

Supply of tractors to business subjects in Poltava region. Problems and perspectives

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The development of agricultural production, especially its technical support, requires constant improvement and the introduction of advanced models of mechanization. The relevance of the national and economic problem of the quality of material and technical support of agro-industrial production is substantiated. It is claimed that the forecasting of quantitative and qualitative indicators of the technical condition indirectly affects the technologies used in the fields, in particular in the Poltava region. The results of statistical analysis of qualitative and quantitative indicators of purchased and registered tractors, which are reflected in the single register for keeping automated records of tractors of the agricultural machinery registration department of the Main Department of the State Production and Consumer Service in Poltava region for the period from 2018 to 2023, are given. The trends and dynamics of replacing tractors in the region's farms are given and substantiated, and ways of improving the organizational and technical mechanisms for providing tractors to enterprises and individuals of the Poltava region are recommended, taking into account the current challenges caused by the state of war. The organizational, technical and economic mechanisms for updating the tractor fleet of enterprises and private owners - individuals of the Poltava region have been determined. There is a sharp reduction in the dynamics of the number of purchased and registered tractors and tractor equipment in 2022. The beginning of the war led to a sharp reduction of purchased and registered tractors and tractor equipment by more than two times. Studying the dynamics of the ratio of the use of foreign tractors and tractors of domestic production is no less a painful topic for the state. We have a negative trend towards a significant relative increase in the tractor market of the Poltava region of foreign-made tractors and tractor equipment. A situation arose when the number of foreign tractor models in 2022 and most of 2023 exceeded the registration actions for domestically produced tractors by almost three times. The fact that the absence or insufficient number of domestic manufacturers of agricultural machinery, including tractors, leads to export dependence of the market is statistically confirmed. The consequence of this is a significant increase in prices for spare parts and tracts of foreign production.

Keywords: tractors, spare parts, engineering, registration, analysis, dynamics, forecasting, renovation, agriculture, provision strategy.

Забезпечення тракторами суб'єктів господарювання у полтавській області. Проблеми та перспективи

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Розвиток сільськогосподарського виробництва, особливо його технічне забезпечення, потребує постійного вдосконалення та впровадження передових зразків засобів механізації. Обґрунтовано актуальність народно-господарської проблеми якості матеріально-технічного забезпечення агро-промислового виробництва. Стверджується, що прогнозування кількісних і якісних показників технічного стану опосередковано впливає на технології, які застосовуються на ланах зокрема у Полтавському регіоні. Наведено результати досліджень статистичного аналізу за якісними та кількісними показниками придбаних та зареєстрованих тракторів, що відображені у єдиному реєстрі для ведення автоматизованого обліку тракторів відділу реєстрації сільськогосподарської техніки Головного управління Держпродспоживслужби в Полтавській області за період з 2018 року по 2023 рік. Наведені та обґрунтовані тенденції та динаміка заміни тракторів у господарствах регіону, рекомендовані шляхи удосконалення організаційно-технічних механізмів щодо забезпечення тракторами підприємств та фізичних осіб Полтавської області з урахуванням викликів сьогодення, зумовлених воєнним станом. Визначено організаційно-технічні та економічні механізми оновлення тракторного парку підприємств та приватних власників-фізичних осіб Полтавського регіону. Спостерігається різке скорочення динаміки щодо кількості придбаних та зареєстрованих тракторів та тракторної техніки у 2022 році. Початок воєнних подій призвели до різкого – більш ніж у два рази, скорочення придбаних та зареєстрованих тракторів та тракторної техніки. Дослідження динаміки співвідношення використання закордонних тракторів та тракторів вітчизняного виробництва не менш болюча тема для держави. Маємо негативну тенденцію до значного відносного збільшення на тракторному ринку Полтавської області тракторів та тракторної техніки закордонного виробництва. Склалась ситуація, коли кількість закордонних моделей тракторів у 2022 році і більшій частині 2023 року перевищила реєстраційні дії відносно тракторів вітчизняного виробництва майже у три рази. Статистично підтверджено той факт, що відсутність чи недостатня кількість вітчизняних виробників сільськогосподарської техніки, в тому числі тракторів, призводить до експортної залежності ринку. Наслідком цього є значне зростання цін на запчастини та тракти закордонного виробництва.

Ключові слова: трактори, запчастини, засоби механізації, реєстрація, аналіз, динаміка, прогнозування, оновлення, сільське господарство, стратегія забезпечення.

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Introduction

Agricultural production engineering is a guarantee of the state's sustainable development. The national economic problem of agricultural production engineering quality is gaining special relevance, particularly in the Poltava region. In view of the existing wartime, this problem rapidly becomes crucial.

This situation is due to the fact that there are significant difficulties associated with the export of agricultural products to the foreign market. At the same time, there is a significant increase, almost one and a half times, in the cost of imported agricultural machinery and their components. That is, today's conditions lead to a high price disparity between the market value of agricultural products and the price of production engineering, which occasionally leads to a situation when agricultural production becomes insensible.

However, taking into account the agrarian sector's importance for the economy with regard to the state's food security formation, agrarians find solutions to the crisis situation, even in such complex circumstances. Therefore, this research direction is relevant – the analysis of the current state of the machine-and-tractor park's renovation.

The strategy of providing Ukrainian agriculture with state-of-the-art agricultural machinery and the engineering system development is regulated by the Laws of Ukraine [1, 2]. In these standards, attention is focused on the development of domestic mechanical engineering and the training of highly qualified specialists in engineering specialties for the improvement of the technical service system in the agricultural industry.

The main trends in domestic mechanical engineering are covered by the authors of the paper [3]. Research aspects of the investing system in agricultural machines and the experience of other countries in this matter are covered in papers [4–6]. Nevertheless, the direction of attracting foreign investments and economic models for their implementation is promising [7–9]. A comparison of investment models by our country's example is presented in articles [10–21].

Regarding the aspect of the domestic tractor manufacturing development, the positive points are outlined in the historical essay [12]. The experience of providing material resources to agricultural enterprises of the Kharkiv region in the pre-war period is described in the paper [13]. Also, many scientific publications aimed at the assessment of the modern tractors' market and agricultural machinery in Ukraine, and the determination of mechanisms for improving the organizational and financial component of such research direction [14–22]. Unfortunately, due to the military actions, a significant part of the proposed scientifically based strategies needs certain correction and additional research.

The aim of the study

The aim of the study is to improve the organizational and technical mechanisms for providing tractors to enterprises and individuals of the Poltava region, in view of the challenges caused by the state of war.

Materials and methods

The subject of the study is the identification of organizational, technical, and economic mechanisms for renovating the tractor fleet of enterprises and individuals of the Poltava region.

The methods of mathematical analysis and statistical processing of the empirical data are used.

Results and discussion

The input data for the analytical part of the research are the quantitative and qualitative characteristics of purchased and registered tractors for the research period from 2018 to 2023, which are reflected in the Unified Register for keeping automated records of tractors [20] of the agricultural machinery registration department of the head office of the State Production and Consumer Service in Poltava region.

The following characteristics are listed among the research factors:

1. The registration year of tractors, which is defined as the time period from the moment of documents' submission to the Unified Register for keeping automated records of the agricultural machinery registration department of the Main Department of the State Production and Consumer Service in Poltava region.

2. Entities registering tractor equipment are divided into three conditional groups: individuals; agricultural enterprises, and enterprises engaged in other economic activities.

Based on the data statistical analysis results from the Unified Register, the following charts were built. **Figure 1** shows the dynamics of the tractors and tractor equipment registration in the Poltava region in 2018–2023. The top graph (bar chart) of **Fig. 1** shows the results of tractor registration by year in absolute terms.

As can be seen from this graph, from 2018 to 2021 there is a clear tendency of the generalized trend towards a stable increase in the number of purchased equipment for all three study groups. For example, the maximum amount of purchased equipment was registered in 2021 – 1,183 units were registered by individuals, 301 units were registered by farmers, and 469 tractors were registered by other enterprises. In relative terms (**Fig. 1** – lower diagram), the following values were obtained: 61 % of the total number of tractors were registered by individuals, 15 % – by farmers, 24 % of tractors were registered by other enterprises.

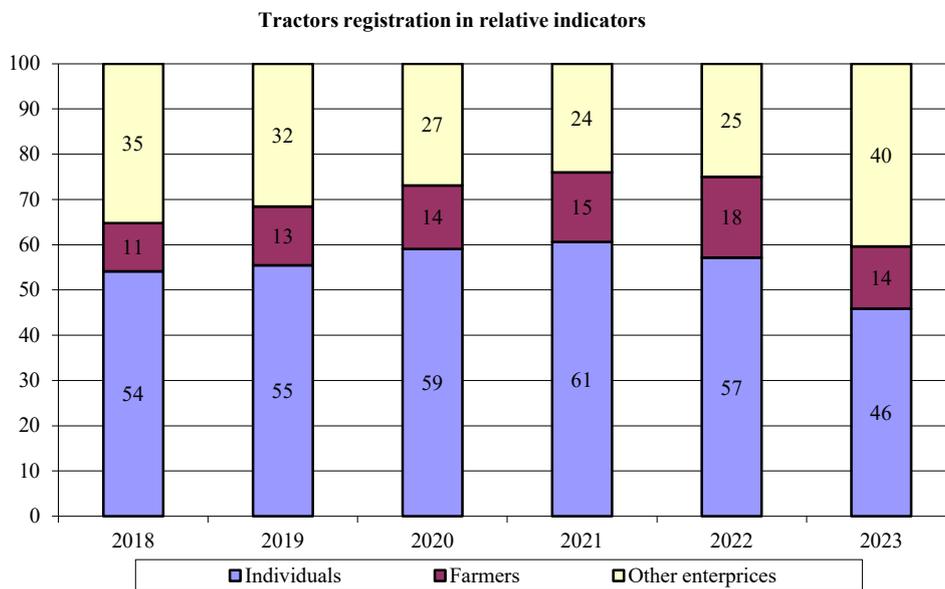
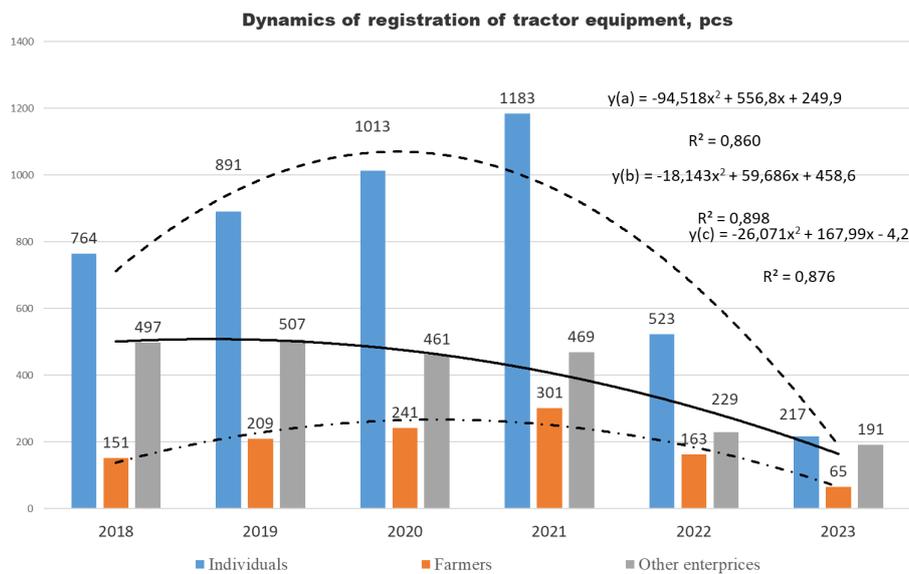


Figure 1. Dynamics of tractor equipment registration in the Poltava region for 2018–2023 in absolute (top) and relative (bottom) indicators

The year 2022 saw a sharp reduction in the dynamics of purchasing and registering tractors and tractor equipment. The beginning of a full-scale invasion of our country and subsequent military events led to a sharp – more than twofold – reduction of purchased and registered tractors and tractor equipment. In relative terms, the activity of the aforementioned business entities had not changed much and, accordingly, was: 57 % of the total number of tractors was registered by individuals, 18 % - by farmers, 25 % of tractors were registered by other enterprises. The year 2023 worsened the activity of the purchased tractor machinery market in the Poltava region by almost two times, although the data for 2023 are not final, the situation may be partially improved after the harvesting of late grain crops and the selling the portion of the agricultural products by agricultural enterprises.

An equally painful topic is the results of dynamics in foreign to domestically manufactured tractors usage ratio (Fig. 2). In 2018–2021, the development of agricultural production and other areas of the economy, where tractors

are used, became the root cause of the growing need to renovate the tractor fleet of the Poltava region. Comparing 2018 with 2021, we notice a positive trend towards an almost threefold increase in the absolute number of purchased tractors of domestic production by business entities of various forms of ownership. In relative terms, studying the dynamics from 2018 to 2021, we have a somewhat stable average ratio of registered domestic and imported tractors. At the same time, the maximum deviation was: 59.6–47.5 %. And the indicators for 2022 and 2023, in addition to the sharp reduction in purchased and registered models mentioned above, contain a negative trend towards a significant relative increase in the number of foreign-made tractors and tractor equipment in the Poltava region. The situation arose that the number of foreign equipment units in 2022 and the majority of 2023 exceeded the registration share of domestically produced tractors by almost three times. The statistical trend of meeting production demand with foreign-made tractors in peacetime was more balanced.

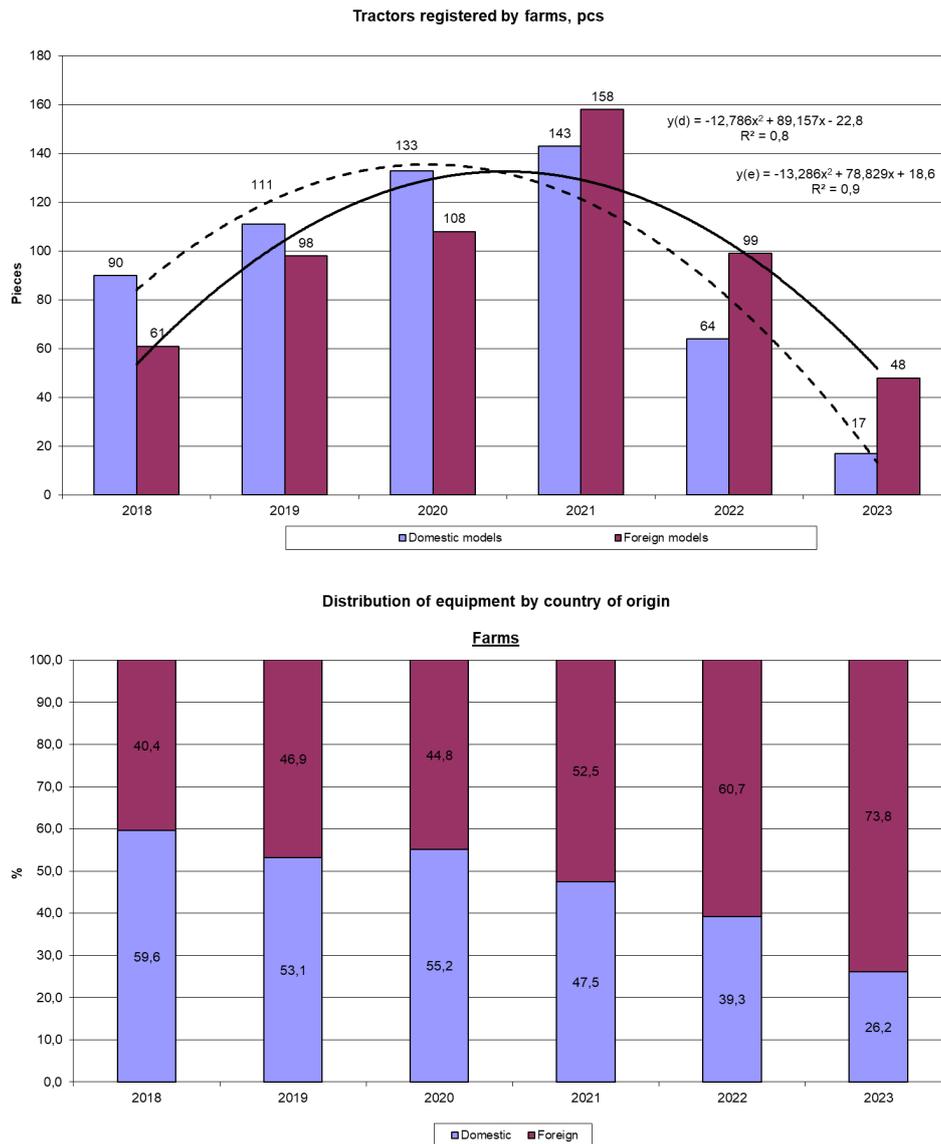


Figure 2. Tractors registered by farms with regards to the country of manufacturer's origin, the top diagram is the absolute number, pcs., the bottom diagram is the percentage ratio, %

A sharp change to an increase in imported equipment occurred during the war in Ukraine. Such a situation additionally slows down the development of domestic mechanical engineering and deepens the problem of technical service of purchased foreign-made tractors. It is necessary to take into account that some of these imported tractors are already used, with a partially depleted resource. The problem is complicated by the lack of qualified service engineers, the pricing policy of both the service itself as well as the high cost of imported equipment's spare parts. Thus, it increases work processing time due to regrouping the logistics ways of goods supplied to Ukraine.

A significant disadvantage in the purchase of imported tractors is the price of its implementation, which is one of the decisive factors in the purchase and selection of the model and power of the machine. The advantage of modern technical solutions, advanced design, and greater reliability of foreign tractors encourage their purchase, including used ones. And the extensive offer on foreign markets (auctions) of tractor equipment leads to the fact that the average enterprise in Ukraine buys

imported equipment on an unplanned basis. In production, we have equipment from different manufacturers, of different age categories, complexity, and operational output. Effectively using and performing technical service of such a tractor fleet is quite burdensome, and in most cases, it is economically inefficient.

We will consider in more detail the absolute and specific indicators regarding the age distribution of tractors purchased and registered in the Poltava region for the period 2018–2023 by farms in the region. The dynamics of this distribution is presented in Fig. 3. According to the research results, the positive point is that the age groups of tractor equipment are dominated by new tractors, and the working life of the latter does not exceed three years. The largest amount of new equipment was purchased in 2021 – 237 units, which accounted for 77.7 % of the total number of purchased and registered tractors that year. The purchase and registration dynamics of tractors from 2018 to 2021 have a clear upward trend. Regarding the absolute quantitative indicators of this comparative period, we see an increase of two or more times.

In 2022 and 2023 – we have a complex situation with regard to the economic development of the Poltava region, and complex conditions of production activity in the agro-industrial sector. We note a decrease almost

twice in 2022 and 2023 in total number of registered tractors. But in this case, the positive point is the relative ratio toward a significant advantage in the number of new machines in the tractor fleet.

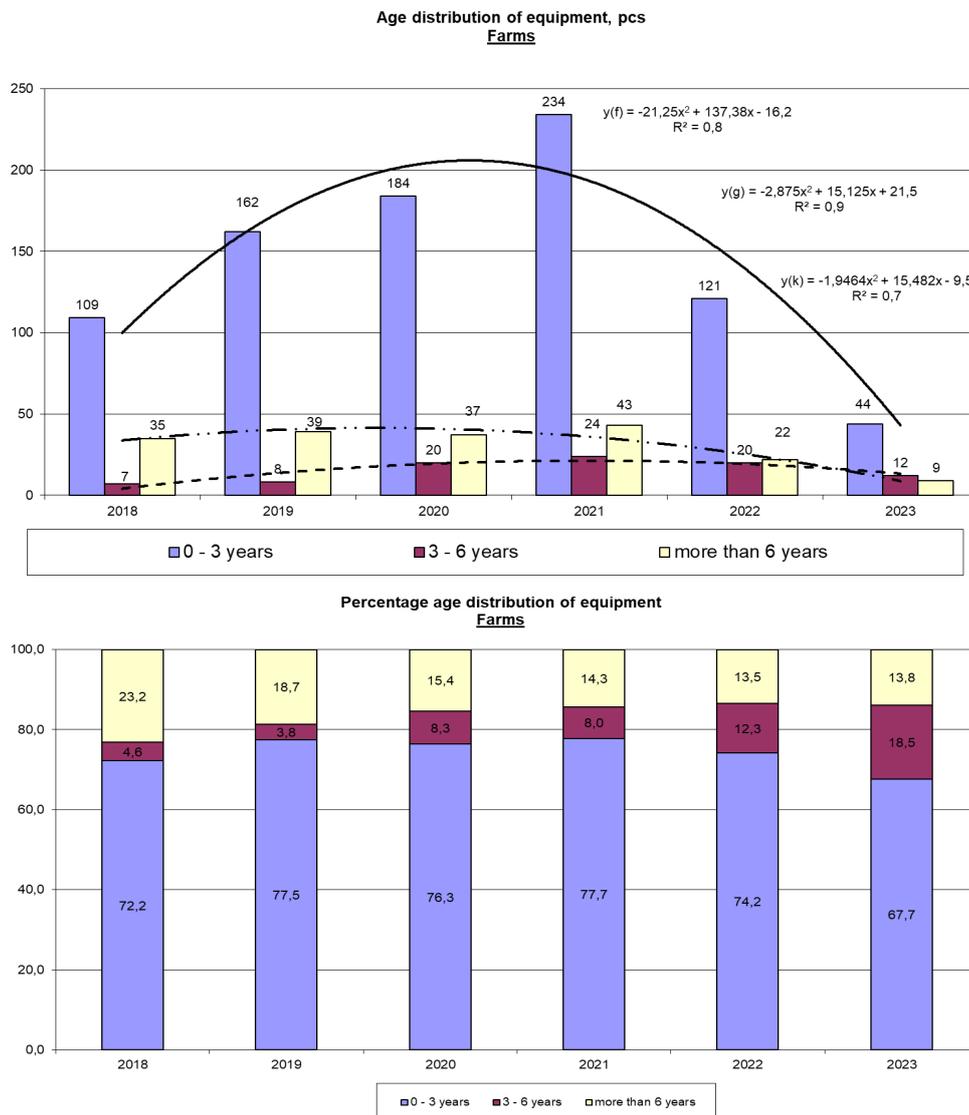


Figure 3. Age distribution of equipment registered by farms, top diagram - absolute indicators, pcs; the bottom diagram - specific indicators, %

Analyzing the trend lines represented by the second-degree polynomials (top diagrams in Fig. 1, Fig. 2, Fig. 3), we notice negative coefficients for the independent second-degree variable in all studied groups of registered tractors. The latter proves the statements made regarding the decrease in the purchasing power of economic entities of various ownership forms during the period of martial law. The main reasons for this are the rapid increase in prices for tractors and tractor equipment, the cheapening of agricultural products, the significant destruction of logistical export corridors, which are confirmed by the results of data analysis in the work of the agricultural machinery registration department of the Main Department of the State Production and Consumer Service in Poltava region for the researched period of 2018-2023, and the period of martial law in 2022–2023.

In order to improve the situation on the highlighted problems, in addition to achieving the strategic goal of

ending the war and overcoming difficult times for the entire country, it is possible to offer the following recommendations.

Business entities of various forms of ownership, which create the demand for tractors and tractor equipment, should pay more attention to the market of domestically produced tractors. The technical lagging of domestic tractor manufacturers compared to foreign equipment can be partially overcome by the creation and development of joint enterprises for the production of such equipment. It is worth lobbying and promoting the possibility of state support, although we understand that we have the state budget of a country at war, and the respective state budget deficit as well.

If the tractor owner preferred imported machinery, it is advisable, practical and scientifically justified to buy machinery of one manufacturer or one brand. In this case, it is easier to solve issues with the effective use of tractors

and the organization of maintenance and repair. At the same time, a reliable dealer (distributor) of tractors and tractor equipment is an important factor in making a managerial business decision to purchase machines of a particular brand.

As difficult as it may seem, the search for internal reserves is an effective way to take for maintenance and functionality restoration of already purchased equipment. The well-known historical experience [19] in the creation and operation of machine-tractor stations made it possible to use tractors more efficiently and to concentrate the relevant repair and diagnostic equipment and highly qualified personnel in their service and repair centers. Nowadays, the revival of machine-tractor stations doesn't seem to be realistic due to the different ownership forms of business entities – owners of tractors and tractor equipment, but at the same time, there is a positive experience of economic co-operation.

In the agricultural industry, it is advisable to pay special attention to energy-saving technologies. The use of tractors and other agricultural machinery for energy-intensive operations (deep loosening of the soil, plowing, deep disking...) should be avoided, replacing them with appropriate biological technologies implemented in advanced enterprises with global experience.

In order to restore and dominate the market of tractors of domestic models, machine-building enterprises, in addition to the reconstruction of the technological base and equipment, need to master new tractor-building technologies, taking into account the experience of the world's leading manufacturers, and implement modern dominant strategies of economic development.

Conclusions

According to the results of a scientific study of statistical data presented in the single register for keeping automated records of tractors of the agricultural machinery registration department of the main administration of the State Production and Consumer Service in Poltava region from 2018 to 2021, there is a clear correlation of a generalized trend towards a stable increase in the number of purchased machinery in all three selected research groups. So, for example, the maximum number of purchased equipment registered in 2021 – 1.183 units were registered by individuals, 301 units were registered by farmers, and 469 tractors were registered by other enterprises.

There is a sharp reduction in the dynamics of the number of purchased and registered tractors and tractor equipment in 2022. The beginning of military events led to a sharp – more than twofold – reduction of purchased and registered tractors and tractor equipment.

The study of the dynamics of foreign to domestic tractor use ratio revealed a crucial problem for the state's mechanical engineering industry. The indicators of 2022 and 2023, in addition to a sharp reduction in purchased and registered tractor models, have a negative trend towards a significant relative increase in the tractor market of the Poltava region of foreign-made tractors and tractor equipment. A situation emerged when the number of foreign tractor models in 2022 and most of 2023

exceeded registration actions for domestically produced tractors by almost three times.

In order to restore and dominate the domestic market, in addition to the reconstruction of the technological base and equipment, machine-building enterprises need to master new technologies of tractor construction, taking into account the experience of the world's leading manufacturers, and implement modern dominant strategies of economic development.

Conflict of interest

The authors state that there is no conflict of interest.

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