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Study of structural imbalances in agricultural engineering

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Abstract. The authors emphasized that the development of the agricultural machinery industry is inextricably linked with the development of agricultural production, and consequently, changes in land use forms and the development of agricultural science, which, in turn, are conditioned by the current socio-political conditions and progress in the field of agricultural knowledge. It is proved that the impetus for the development of domestic agricultural machinery is the agricultural holdings. The authors focused on the fact that state support and regulation of the agricultural machinery market was proposed by stimulating the renewal of the technical park through the improvement of financial leasing, the reduction in the cost of medium- and long-term loans, and the improvement of the procedures for putting equipment into operation. It is noted that in order to preserve the process of updating the machine and tractor fleet and high-tech equipment in agriculture, it is necessary to ensure the effectiveness of state programs to support domestic agricultural enterprises, which will allow the restoration of their financial viability, and this in turn will serve as an impetus to the development of the market of agricultural machinery due to the growing demand for technical means.

1 Introduction

Agricultural engineering is a knowledge-intensive industry, in this regard, an important factor influencing its development is the level of scientific and technological progress. Mechanical engineering is one of the most important branches of the economy, since any production is provided with machinery and equipment, and the population is provided with consumer goods. Consequently, the industrial potential of the country and competitiveness in foreign markets depend on the level of development of mechanical engineering.

Mechanical engineering is an extremely important and complex intersectoral complex of the economy of Ukraine, which plays a leading role in the formation and improvement of the material and technical base, implements the achievements of scientific and technological progress, provides comprehensive mechanization and automation of production. However,

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today this industry, the state of which is one of the main indicators of the economic and industrial development of the country, is in a difficult economic situation.

Research of financial and economic activity at Agricultural Engineering Enterprises was carried out by such scientists as Abuselidze, 2021; Abuselidze et al., 2022; Abuselidze & Slobodianyuk, 2022; Andriushchenko et al., 2021; Bojnec & Žampa, 2021; Chomanov et al., 2019; Dadayan et al., 2020; Dalisova & Yamshchikov, 2021; Datsii et al., 2021; Glushchenko et al., 2020; Hutsaliuk et al., 2020; Isaeva et al., 2020; Kostornoi et al., 2021; Leonov et al., 2021; Mandrykin & Pakhomova, 2020; Ozerova & Sharopova, 2021; Panova et al., 2020; Semenyshena et al., 2021; Sklyarov et al., 2021; Slobodianyuk et al., 2019; 2021; Shvets et al., 2013; Tkach et al., 2019; Valaskova et al., 2020; Zakirova et al., 2020.

The implementation of integration processes is an important element of the overall process of socioeconomic development of the company. The main provisions of the integration strategy of the jointstock company should follow and be fully consistent with other aspects of strategic planning of JSC development (Hutsaliuk et al., 2020).

Under appropriate conditions, domestic enterprises need to improve and constantly adapt existing evaluation methods by creating a system of evaluation indicators - indicators that serve as criteria for determining the prospects for further economic and environmental expertise of environmentally oriented investment projects (Shvets et al., 2013).

In this context, the issue of ensuring the effectiveness of this mechanism is extremely important, as the action of the first international mechanism of low-carbon development has proved that the Kyoto mechanisms have not had a positive impact on the situation with carbon emissions in the world (Datsii et al., 2021).

To objectively identify the key factors of development of innovation processes in agricultural engineering, a list of indicators that allow assessing the state of the industry qualitatively and quantitatively and solving problems was formed during the study (Andriushchenko et al., 2021).

However, a comprehensive, systematic approach to the financial and economic activities of agricultural machinery enterprises has not yet received sufficient theoretical and practical justification.

The purpose of the article is the substantiation of theoretical and methodological provisions and the development of practical recommendations for the formation of a system of financial and economic activities of agricultural machinery enterprises.

2 Methods

In the process of work, the following research methods were used: historical and retrospective review - to characterize the processes of formation and development of machine-building enterprises in Ukraine; system, situational and process approaches to determining the essence of financial and economic management of agricultural machinery enterprises; abstract-logical; strategic analysis; statistical and technical-economic; economic and mathematical modeling.

3 Results and Discussion

Agricultural engineering traditionally occupies an important place in the structure of the machine-building complex of Ukraine. It focuses on the areas of agricultural production, and its placement is associated with the zonal specialization of agriculture.

The development of the agricultural machinery industry is inextricably linked with the development of agricultural production, changes in land use forms and the development of agricultural science. Which, in turn, are conditioned by the current socio-political conditions

and progress in the field of agricultural knowledge. The second factor influencing the development of agricultural machinery is scientific and technological progress, the historical march of which makes it possible to technically improve both agricultural machinery and equipment and technologies for their production.

The largest centers of agricultural engineering are Kharkiv (motors for self-propelled combines), Odessa (tractor plows), Kirovograd (seeders), Dnepropetrovsk and Ternopil (beet harvesters), Kherson (corn harvesters, the production of grain harvesters is being created), Berdyansk (harvesters).

In accordance with the state target economic program for the development of domestic mechanical engineering for the agro-industrial complex until 2020, agricultural engineering of Ukraine is a strategically important branch of the state economy, which forms and has a significant impact on production volumes, production costs and prices for basic types of food for the population of the country. The concept of the state target economic program for the development of domestic mechanical engineering for the agro - industrial complex stated: reducing the volume of equipment output; closure of enterprises; low competitiveness of the industry's products, physically and morally worn-out production base, etc. Now the situation has not changed, and according to some indicators it has also worsened (Table 1).

Table 1. Production of certain types of machinery and equipment for agriculture and forestry for 2014-2020, units.

Product Name	2014	2015	2016	2017	2018	2019	2020
Tractors for agriculture and forestry	6847	5280	4273	4121	4206	4894	4661
Plows	6115	15403	6203	4446	3672	2068	1623
Baking powder and cultivators	7396	4652	4358	3739	3440	3607	3141
Disc harrows	7421	1645	1975	2044	2252	2799	3027
Harrows (except disc harrows)	11054	7500	7769	7881	5815	8642	6738
Agricultural, garden seeders	2806	1898	2381	2236	2806	4520	3959
Organic and inorganic fertilizer spreaders	1	1	384	508	252	480	945
Agricultural, forestry machines; lawn and sports field rinks	2599	1696	1833	2417	3067	3569	3047
Tractor mowers, including mounted cutting mechanisms designed to drive or tow a tractor	1710	2182	2307	2609	2463	3729	3272
Potato diggers and potato harvesters	1	292	2067	1135	561	—	—
Combine harvesters	399	59	68	...1	100	154	65
Portable mechanical devices, whether equipped with an engine or not, for spraying or spraying liquid or powdery substances, thousand pieces	672	692	815	985	640	800	643
Sprinklers and sprayers of liquid and powdery substances installed on the tractor	844	1099	831	804	800	816	1048

Self-loading trailers and semi-trailers	3342	2931	3135	2044	1666	2738	3260
Machines for the preparation of animal feed, thousand pieces	161	123	102	98,7	63,2	74,8	46,1
The volume of sales of mechanical engineering products (codes 26+27+28+29+30), billion UAH	130,0	140,5	113,5	101,9	115,2	130,2	130,0
% to industry	10	10	8	7	6,5	6,1	6,8
The volume of sales of agricultural machinery products (code 28.3), billion UAH	4,83	4,55	3,67	4,13	6,29	7,64	9,26
% to mechanical engineering	3,7	3,3	3,2	4,1	5,5	5,9	7,1

Source: Compiled according to the State Statistics Service.

In January-November 2020, compared to the same period in 2019, the production of tractors for agriculture and forestry increased by 6%, disc harrows - by 17.6%, the production of plows, seeders, cultivators, mowers is stable, and the production of spreaders increased 2.7 times, sprayers - by 41.6%, trailers - by 27.4%. In monetary terms: in 2014, the sale of agricultural machinery products amounted to UAH 4.826 billion (3.7% of machine-building products), then in 2020 – UAH 9.26 billion (7.1%). That is, the dynamics of agricultural engineering has become more positive.

The mechanism of state support for agricultural machinery is based on a number of regulations. In particular, compensation for the purchased Ukrainian agricultural machinery occurs in accordance with the Procedure for using the funds provided for in the state budget for partial compensation of the cost of agricultural machinery and equipment of domestic production.

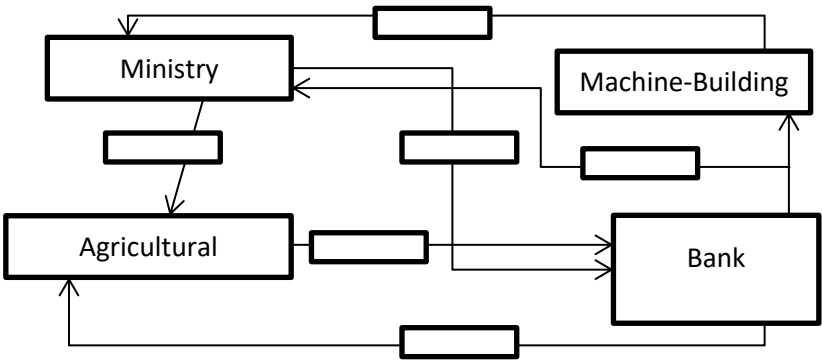


Fig. 1. Mechanism of partial compensation of the cost of agricultural machinery and equipment of domestic production

Source: compiled according to Ministry of Economy of Ukraine, (2021)

Symbols:

- 1.Machine-building enterprises apply for participation in budget programs;
- 2.The Ministry is forming a list of agricultural machinery, the cost of which will be partially compensated to farmers from the budget;

3. Agricultural producers pay machine builders for machinery and equipment included in the List through state and other banks with a state share of 75%: Oschadbank, Ukreximbank, Privatbank, Ukrgasbank;

4. The agricultural manufacturer opens an account in one of these banks and submits to him an application and a package of documents: - a copy of the payment order; - an act of acceptance and transfer of equipment and equipment: - a certificate of state registration of equipment (if the equipment is subject to mandatory state registration);

5. The State Bank provides the Ministry with information on the amount of funds subject to partial compensation;

6. A special fund forms a register of agricultural producers and transfers funds to the state bank within the scope of open allocations from the register;

7. The Bank transfers compensation funds for equipment within 20% to the current accounts of Agricultural enterprises to producers.

The government has decided to use budget funds to partially compensate farmers for the cost of Ukrainian agricultural machinery and equipment with a forecast that will increase the purchasing power of agricultural producers and upgrade the technical park by reducing the cost of purchased machinery and equipment of Ukrainian production, and will also stimulate the production of machinery and equipment by Ukrainian agricultural machinery enterprises.

The Commission under the Ministry of Economic Development approved a list of agricultural machinery of Ukrainian production, 20% of the cost of which is compensated from the state budget. The specified list includes 40 Ukrainian manufacturers — almost 800 types and brands of machinery and equipment. Among them, in particular, PJSC "Kharkiv Tractor Plant", SE "PO Southern Machine-Building Plant named after Makarova", LLC "NPP Belotserkovmaz", PJSC "Berdyansk harvesters", LLC "Orikhovselmash", LLC "Soyuz-special equipment".

In 2020, compared with 2018, there was also a decrease in the vast majority of varieties of agricultural machinery, although the list of varieties of machinery for which there was a slight increase in its number increased slightly. In 2020, compared to 2018, an increase in the number of the following types of equipment was observed: sprinkler machines (+10.21%), roller harvesters (7.36%), mowers (+2.67%), seeders (+2.38%), tractors (+1.75%), combine harvesters (+0.63%).

Thus, in 2021, there is a positive trend towards increasing the number of technical means both in all agricultural enterprises and in farms, in particular.

Table 2. Structure of the agricultural products market in the context of the main groups of machinery

Technical means	Main trademarks	Market share in value terms
Combine harvesters	Imported: "Klaas" (25.3% of the total import of combines to Ukraine), John Deere (17.4%) and Polesie (Gomselmash, Belarus) (15.1%)	99,5%
	Domestic: "Slavutich" manufacturer "Kherson Machine-building Plant"	0,3%
Tractors	Imported: MTZ (47.2% of total imports)	88%
	tractors in Ukraine, "John Deere" (19%)	10,5%

It is proved that "the purchasing power of Ukrainian enterprises for the purchase of equipment annually amounts to only UAH 5-7 billion with an annual market capacity of UAH 22-28 billion. That is, the technological need is covered by only 15-20%. Most agricultural enterprises are practically unable to purchase modern equipment and combined machines." In order to preserve the process of updating the machine and tractor fleet and

high-tech equipment in agriculture, it is necessary to ensure the effectiveness of state programs to support domestic agricultural enterprises, which will allow the restoration of their financial viability, and this in turn will serve as an impetus to the development of the primary and secondary agricultural machinery market due to the growing demand for technical means.

Analysis of the functioning of machine-building enterprises in modern market conditions indicates that external changes are divided into two types: continuous and intermittent. Continuous changes in the environment occur slowly and are quite predictable. With external changes of this kind, the company has time to adapt to new problems and implement new opportunities (Table 3).

Table 3. Analysis of macro-environment factors essential for machine-building enterprises

Macro environment components	Macroenvironment factors	Development trend	The nature of the impact on the company (negative; positive)	Company reaction
Political	Political instability	Possible stabilization	Political struggle to introduce instability into the company's activities	Instability of partnerships
Economic	Inflation rate	Possible stabilization	depreciation of funds; payments on long-term loans; the possibility of obtaining working capital	Provides for indexing of payments in case of their delay in contracts; buying and selling currency
	Production development	Possible stabilization	decline in production; the possibility of expanding the range	Modernization of production in order to produce new types of products
	Structure of investment activity	Possible stabilization	the dynamics of investment processes weakly correlates with the needs of the real sector in innovative technologies and materials; increasing the share of investment in innovative sub-sectors of mechanical engineering	
Scientific and technical	Innovations in the product range	Slowing down	expansion of sales markets;	Development and release of

			improving competitiveness; additional costs for innovation.	new types of products
	Innovation in the use of technology	Slowing down	improving competitiveness; additional costs for innovation	The possibility of expanding production and entering new markets
	Technological structure of industrial production	Slowing down	preservation of the inefficient structure of industrial production with the predominance of lower technological structures	

Source: compiled by the author based on the generalization of the study

As a result of the analysis, the composition of the most influential factors, the trends of their development, the nature of the impact on the enterprise, as well as possible actions of the enterprise as a response to the manifestation of factors are established. Factors and conditions of the general external environment do not have a direct effect on the operational activities of the enterprise, but they determine strategically important decisions made by its management. The impact of these factors on the enterprise is manifested in the form of opportunities, the use of which can positively affect the activities of the enterprise, as well as threats characterizing such factors that, when implemented, pose a danger to the enterprise.

4 Conclusions

During the study period, the volume of sales of industrial products decreased. The negative dynamics of industrial development indicates significant risks for the prospects of modernization of the national economy and economic dynamics in general. "The main negative factors determining the downward indicators of the industry during the intensive deployment of the economic crisis are: falling solvency of enterprises; the increase in the cost of production. The synergistic effect of the simultaneous action of these destructive factors has led to a crisis rate of decline in industry." Mechanical engineering largely depends on the development of the economy of Ukraine and the CIS countries, therefore, all the negative phenomena caused by the global crisis caused a drop in the production of machine-building products. During the period under study, the dynamics of machine-building production showed a steady trend of slowing down.

An important factor in the slowdown in industrial development was the decline in investment dynamics. By types of economic activity, mechanical engineering is the main manufacturer and supplier of high-tech products. A small number of industrial enterprises introduced innovations into their activities: carried out complex mechanization and automation of production, introduced new technological processes, they mastered the production of innovative types of products. The current level of investment in mechanical engineering does not meet the needs of structural renewal and extensive modernization of the industry's production base.

An important factor contributing to the growth or decrease in the level of variability of the external environment is the economic policy of the state, stimulating or dampening

business activity. The rise of domestic engineering is largely determined by the scale of technical re-equipment. But there is a situation when in many cases this is possible only with the use of imported materials and equipment.

References

1. G. Abuselidze, *Use of hedging instruments on example of grain market*. 20th International Scientific Conference Engineering for Rural Development Proceedings, pp. 1655-1662 (2021). doi: 10.22616/erdev.2021.20.tf359
2. G. Abuselidze, K. Alekseeva, O. Kovtun, O. Kostyuk., L. Karpenko, *Application of Hedge Technologies to Minimize Price Risks by Agricultural Producers*. Lecture Notes in Networks and Systems. **246**, 906–915 (2022). doi: 10.1007/978-3-030-81619-3_101
3. G. Abuselidze, A. Slobodanyk, *Marketing Aspects of the Key Issues of Agricultural Machinery in the Industrial Enterprises*. Journal of Optimization in Industrial Engineering. **15(1)**, 311-320 (2022). doi:10.22094/JOIE.2021.1921197.1819
4. E. Aliev, V. Bandura, V. Pryshliak, V. Yaropud, O. Trukhanska, *Modeling of mechanical and technological processes of the agricultural industry*. INMATEH-Agricultural Engineering, **54(1)**, 95-104 (2018).
5. K. Andriushchenko, O. Datsii, O. Lavruk, R. Dmytrenko, I. Kutashev, I. Vinichenko, D. Mishchenko, Y. Kakhovych, K. Pivovarov., G. Ortina.: *Development of a matrix of food industry capacity for making management decisions in the formation of sustainable development of agroecosystems*. Eastern-European Journal of Enterprise Technologies, **2(13(110))**, 16–27 (2021). doi:10.15587/1729-4061.2021.227805
6. Š. Bojnec, S. Žampa, *Subsidies and Economic and Financial Performance of Enterprises*. Journal of Risk and Financial Management, **14(11)**, 505 (2021). doi: 10.3390/jrfm14110505
7. U. Chomanov, T. Tultabaeva, G. Kenenbay, M. Tultabaev, E. Shoman, *Development of industrial and agricultural enterprises on the basis of innovation management*. Journal of Advanced Research in Law and Economics. **10(8)**, 2297-2304 (2019). doi: 10.14505/jarle.v10.8(46).08
8. E. Dadayan, A. Storozheva, E. Letyagina, *Impact of economic risks on the financial stability of agricultural enterprises*. E3S Web of Conferences. **161**, 01065 (2020). doi: 10.1051/e3sconf/202016101065
9. N. Dalisova, A. Yamshchikov, *Risk management in the export activities of agricultural enterprises*. IOP Conference Series: Earth and Environmental Science. **839(2)**, 022027 (2021). doi: 10.1088/1755-1315/839/2/022027
10. O. Datsii, N. Levchenko, G. Shyshkanova, R. Dmytrenko, , G. Abuselidze, *State Decoupling Audit of Low-Carbon Agricultural Production*. Rural Sustainability Research. **45(340)**, 94-112 (2021). doi: 10.2478/plua-2021-0011
11. O. Datsii, N. Levchenko, G. Shyshkanova, O. Platonov, G. Abuselidze, *Creating a Regulatory Framework for the ESG-investment in the Multimodal Transportation Development*. Rural Sustainability Research. **46(341)**, 39-52 (2021). doi: 10.2478/plua-2021-0016
12. A. Glushchenko, M. Slozhenkina, E. Samedova, D. Mosolova, *Financial risks of sustainable development of small agricultural enterprises assessed to ensure national food security*. IOP Conference Series: Earth and Environmental Science. **548(8)**, 082061 (2020 doi: 10.1088/1755-1315/548/8/082061

13. O. Hutsaliuk, V. Koval, O. Tsimoshynska, M. Koval, H. Skyba, *Risk management of forming enterprises integration corporate strategy*. TEM Journal. **9(4)**, 1514-1523 (2020). doi: 10.18421/TEM94-26.
14. O. Isaeva, M. Kabanenko, A. Chistyakov, L. Dubrova, N. Filin, *The key factors for development of Russian agricultural enterprises of various business patterns*. E3S Web of Conferences. **175**, 13022 (2020). doi: 10.1051/e3sconf/202017513022
15. O. Khodakovsky, O. Mohini, *The Modern State Agricultural Policy of Ukraine: problems of countries with transition economy*. Public policy and administration, **17(4)**, 526-538 (2018). doi: 10.13165/VPA-18-17-4-03
16. S. Kostornoi, O. Yatsukh, V. Tsap, I. Demchenko, N. Zakharova, M. Klymenko, W. Tomaszewska-Górecka, *Tax Burden of Agricultural Enterprises in Ukraine*. Agricultural Engineering. **25(1)**, 157-169 (2021). doi: 10.2478/agriceng-2021-0013
17. O. Leonov, G. Temasova, N. Shkaruba, Y. Vergazova, *Methods for analyzing the costs of the process at mechanical engineering enterprises of the repair profile*. IOP Conference Series: Earth and Environmental Science. **677(2)**, 022033 (2021). doi: 10.1088/1755-1315/677/2/022033
18. A. Mandrykin, Y. Pakhomova *Methods for assessing the efficiency of investment programs of energy enterprises in the agricultural sector*. E3S Web of Conferences. **175**, 13001 (2020). doi: 10.1051/e3sconf/202017513001
19. Ministry of Economy of Ukraine.: Programs and Plans of Economic and Social Development. (2021). <https://me.gov.ua/Documents/List?lang=en-GB&id=ff38c1e3-2331-4c21-a798-183d54ca83bf&tag=ProgramsAndPlansOfEconomicAndSocialDevelopment>
20. M. Ozerova, A. Sharopatova, *Financial risks and their impact on the economic security of agricultural enterprises*. IOP Conference Series: Earth and Environmental Science. **839(2)**, 022090 (2021). doi: 10.1088/1755-1315/839/2/022090
21. N. Panova, A. Malofeev, A. Voronkin, E. Likholetov, A. Likholetov, *Financial and legal policy in the agricultural sector of the region and features of its implementation*. E3S Web of Conferences. **175**, 13043 (2020). doi: 10.1051/e3sconf/202017513043
22. N. Romanova, N. Anisimova, I. Provotorov, *Application of budgeting tools to cut structural imbalances in regional development*. MATEC Web of Conferences. **239**, 08017 (2018). doi: 10.1051/mateconf/201823908017
23. N. Semenushena, O. Radchenko, A. Zelenskyi., N. Khocha, U. Pelekh, *Development of the institutional accounting for the needs of financial regulation: experience in the agricultural sector of Ukraine*. Independent Journal of Management & Production. **12(6)**, S702-S720 (2021). doi: 10.14807/ijmp.v12i6.1760
24. I. Sklyarov, Y. Sklyarova, S. Gorlov, O. Mandritsa, G. Narozhnaya, *Influence of Financial and Economic Factors on the Sustainable Development of Russian Agriculture*. Lecture Notes in Networks and Systems. **205**, 329-337 (2021). Springer, Cham. doi: 10.1007/978-3-030-73097-0_37
25. A. Slobodanyk, G. Abuselidze, *Prospective of Provision of Dairy Products for the Population of Ukraine*. E3S Web of Conferences. **135**, 01019. doi: 10.1051/e3sconf/201913501019
26. A Slobodanyk, G. Abuselidze, V Lymar, *Economic efficiency of oilseed production in Ukraine*. E3S Web of Conferences. **234**, 00001 (2021). doi: 10.1051/e3sconf/202123400001

27. V Shvets, E. Rozdobudko, G. Solomina, *Aggregated methodology of multicriterion economic and ecological examination of the ecologically oriented investment projects*. Naukovyi Visnyk Natsionalnoho Hirnychoho Universytetu. **3**, 139-144 (2013).
28. V. Tkach, E. Makarenko, T. Kushnarenko, V. Eremenko, E. Rusina, K. Oleg, *Digital accounting and management of economic processes in the agricultural sector*. IOP Conference Series: Earth and Environmental Science. **403**, 012135 (2019). doi: 10.1088/1755-1315/403/1/012135
29. K Valaskova., P. Durana, P. Adamko, J. Jaros, *Financial Compass for Slovak Enterprises: Modeling Economic Stability of Agricultural Entities*. Journal of Risk and Financial Management. **13(5)**, 92 (2020). doi: 10.3390/jrfm13050092
30. A. Zakirova, G. Klychova, G. Ostaev, Z. Zalilova, A Klychova. *Analytical support of management accounting in managing sustainable development of agricultural organizations*. E3S Web of Conferences. **164**, 10008 (2020). doi: 10.1051/e3sconf/202016410008
31. H. Zhao, Y. Huang, Z. Liu, W. Liu, Z. Zheng, *Applications of Discrete Element Method in the Research of Agricultural Machinery: A Review*. Agriculture, **11(5)**, 425 (2021). doi: 10.3390/agriculture11050425