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A PROMISING MECHANISM FOR THE MATERIAL SUPPORT OF THE FARMING INDUSTRY (A CASE STUDY OF THE NOVOSIBIRSK REGION)

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Abstract

The ramp-up of the agricultural industry output requires the use of new, high-performance machines, whilst the complicated world economic situation has made it difficult to purchase foreign agricultural equipment. All these factors contributed to an increase in the demand for both domestic and Belarusian equipment. Tractors and various attachments are the most popular type of farm machinery with agricultural producers, which is used in almost all farm works. In this regard, there is a significant load being placed on them which leads to frequent breakdowns. At the same time, the age of tractors in farms of the Novosibirsk Region is mostly more than 10 years, which is also one of the reasons for failing. Most farms are simply unable to regularly update their machine and tractor fleet; therefore, during the spring field works or crop harvesting, it often happens that machines break down and wait for repairs for a long time. This results in crop losses and low yields. It is necessary to develop such a mechanism of the material support for agricultural producers which will help to avoid equipment downtime and lead to an increase in the gross collection.

Key words: *agriculture, tractors, trade-in, after-sales service, MTZ, purchase and sale*

INTRODUCTION

The farming industry of the Novosibirsk Region is a dynamically developing branch of the national economy and one of the drivers of the regional economic development. Because of the growing demand for food commodities, which has been observed in our country in recent decades, agricultural producers are expected to increase production volumes and efficiency, which is impossible without the use of modern high-performance agricultural equipment. The high level of mechanization determines the growth in the volume and quality of farm products. The issue of technical modernization of the farming industry is of big importance for commodity producers, for the state, and for producers and sellers of the agricultural equipment [12].

The machine and tractor fleet of agricultural producers in the Novosibirsk Region is in a rather worn condition, and needs modernization. MTZ tractors are the most popular technique equipment for agricultural producers, which is confirmed by statistical data: about 40% of all tractors in the Novosibirsk Region are the MTZ tractors [2].

The efficiency of farm production depends more on the level of energy supply of farm organizations. The Novosibirsk Region is one of the country's leaders in terms of the pace of technical and technological reequipment of the industry, but at the same time, it is still not enough and the fleet is in a rather worn condition [15].

MATERIALS AND METHODS

The research aimed to develop theoretical foundations and recommended practices for the implementation of the material support mechanism for the farming industry.

The target of research is the organizational and economic relations that arise between agricultural producers and service centers in

the region.

The subject of research is the economic processes and patterns of development of the material and technical resources of the farming industry.

The objects under observation are agricultural organizations and service centers of the Novosibirsk Region.

The information basis of the research is the official materials of the Federal State Statistics Service of the Russian Federation; the Novosibirsk Region territorial body of the Federal State Statistics Service; the latest information of the Ministry of Agriculture of the Novosibirsk Region; the data of statistical and accounting reports of agricultural and processing organizations; normative and legal acts of the Russian Federation, executive and legislative authorities of the regions; scientific publications on the problem under study and other sources.

The theoretical and methodological background of the research is provided by scientific works of domestic agricultural economists on the development of material and technical resources, development and recommendations of research institutes and universities, normative and methodological materials, authorial calculations and generalizations. Various methods of economic research are applied in the work: abstract-logical, statistical-economic, balance, computational-constructive, dialectical, monographic and others.

To determine the profit loss in crop production or animal husbandry, the following formulas were used:

-loss of profit from 1 ha of crops = average crop yield x area of crops x price of crop;

-loss of profit from 1 liter of milk = Average milk yield per 1 cow x volume of milk loss x milk price.

RESULTS AND DISCUSSIONS

With a view to increase the efficiency of the material support of agricultural organizations, we propose the sale of agricultural machinery through the trade-in technology, the essence of which is the acquisition by dealers of used equipment from customers as payment for new equipment [18].

The trade-in agreement allows upgrading the fleet of used equipment without problems associated with its sale in the aftermarket and getting new high-performance equipment with guaranteed quality. Trade-in is designed to make the sale of old equipment safe and to simplify as much as possible the acquisition of new generation equipment, protecting buyers from all sorts of risks that may arise in case of self-sale. This scheme opens up new opportunities for agricultural producers which expand their production, implement new technologies or replace equipment even if they do not have temporary free funds by that time [7].

This mechanism is an effective tool for increasing the material and technical security of agricultural producers in the Novosibirsk Region as well as for increasing the dealer's sales and improving the quality of services provided [4].

Calculation showed that in case of a tractor failure, the replacement tractor delivery mechanism did not work and the farms lost significant money, both in the crop and livestock industries. At the same time, the more the acreage or the number of dairy cows, the greater the loss of production.

Using tractors from a fleet of replacement vehicles will result in the growth in revenue and production efficiency: production profitability up to 35.1%, profitability of sales up to 26%, main production cost recovery up to 101.5%.

Analysis of the use of agricultural producers' machine and tractor fleet in the Novosibirsk Region

Tractors are the kind of machinery that is present in every farm and performs a significant amount of agricultural work [20]. The efficiency of the entire production in an agricultural organization depends on their normal functioning. Figure 1 shows the quantity of tractors in each municipal district of the Novosibirsk Region, as well as the number of repaired machines [9].

According to the number of tractors in 2017, the region's leaders are the Toguchinsky District with 740 units, among which 634 units or 86% are the repaired ones, and the

Krasnozersky District with 750 units, 692 repaired units (92%). Areas with a very little number of tractors are the Severniy District with 55 units, the Ubinsky District with 129 units, and the Moshkovsky District with 130 units. On the average in the region, 93% of all tractors are in good order. Their total number is 10,809 units.

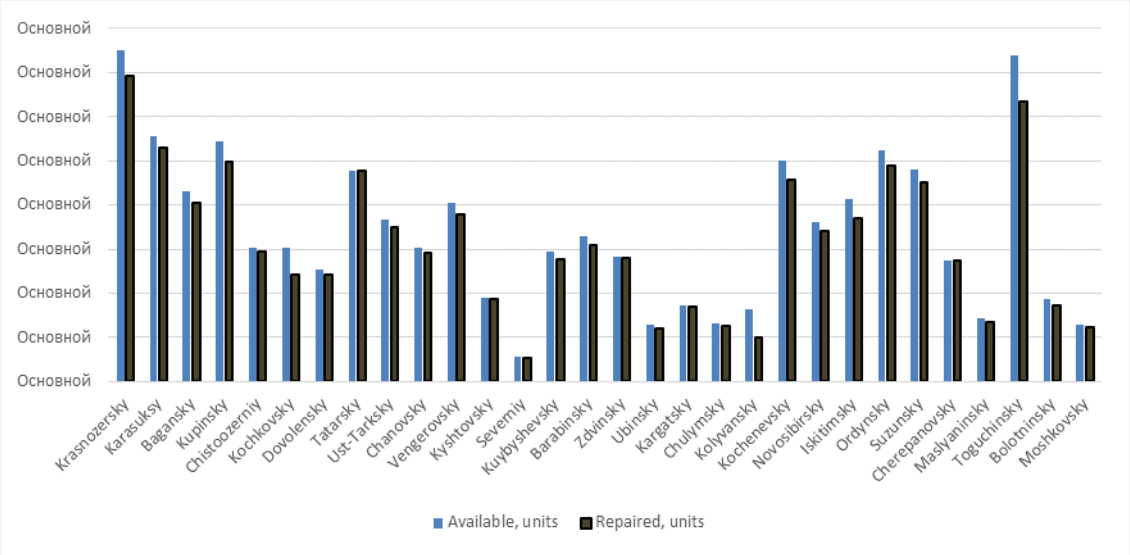

Fig. 1. Distribution of the total number of tractors, including those reconditioned, in the Novosibirsk Region as of July 1, 2017.
Source: http://mcx.nso.ru/

Let us consider the acquisition of tractors by farms in the municipal districts of the Novosibirsk Region in 2016 (Figure 2).

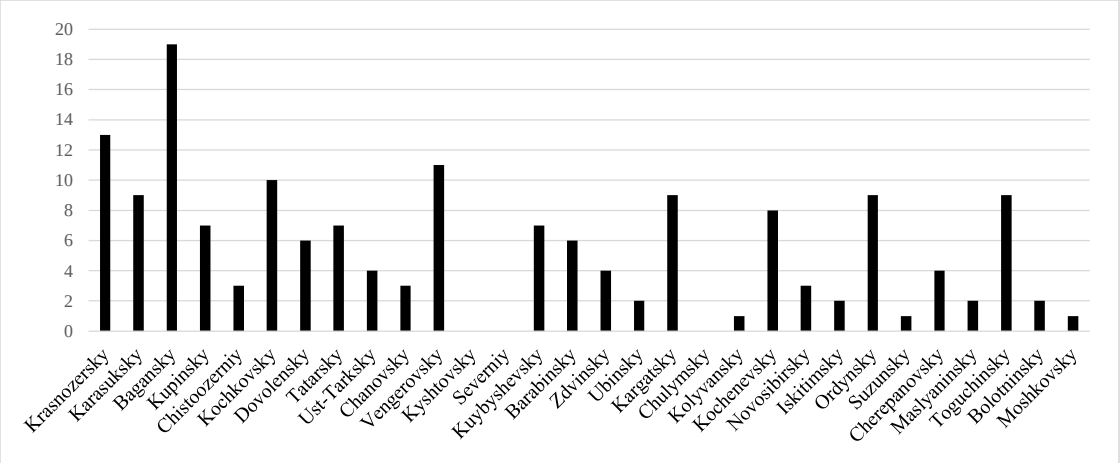

Fig. 2. Number of purchased tractors in the Novosibirsk Region in 2016.
Source: http://mcx.nso.ru/

In 2016, the greatest number of tractors was purchased in the Bagansky District (19 units), and the Krasnozerskksky District (13 units). In Kyshtovsky, Severniy and Chulymsky Districts, no machines were bought.

As already mentioned above, the most common type of machinery at farms are tractors aged mostly more than 10 years (Table 1). The most common model of the tractor in the agricultural organizations of the Novosibirsk Region (about 40% of the total tractor fleet) is the MTZ-80 and MTZ-82. K-700A, K-701 are also quite popular tractors models.

More than half of all available tractors are older than 10 years; at the same time, as for tractors MTZ, only 33% of them can be attributed to this category [3].

Table 1. Availability of tractors with agricultural producers in the Novosibirsk Region in 2016

No.	Brand of machine	Available, in total	Older than 10 years	
			Total	%
1.	K-700A, K-701, K-744	68	68	100.0
2.	T-150K, T-150, KhTZ	56	56	100.0
3.	T-130, T-170, T-100	39	39	100.0
4.	T-4A	1	1	100.0
5.	DT-75, DT-75M	22	21	95.5
6.	MTZ-80, MTZ-82	204	68	33.3
7.	UMZ-6, ZTM-60	8	8	100.0
8.	T-40, T-40AM, LTZ-60	13	12	92.3
9.	T-16, T-25, VTZ-30	8	8	100.0
10.	Other, incl. self-made tractors	91	34	37.4
11.	TOTAL of tractors	517	281	54.4

Source: http://mcx.nso.ru/

According to the Ministry of Agriculture of Russia, deviations in the basic performance criteria are characteristic for more than 30% of the units produced; many tractors provide an average mean time to failure 2 to 3 times lower than the performance standards, since more than half of them have a leak of fuel, oils, have various gaskets damaged, etc. The main types of defects detected during testing are, first of all, poor-quality assembly of machines (10-20% of all failures) and poor quality of welding (9-13%). Up to a third of spare parts and components of agricultural machinery are scrapped. They are bought up at lower prices at the plants by for-profit businesses, and then sold to agricultural producers as high-quality ones. Along with this, they do not bear any pecuniary responsibility for this [11].

In 2016, 4,252 tractors out of 10,809 units underwent a technical check-up, only 273 of them not meeting the safety requirements (Table 2).

Table 2. Results of technical check-up of the Novosibirsk Region agricultural producers' machine and tractor fleet in 2016

	Trailers	**Self-propelled vehicles**	**Tractors**	**Other self-propelled vehicles**
Registered in the inspection of Gostekhnadzor (State supervision of the technical condition of self-propelled machines and other types of equipment)	2,371	17,176	10,809	582
Submitted for technical checkup	595	7,398	5,313	149
Passed technical checkup	547	6077	4,252	141
of them after drawing up a report of technical checkup	94	1166	663	68
including within 20 days from the date of registration of the technical checkup report containing information on the non-compliance of the machine with the safety requirements	17	337	271	0
Total of drawn up acts of technical checkup	129	991	730	6
including for the reasons:				
lack of information on the state fee payment for issuing a technical checkup confirmation document	1	63	52	0
failure to submit documents	45	554	374	0
non-conformity with the data specified in the submitted documents	12	35	31	0
non-conformity with safety requirements	71	339	273	6

Source: http://mcx.nso.ru/

Characteristics of the trade-in technology

All violations associated with the operation of the machine and tractor fleet of agricultural producers result in the fact that the costs of agricultural organizations for the repair and maintenance of the acquired equipment reach 80-85% of their book value over the period of operation. In addition, the constant breakdown of equipment during the execution of technological operations significantly prolong their time, which inevitably leads to lost production [14]. At the same time, the annual scrapping of equipment exceeds new machinery put into service. The improvement of machinery for agricultural organizations in the Novosibirsk Region for the period under review was 7-34%, while it was by 80% due to the acquisition of agricultural machinery used in the operation by other organizations.

With a view to increase the efficiency of the material support of agricultural organizations, we propose the sale of agricultural machinery through the trade-in technology, the essence of which is the acquisition by dealers of used equipment from customers as payment for new equipment [18].

The old equipment acquired from agricultural producers is prepared for exploitation in service centers and goes on sale with warranty [13]. Accordingly, some agricultural producers renew their technical fleet, others get an opportunity to purchase more affordable equipment, while dealers expand the circle of customers and increase the sales results [8].

The purchase and sale of equipment under the trade-in scheme involves the receipt of one machine in exchange for another. The cost of the first one is deducted from the cost of the second one, and the difference is paid either by ready cash or by credit [17].

The term "trade-in" means "repurchase" in English. This is a system of offset whereby used equipment can be used as a means of partial payment for new equipment. This principle of sales has been successfully working in America and Europe for many years. Trade-in is the exchange of a used car for a new or another vehicle [6].

In European countries, the trade-in system has been successfully working for several decades. With the help of this scheme, Western companies are constantly updating their fleet of vehicles, acquiring more and more advanced models of equipment. In Russia, this method of payment is already becoming popular in the sales of motor vehicles. As for trucks, buses, special and farming machinery, this scheme is just beginning to be applied [5].

The old equipment purchased from customers under the trade-in scheme undergoes a predelivery inspection with the replacement of all defective units and assemblies, and then is put up for sale [19].

Advantages of trade-in:

(i)An agricultural producer gets rid of unclaimed equipment with minimum fuss, without wasting time searching for a buyer [10].

(ii)The farmer gets new equipment immediately, and not after the old one is sold.

(iii)The agricultural producer minimizes the amount of money needed for the new equipment.

(iv)The agricultural producer optimizes its tax base.

(v)An agricultural producer forms a machine and tractor fleet for specific tasks, exchanging used machinery that is not needed at this point for new one that is required now [16].

A scheme for selling tractors using the trade-in technology

The uniqueness of the trade-in agreement is that it combines two processes: the sale of the old and the purchase of the new equipment [1].

Figure 3 shows a scheme for selling tractors by OOO "Trading Company MTZ-Sibir" through the trade-in technology.

1. An agricultural commodity producer goes to OOO "Trading Company MTZ-Sibir" to purchase a tractor "Belarus". Then a sales contract or a TRADE-IN sales contract can be concluded with a discount and gift to the buyer in the form of a BELARUS brand wrench kit. Also, a service agreement is concluded, within the framework of which it is possible to purchase a package of services allowing the client to apply for services to OOO "Trading Company MTZ-Sibir". Three types of service packages are implemented in

the organization: - Starter Package: warranty service with a dealer guarantee;
- Basic Package: "Starter package" plus 24-hour service response;
- VIP package "Starter package" plus "Basic package" plus offering of replacement equipment for the period of repair.
2. In case of customer complaint on, in his opinion, a poor-quality service, expressed orally or in writing, and requiring a response, reaction of the manufacturer or seller, service specialists will directly visit the agricultural producer. A minor malfunction will be promptly eliminated, and if complicated repairs are required, the farmer will be provided with a similar equipment from the fleet of replacement vehicles of OOO "Trading Company MTZ-Sibir".

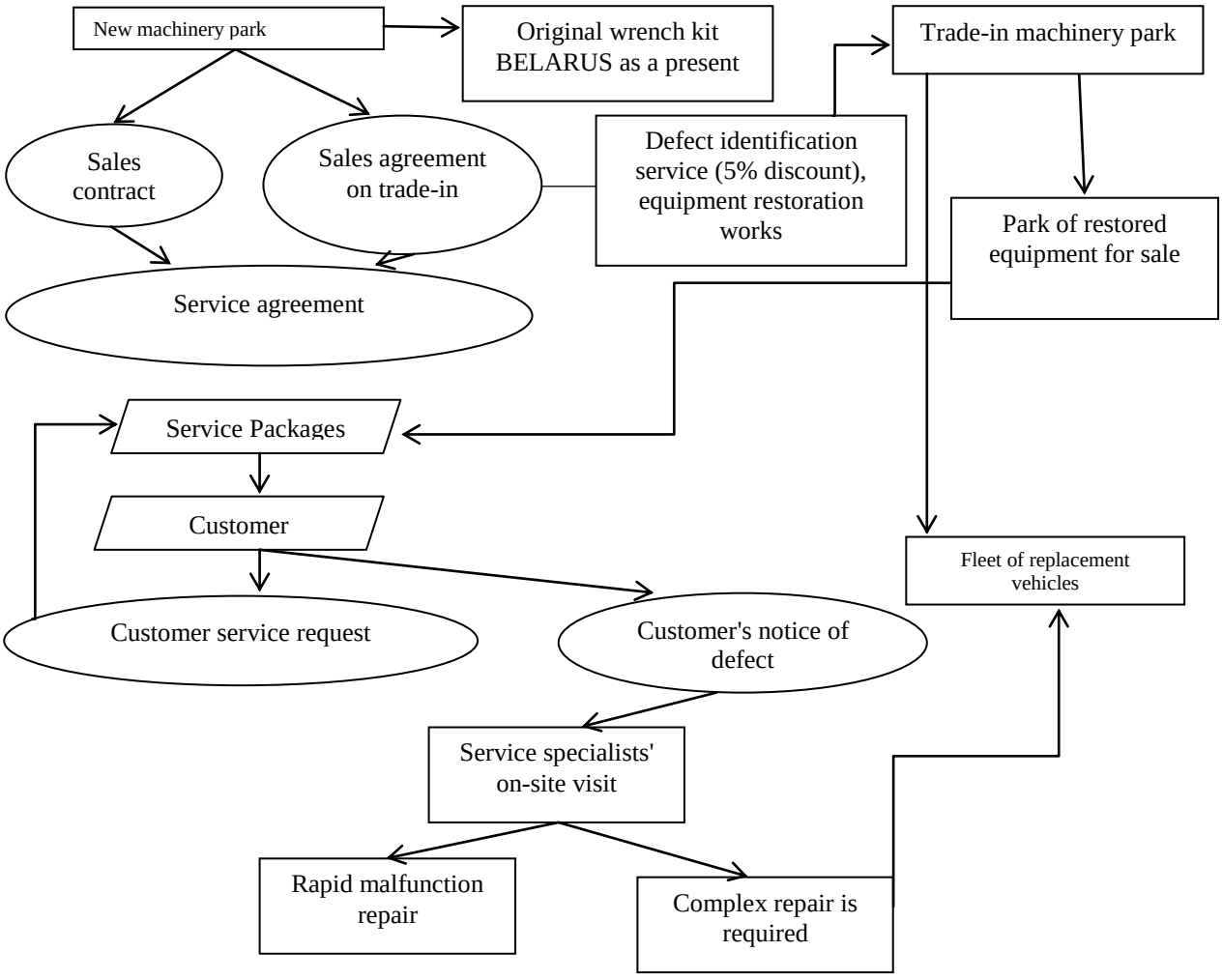

Fig. 3. Mechanism for selling tractors by OOO "Trading Company MTZ-Sibir".
Source: developed by the authors.

The fleet of replacement vehicles is formed through the sale of trade-in sales contracts. After the receipt of used tractors, OOO "Trading Company MTZ-Sibir" carries out a defect identification, as well as works to restore the equipment. As a result, a fleet of replacement vehicles and a fleet of restored equipment are being formed for sale.
In the absence of necessary spare parts and accessories or the occurrence of long-term repairs (complex repairs), the trading company can offer the agricultural producer, for the time of repair, replacement machinery from the TRADE-IN fleet. In case of his consent, an invoice for prepayment is issued and delivery of the equipment is carried out within 5 hours (provided that the remoteness of the farm is not more than 200 km).
OOO "Trading Company MTZ-Sibir" delivers the equipment in accordance with the certificate of delivery and acceptance. After the full repair/renovation of the warranty

claim equipment, the calculation of the replacement equipment use is made and the final bill is issued to the agricultural producer. The acceptance of the replacement equipment is also carried out through the act of delivery and acceptance. If the state of the replacement equipment is different from the act of delivery and acceptance, discrepancies marks are made, and the agricultural producer is billed in the case of his fault.

Aftersales service mechanism

Let us consider in detail the mechanism of aftersales service of OOO "Trading Company MTZ-Sibir". Alongside with the purchase of the tractor, the company concludes a service agreement with the customer with the possibility to purchase one of the above service packages. In case of a customer's complaint about any malfunction of the tractor (notice of defect), first, the company's engineer concludes an agreement with him for the provision of services (to be safe), and, secondly, prepares service teams for visit to the site of breakdown. As already mentioned above, simple breakdowns are eliminated on site, and in case of complex ones, the equipment is transferred according to the act and the replacement tractor is delivered from the trade-in fleet for the period of repair works.

At the same time, the service agreement can be concluded not only with the clients of OOO "Trading Company MTZ-Sibir", but with third-party agricultural producers, too.

A notice of defect is a buyer's claim against the seller or supplier regarding the improper quality of the delivered goods during the warranty period.

In that way, the customer's notice of defect is realized as follows (Figure 4):

(i)A customer's notice of defect on the operation of machinery and equipment during the warranty period can be received by the technical service department either in written or oral form. It is accepted by a service engineer.

(ii)Consideration of the application for warranty repair can be initiated if the machinery and equipment:

(iii)were acquired in "Trading Company MTZ-Sibir" (confirmed by the relevant fiscal documents);

(iv)notices of defect on the operation of the machinery and equipment are made during the warranty period of operation of this machinery and equipment as of the date of the customer's appeal;

(v)were serviced by specialists of the maintenance service department, in accordance with the service agreement (if available).

The service engineer is responsible for the quality of work performed in accordance with the requirements of the service agreement, as well as for accepting the results of the work by the customer, including the completion and signing of the relevant fiscal and basic documents. The acceptance and registration of a customer's notice of defect are carried out continuously.

After receiving a client's claim, notice of defect on the operation of the machinery and equipment (hereinafter notices of defect), the service engineer:

-checks for the availability of a concluded service agreement;

-assesses the conditions on the basis of which the equipment will be repaired.

In the event that a service agreement with the customer is not concluded, the service engineer: sends a request to the client to provide a package of documents for the consideration of the notice of defect.

In the event that the service agreement has been concluded with the customer, the service engineer verifies with the customer the fulfillment of the service agreement terms for the machinery and equipment specified in the complaint. On the basis of the documents' analysis (package of documents sent by the client or the service

agreement), the service engineer draws up and forwards to the immediate supervisor an acceptance conclusion (or refusal) of the notice of defect for approval. The conclusion on accepting a notice of defect may be a phone call or an e-mail containing a notice that repair works during the warranty period will be initiated after the client has agreed on the terms of an on-sight visit and execution of work (Figure 5).

The conclusion on the notice of defect refusal

must be executed in the form of a letter using official or registered correspondence at the stage of consideration of the submitted package of documents and is accepted in the following cases: the contractual warranty period for the machinery and equipment is expired, the installation and operation of machinery and equipment have been performed with violation of its installation and operation conditions; the routine maintenance has not been made, or has not been carried out in full; the notice of defect refers to the machinery and equipment not purchased in the trading company; the received package of documents does not correspond to the requested one, and the submitted documents are issued in violation of the established requirements; there are violations or non-fulfillment of the requirements (conditions) of the contract of sale; there are violations or non-fulfillment of the requirements (conditions) of the service agreement.

Main activities of the service team

The service engineer, following the results of the taken decision, performs the following actions:

(i)if the equipment failure is not recognized as a warranty case, calls up the client, through e-mail or fax sends the client a dismissal of the notice of defect, invites the client to carry out commercial repairs, and issues a provisional invoice;

(ii)if the equipment failure is recognized as a warranty case, specifies information about the nature of the failure, the form of its manifestation, etc., with the purpose of preliminary determining the components, units and assemblies that require repair or replacement (to form a fund of spare parts for the on-sight visit), as well as the probability of the exploitation or manufacture fault;

(iii)in case the client agrees to carry out commercial repairs, requires them to guarantee payment (letter of guarantee);

(iv)after receiving the payment guarantee, organizes a visit to the client.

The service engineer coordinates with the client the terms of departure of the service team for repair works and performs the following actions:

(v)forms the composition of the service team, depending on the complexity group;

(vi)in the event that the customer service is located at a significant distance from the client and the insignificance of the operation of machinery and equipment failure, the service engineer may, in agreement with the immediate supervisor, entrust the elimination of the failure to a third-party organization;

(vii)issues a signed and printed work order to the service team for obtaining spare parts and consumables from the storekeeper;

(viii)instructs the service team on the scope of work to be performed, controls the departure, as well as the preparation of all necessary documents: notice of defect; certificate of completion; invoice.

(ix)notifies the service team of the scope of work to be performed, supervises the departure, as well as the preparation of all the necessary documents (notice of defect, certificate of completion, invoice).

Upon arrival to the client, the service team:

-checks the availability and correctness of registration of the originals of technical and maintenance documentation for the failing machinery or equipment;

-makes a full inspection of the machinery and equipment for detecting violations of operating and maintenance rules.

-if violations of operating and maintenance rules are revealed, notifies the customer about the removal of obligation for warranty, draws up an act of notice of defect, and proposes to eliminate the failure of machinery and equipment on a fee paid basis.

In the event that the client refuses the paid repair, the service team makes a note in the act of notice of defect about the failure in the operation of machinery and equipment by the fault of the client and organizes the signing of the notice of defect by the client.

-in the absence of violations of the rules of operation and maintenance, repairs the machinery and equipment with replacement, if necessary, of damaged parts, assemblies and units with new ones, performs repair work in accordance with agreements with the client.

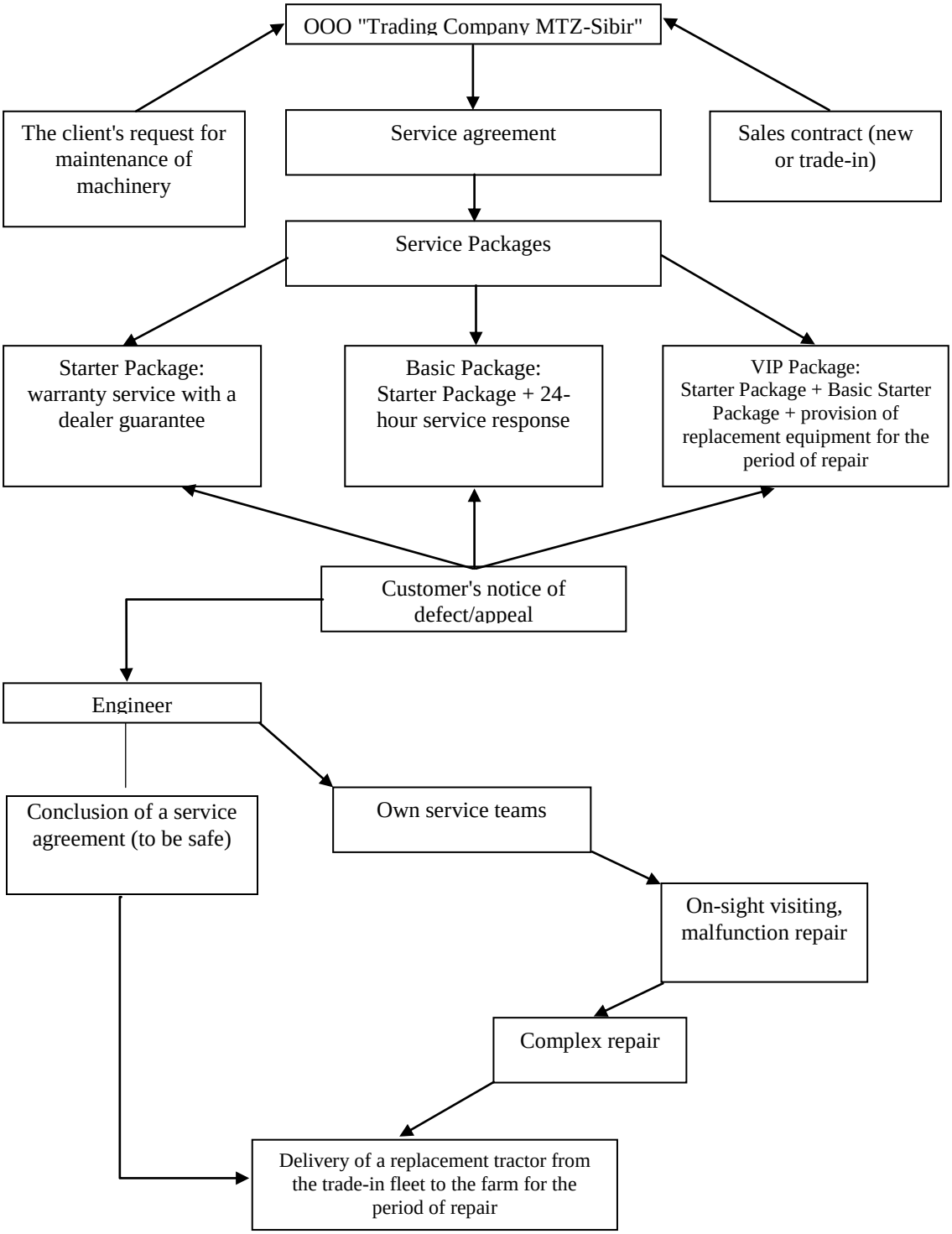

Fig. 4. After-sales service of OOO "Trading Company MTZ-Sibir".
Source: developed by the authors.

When carrying out commercial repairs, the service team transmits the replaced parts, assemblies and units to the customer and issues an invoice. In case of warranty repair, the service team returns the replaced parts, assemblies and units to the warehouse. Regardless of the type of repair (warranty or commercial), the service team, based on the results of the work, makes up two copies of the act of notice of defect and ensures its signing by the client.

-after the completion of the repair work, provides the client with a questionnaire for assessing the customer satisfaction score.

Upon return, the service team hands over a customer satisfaction questionnaire and

documents to the service engineer for releasing an official letter to the client, signs the act of removal of equipment from the warranty service and invoices for the on-sight visit at the immediate supervisor's office.

Specificity of the procedure of the complex repair of equipment

In cases of "complicated repair" (lack of spare parts for repair, repair of equipment for more than 1 day, etc.).

(i)The service engineer, when accepting a notice of defect from the client, initially assesses the scale of repair of the equipment in comparison with a company's capabilities (availability of free service crews, availability of necessary spare parts, conditions for repairs, etc.);

(ii)In the case of "complicated/permanent repair" of equipment, to avoid equipment downtime during the agricultural season and violation of the agrotechnical terms, the service engineer offers the customer a replacement tractor from the fleet of trade in campaign vehicles;

(iii)Given the client's consent, the service engineer:

-chooses the necessary tractor from the trade-in fleet;

-calls up and agrees with the trading company on the delivery of the tractor to the client (a contract with the trading company is concluded in advance);

-calculates the preliminary cost of renting a tractor (the estimated lease time is determined by the tractor's repair time) + shipping cost;

-provides the invoice to the client for tractor rental advance payment, and requests from them a letter of guarantee;

-forms the entire package of documents for the replacement tractor and sends it with the driver to the service team (availability of a laptop and a portable printer within the service team is welcome, as well as a digital device for visualizing the technique during delivery and acceptance);

-when a replacement tractor arrives to the customer, the service team personnel will personally transfer it to the client's representative, after delivery and acceptance, sign the required package of documents and accept from the customer the original prepayment of services guarantee letter;

-the service engineer, having received information from the service team on the tractor's breakdown scale, calls up the customer, and the following is determined:

(a)Repair of the tractor at the customer's sight.

(b)Repair of the reclamation tractor at the service premises of the company (in this case, to motivate the customer, they can be informed that the transportation of the tractor is free of charge).

(c)The customer repairs the tractor themselves (only in case of commercial repairs).

-after the recovery of the client's tractor, they are billed for the services provided (repair + replacement tractor rental);

-after the invoice is paid by the client, the repaired tractor is delivered to them and the replacement tractor is returned according to the certificate of delivery and acceptance. The process of delivery and acceptance of the equipment takes place with the personal presence of a service engineer or service team;

-in the event that a breakdown/defect due to the customer's fault is detected during the delivery and acceptance of the replacement tractor, the service engineer makes a mark in the certificate of delivery and acceptance, notifies/proves to the customer their fault and checks the customer's confirmation of this by their signature (under power of attorney) in the certificate of delivery and acceptance.

When the replacement tractor arrives to the premises of the company, the service engineer performs an identification of defect occurred due to customer's fault, calculates it in terms of value, invoices the customer and monitors the payment from the customer.

Thus, the service system of OOO "Trading Company MTZ-Sibir" is as follows: in case of customer complaint on, in his opinion, a poor-quality service, expressed orally or in writing, and requiring a response, reaction of the manufacturer or seller, the service specialists will directly visit the agricultural producer. A minor malfunction will be promptly eliminated, and if complicated repairs are required, the farmer will be provided with a similar equipment from the fleet of replacement vehicles of OOO "Trading

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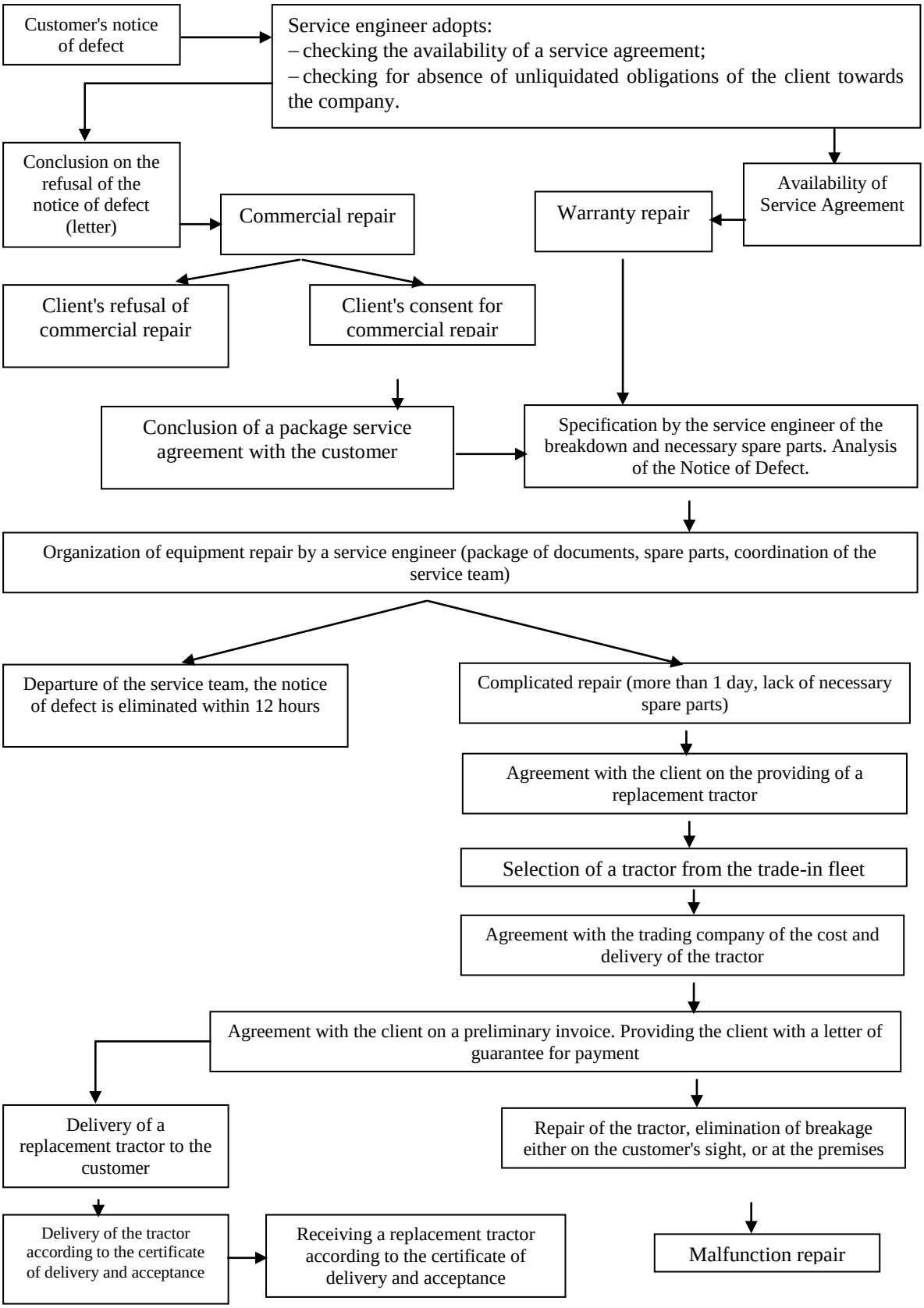

Fig. 5. Algorithm of tractor aftersales service.
Source: developed by the authors.

Losses in crop and animal production as a result of idle machinery

The economic efficiency of the mechanism proposed by us is determined by the reduction in the amount of losses of crop and animal products as a result of the downtime of farming machinery.

Here we calculate the estimated losses per day and per hour (Table 3).

To determine crop losses in crop production due to a tractor failure, we identified 4 types of work carried out by this equipment: tillage, pre-sowing works, sowing and harvesting. Two types of crops were also considered: milling grain (1st class wheat) and coarse grain crops (5th class wheat), which were used to feed animals. The yield index is the average for the last 3 years in the farms of the Novosibirsk Region. For the first type of crops it is 14 dt/ha, for the second one – 17 dt/ha. As a result of determining the approximate losses of crops, it was found that the greatest amount of losses of the1st class wheat occurred during the harvesting period – up to 26.6 kg/ha per day and, respectively, 0.06 kg/ha per hour. For coarse grain crops, the situation was similar, here losses during harvesting and sowing were the same and amounted to 11.9 kg/ha.

To calculate the yield losses in rubles, the average prices for wheat at the end of the year were used during the period from 2015 to 2017. In our case, this was 8,776 rubles per tonne without VAT.

Thus, we identified losses in crop production during the idle time of a single tractor.

Table 3. Crop losses as a result of deviations of the field work completion time from the agrotechnical one

Crop	Type of work	Productivity, dt/ha	Type of CROP	Approximate crop losses, kg/ha		Approximate yield losses, rub/ha	
				per day	per hour	per day	per hour
Milling grain	Tillage	14	1st class wheat	1.54	0.06	13.4	0.6
	Presowing	14	1st class wheat	7	0.29	60.9	2.5
	Sowing	14	1st class wheat	11.2	0.47	97.4	4.1
	Harvesting	14	1st class wheat	26.6	1.11	231.4	9.6
coarse grain crops	Tillage	17	5th class wheat	1.87	0.08	16.3	0.7
	Presowing	17	5th class wheat	8.5	0.35	74.0	3.1
	Sowing	17	5th class wheat	11.9	0.50	103.5	4.3
	Harvesting	17	5th class wheat	11.9	0.50	103.5	4.3

Source: http://mtzsibir.ru/

Now let us calculate the same index for animal production. In this industry, milk losses occur due to untimely feeding of animals and their underfeeding (Table 4).

The intensity of losses in the cases considered differs. As a result of underfeeding of cows in the dry period due to breakage of the tractor, the yield of milk throughout the herd decreases by 10-22%, depending on the degree of underfeeding. In connection with the untimely feeding of animals due to breakage of the tractor, the milk yield is reduced by 5-8% throughout the livestock.

Table 4. Losses in animal production due to idle machinery

Cause of losses in animal production	Average milk yield per cow and day, (l)	Average amount of milk losses, (l/day)	Cost of milk purchase, (rub/l)	Loss of profit from 1 liter, (rub/day)
Underfeeding of cows in the dry period due to breakage of the tractor	11.6	2.6	19	49.4
Untimely feeding of animals due to breakage of the tractor	11.6	0.9		17.1

Source: http://mtzsibir.ru/

On an average in the Novosibirsk Region, the daily milk yield per cow is 11.6 liters, of which 2.6 liters are lost as a result of underfeeding, 0.9 liters - as a result of untimely feeding of animals. The average purchase price for milk is 19 rubles per liter. Accordingly, the loss of profit of farms in the first case is equal to 49.4 rubles/day, and in the second case is 17.1 rubles/day on one cow.

Table 5. Calculation of a tractor's idle time

Index	New equipment	Equipment with a useful lifetime of no more than 10 years	Technique, with a useful lifetime of more than 10 years
% of the time for current repairs and service	5	10	20
Number of days in the agr. season (May-October)	180		
Number of work hours per day (08:00-22:00)	13		

Source: http://mtzsibir.ru/

In connection with the absence in the agricultural organizations of a specially dedicated staff unit for calculating the idle time of equipment during the period of agricultural work, the following action plan of actions was made a rule (Table 5).

Downtime calculation

The algorithm for calculating the downtime is as follows: 5% of working time for the new equipment, 10% for the equipment no older than 10 years, 20% for the equipment older than 10 years. The results of the downtime calculation are presented in Table 6.

Table 6. Tractor downtime

Type of equipment	New equipment		Equipment with a useful lifetime of no more than 10 years		Technique, with a useful lifetime of more than 10 years	
Tractor	No. of days per season	No. of hours per shift	No. of days per season	No. of hours per shift	No. of days per season	No. of hours per shift
	9	0.65	18	1.3	36	2.6

Source: http://mtzsibir.ru/

The older the equipment, the more days in a season it costs: 9 days for the new one, 4 times more – 36 days over for the equipment older than 10 years.

Thus, we determined how long the tractor is idle for one agricultural season and how much money is lost by the farm as a result. However, the mechanism for creating a fleet of replacement vehicles prevents these losses.

In the Novosibirsk Region, this mechanism was tested at four farms: ZAO "Kubanskoe" of the Kargatsky district, ZAO "Bobrovskoye" of the Suzunsky District, OAO "Priobskoye" of the Novosibirsk Region, and ZAO "Skala" of the Kolyvan District. The above organizations purchase tractors from OOO "Trading Company MTZ-Sibir". Table 7 shows the number of tractors in these farms.

We will calculate the loss of money by farms as a result of a tractor failure. The age of tractors is no more than 10 years, accordingly, 1 tractor is idle 18 days in a season. As already mentioned above, we identified 4 types of work, to each of which falls within 4.5 days (uniform distribution).

That is, for the 1st class wheat losses of profits will be:

-13.4 rub/ha × 4.5 days = 60.3 rub/ha during tillage;

-60.9 rub/ha × 4.5 days = 274.1 rub/ha during presowing works;

-97.4 rub/ha × 4.5 days = 438.3 rub/ha during sowing;

-231.4 rub/ha × 4.5 days = 1041.3 rub/ha during harvesting.

With the change of the type of work, the value of the crop, which can be lost, grows. In total, due to the downtime of one tractor, the farm will lose 1,814 rubles per each hectare of arable land.

Let us make a similar calculation for the animal production:

-Owing to the underfeeding of cows, 49.4 rubles are lost per one cow per day.

Downtime is 18 days per season.
-Because of the untimely feeding of animals, 17.1 rubles are lost per one cow per day. Downtime is 18 days per season.

Table 7. Availability of tractors with agricultural producers in the Novosibirsk Region, which are using the replacement vehicles fleet mechanism

Organization Name and Location	Tractor Brand	Quantity, pcs.	Total MTZ Tractors in the Farm, pcs.
ZAO "Kubanskoe", Kargatsky district	Belarus-82.1	13	18
	Belarus-82.1MK	2	
	Belarus-922.3	2	
	Belarus-1221.2	1	
ZAO "Bobrovskoye", Suzunsky district	Belarus-80.1	9	20
	Belarus-82.1	6	
	Belarus-922.3	2	
	Belarus-1221.2	3	
OAO "Priobskoye", Novosibirsk Region	Belarus-80.1	2	20
	Belarus-82.1	12	
	Belarus-1223	3	
	Belarus-1221.2	2	
	Belarus-1523	1	
ZAO "Skala", Kolyvan district	Belarus-80.1	6	26
	Belarus-82.1	15	
	Belarus-920	2	
	Belarus-921	1	
	Belarus-922.3	2	

Source: http://mtzsibir.ru/

The economic efficiency of the aftersales service mechanism

Calculations showed that if, in case of a tractor failure, the replacement tractor delivery mechanism did not work, then the farms under investigation would lose considerable money, for example, ZAO "Kubanskoe" would lose more than 13 million rubles per year only in crop production (Table 8).

Table 8. Losses in crop and animal production as a result of one tractor downtime

Name of the company	Area of arable land, ha	Losses in crop production, ths. rub	No. of dairy cows, animal units	Losses in animal production, ths. rub	
				underfeeding	untimely feeding
ZAO "Kubanskoye"	7,312	13,264	1,000	889	308
ZAO "Bobrovskoye"	8,690	15,764	830	738	256
OAO "Priobskoye"	620	1,124	-	-	-
ZAO "Skala"	6,984	12,669	651	579	201

Source: developed by the authors

At the same time, the more the acreage or the number of dairy cows, the greater the loss of production.

As a result, the total losses of agricultural organizations will amount to 14,661 thousand rubles in ZAO "Kubanskoe", 16,758 thousand rubles in ZAO "Bobrovskoye", 1,124 thousand rubles in OAO "Priobskoye", and 13,449 thousand rubles in ZAO "Skala". The result of the proposed measures and shortening the downtime of agricultural machinery will be a significant increase in revenues from the sale of agricultural products, as well as performance indicators of farms: the level of profitability of production and sales, as well as cost recovery of the main production (Table 9).

Next, we will make similar calculation of the total losses of all agricultural organizations in the Novosibirsk Region (Table 10). The number of forage-fed cows in the region is 127.5 thousand animal units, the area of arable land is 2,204.6 thousand hectares.

Consequently, the downtime of just one

tractor for a period of 18 days during the agricultural season leads to a shortage of revenues of agricultural organizations in the amount of 3,999,061 thousand rubles in crop production and 152,618 thousand rubles inanimal production.

Table 9: Calculation of the effectiveness of the proposed measures for selected farms

Activities		ZAO "Kubanskoye"	ZAO "Bobrovskoye"	OAO "Priobskoye"	ZAO "Skala"
Revenues from sales, ths. rub	de facto	181,656	146,883	100,664	113,745
	planned	196,117	163,641	101,788	127,194
Cost of sales, ths. rub	de facto	165,817	128,822	81,447	91,662
	planned	165,817	128,822	81,447	91,662
Gross profit, ths. rub	de facto	15,839	18,061	19,217	22,083
	planned	30,300	34,819	20,341	35,532
Cost of the main production, ths. rub	de facto	211,967	211,812	90,690	153,334
	planned	211,967	211,812	90,690	153,334
Production profitability, %	de facto	9.6	14.0	23.6	24.1
	planned	18.3	27.0	25.0	38.8
Profitability of sales, %	de facto	8.7	12.3	19.1	19.4
	planned	15.4	21.3	20.0	27.9
Main production cost recovery, %	de facto	85.7	69.3	111.0	74.2
	planned	92.5	77.3	112.2	83.0

Source: developed by the authors

Table 10. Calculation of losses of farms in the Novosibirsk Region in 2016 as a result of idle agricultural equipment

Region	Area of arable land, ha	Losses in crop production, ths. rub	No. of dairy cows, animal units	Losses in animal production, ths. rub	
				underfeeding	untimely feeding
Novosibirsk Region	2,204,554	3,999,061	127,500	113,373	39,245

Source: developed by the authors

Using the mechanism of providing the tractor from the fleet of replacement vehicles for the period of repair would allow the region's agricultural organizations to significantly improve their financial results (Table 11).

The result of the use of a tractor from a replacement vehicles fleet will result in an increase in sales revenues by an average of 10.5%, and gross profit by 57.6%. The efficiency of production will also increase: production profitability up to 35.1%, profitability of sales up to 26%, main production cost recovery up to 101.5%.

Table 11. Calculation of the effectiveness of the proposed measures for the agricultural organizations of the Novosibirsk Region

Index	De Facto as for 2016	Planned	Deviation	
			%	±
Revenues from sales, ths. rub	39,550,859	43,702,538	110.5	415,1679.0
Cost of sales, ths. rub	32,338,299	32,338,299	100.0	0.0
Gross profit, ths. rub	7,212,560	11,364,239	157.6	415,1679.0
Cost of the main production, ths. rub	43,039107	43,039,107	100.0	0.0
Production profitability, %	22.3	35.1	x	12.8
Profitability of sales, %	18.2	26.0	x	7.8
Main production cost recovery, %	91.9	101.5	x	9.6

Source: developed by the authors.

As already mentioned above, this calculation was made only for the situation when one tractor broke down. In practice, the number of broken tractors is greater, hence, financial indicators would be higher if tractors from the fleet of replacement vehicles would be used for the time of repair use.

CONCLUSIONS

Constant breakdown of equipment during the execution of technological operations significantly prolong their time, which inevitably leads to the loss of production. At the same time, the annual scrapping of equipment exceeds new machinery put into service. The improvement of machinery for agricultural organizations in the Novosibirsk Region for the period under review was 7-34%, while it was by 80% due to the acquisition of agricultural machinery used in the operation by other organizations.

In order to reduce the downtime of agricultural equipment, we offer a service mechanism based on the creation of a fleet of replacement vehicles at OOO "Trading Company MTZ-Sibir". Alongside with the purchase of a tractor, the trading company concludes a service agreement with the agricultural producer with the possibility to purchase one of the service packages. In case of a customer's complaint about any malfunction of the tractor, first, the company's engineer concludes an agreement with him for the provision of services (to be safe), and, secondly, prepares service teams for visit to the site of breakdown. Simple breakdowns are eliminated on site, and in case of complex ones, the equipment is transferred according to the act and the replacement tractor is delivered from the trade-in fleet for the period of repair works. The fleet of the replacement equipment is created by means of the trade-in mechanism, within the framework of which OOO "Trading Company MTZ-Sibir" purchases an old tractor from the agricultural producer and sells instead a new tractor with a significant discount.

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