.

Analysis of the data of Table 5 shows the reduction in the number and simultaneous substantial increase in cost of purchases of tractors and combines as a result of price increases. The average annual growth rate of average prices for all kinds of tractors for

2010-2015 is amounted to 129.8% and harvesters - 124.6%, respectively.

Despite the fact that domestic appliances cheaper agricultural producers prefer imported counterparts, whose share is more than 80% of the total value of funds spent on the purchase of technical support. Foreign technique works longer without repair, fuel spends more economical, less harmful to the environment, can significantly save human resources [7].

**Table 5.** Dynamics of purchasing new tractors and combine harvesters by agricultural enterprises of Ukraine

Years	Tractors of all types				Combine harvesters			
	number, units.	total cost, UAH.	average price		number, units.	total cost, million UAH.	average price	
			UAH, per unit.	% by previous year			UAH, per unit.	% by previous year
2011	2983	1352,4	453374	133,1	804	1140,3	1418244	129,3
2012	3010	1471,9	488997	107,8	541	802,3	1482984	104,6
2013	2788	1512,7	542566	111,0	524	806,2	1538600	103,8
2014	1822	1305,5	716533	132,0	336	673,6	2004757	130,4
2015	2095	2627,4	1254125,2	175,0	479	1573,7	3285475,0	163,9
2015 in % by 2011	70,2	194,3	276,6	x	59,6	138,0	231,7	x

Source: compiled according to the State Statistics Service of Ukraine

\*Excluding the temporarily occupied territory of the Autonomous Republic of Crimea, Sevastopol and the zone of the antiterrorist operation

But the high cost of imported machinery is a deterrent to the modernization and renewal of technical machinery in agricultural production. Table 6 shows the data on the dynamics of the number and value of import tractors and combine harvesters.

According to Table 6 during 2011-2015 there can be observed a significant reduction in imports of machinery. Thus, the number of tractors of all brands, imported to the country fell by more than two-thirds harvesters - almost half. The value of the purchased tractors fell by 59%, combine tractors - by 60.8%.

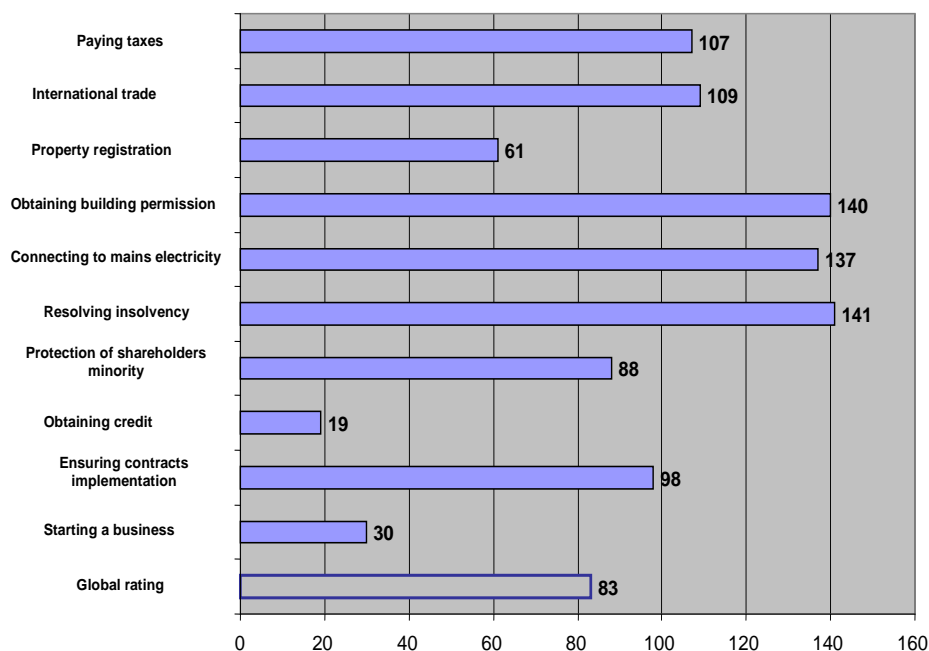
According to the Ministry of Agrarian Policy of Ukraine, the minimum scientifically justified annual update of tractor fleet to the technological needs of the prices prevailing at the beginning of 2016 is 35 bln UAH, including about 40 thousand tractors (15 bln UAH) and nearly 7 thousand combine harvesters (10,5 bln UAH) [5]. In conditions of severe shortage of agricultural enterprises owning funds to upgrade agricultural machinery is needed to find the most effective external financing investment in technical support of agriculture. Among the most common can be identified financial leasing and bank lending.

**Table 6.** Dynamics of import of tractors and combine harvesters

Years	Tractors		Combine harvesters	
	number, thousands, units.	million, USD	number, units.	million, USD
2011	146,4	559,1	2619	272,2
2012	104,9	564,8	1647	187,3
2013	156,0	562,6	1570	183,3
2014	108,8	273,7	935	95,5
2015	39,7	229,3	1285	106,6
2015 in % to 2011	27,1	41,0	49,1	39,2

Source: compiled according to the State Statistics Service of Ukraine

We conducted a comparative analysis of financial leasing and bank loans for the purchase of new agricultural machinery in accordance with NAK "Ukragroleasing" and Ukreximbank. NJSC "Ukragroleasing" with an annual interest rate of 11% provides a choice of term loans (3, 5 and 7 years), options of debt settlement (payment every month, once every 3 or 6 months), and the size of the down payment (10, 15 or 30%). In Ukreximbank with an annual interest rate for the purchase of new agricultural machinery and 22% for loans up to 5 years, monthly or quarterly repayment of debt, the size of the down payment of 15%. The analysis shows that the conditions of financial leasing are more attractive than bank lending. Rise in credit services NAK "Ukragroleasing" depending on the selected size of the down payment is respectively 23.5% (down payment of 15%) and 24.3% (down payment of 10%). At the same time the rise in credit Ukreximbank services is 52.6%, more than twice as much.



**Fig. 2.** Components of the rating level ease of doing business in Ukraine in 2016 (Source: compiled from data [6])

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The shortage of own financial resources, special attention should be given opportunities of foreign investment. Unfortunately, in the ranking of the degree of ease of doing business, characterizing investment attractiveness of Ukraine in 2016 took only 83 among 189 countries. Among the components of the ranking (Fig. 2) is the most problematic "Resolving Insolvency", "Obtaining construction permits" and "Connecting to power supply" - Ukraine's place these criteria in 2016 amounted to 141, 140 and 137 positions.

The highest places in the ranking in 2016 Ukraine ranked according to criteria "Getting credit" and "starting a business" - respectively 19 and 30 positions. To improve the situation, the relevant areas developed 43 objectives, the implementation of which will not only facilitate the business environment, but also improving the investment climate in Ukraine as a whole.

## 5. Conclusion

Thus, we can conclude that to strengthen the competitive position in the markets of agro-food production and sustainable development of the domestic agricultural sector is an urgent need for increasing investment in technical support for agricultural producers. However, its level for a long time tends to decrease as a result of many factors, chief among which consider the lack of sufficient own funds to upgrade the machine-tractor fleet. As an effective source of funding the investment in agricultural machinery is offered more extensive use of financial leasing.

Prospects for further research this issue is the rational study the composition and structure of logistics for the intensification of agriculture in the region.

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