DETERMINATION OF THE LIQUIDITY VALUE OF AGRICULTURAL AND FORESTRY EQUIPMENT

Prof. Dr. Miho Mihov¹, m.mihov@abv.bg; Zhivko Davchev², daveyz@gmail.com
Institute of Soil Science, Agrotechnologies and Plant Protection „N. Poushkarov“ – Sofia¹;
“Ss Cyril and Methodius” University of Skopje².

Abstract: The structure of production in agriculture is changing with the change of priorities, both at EU and national level. On the one hand, this is due to interconnection in individual sub-branches, on the other, to the replacement of traditional technologies with new ones. In both cases, this requires the maintenance of more equipment than is necessary for production and the corresponding increase in the cost of production and the reduction of the profit from production. Significant lagging of the machine-tractor fleet renewal processes and increased loading of the used equipment imply intensive physical wear and obsolescence. Depending on the reasons for write-off, when determining the liquidation value of the machinery, account shall be taken of special features and the possibilities for further use of individual elements (parts, assemblies and aggregates). Several approaches are used to determine the liquidation value:
- the whole machine is considered scrap. The approach is applicable to working machines and attachments to self-propelled agricultural machinery;
- the whole machine is classified as scrap but is dismantled and divided according to the type of scrap (ferrous and non-ferrous metals). The approach is applicable to retractors and attachments to self-propelled agricultural machinery as well as stationary machinery for primary production processing;
- the machine is rated as scrap of ferrous and non-ferrous metals and second-hand spare parts. The approach is only applicable to physically worn machines.
In addition to that, an improved methodology for assessing the liquidation value of different groups of agricultural machinery for moral and physical extinction with and without residual resource elements is suggested.

Keywords: agricultural machinery, spare parts, liquidation value, scrap, methodology, expenses.

The structure of production in agriculture is changing with the change of priorities, both at EU and national level. On the one hand, this is due to interconnection in individual sub-branches, on the other, to the replacement of traditional technologies with new ones. In both cases, this requires the maintenance of more equipment than is necessary for production and the corresponding increase in the cost of production and the reduction of the profit from production. Significant lagging of the machine-tractor fleet renewal processes and increased loading of the used equipment imply intensive physical wear and obsolescence.

The level of reliability of traditionally used universal and specialized machines increases when loading increases sharply. For example, for the most massive tractors such as “Belarus - 954”, the average workmanship to a 550-hour refusal has dropped to 300 hours. Similar is the situation with self-propelled machinery. Average and workout till failure is from 80 to 90 hours. The results of the occurrence of the most common reasons for refusal given in Fig.1.

Maintaining the working capacity of such equipment is extremely labor-intensive and costly. The annual cost of maintenance and repair increase to 20-25% of the machines as 85-95% of the downtime of machines for technical reasons it is to eliminate failures and only 5-15% for maintenance. To reduce them, some of the equipment is removed from the production process without use, and another is used only for spare parts, and is subject to write-off from the company's balance sheet [1].

Depending on the reasons for derecognition, when determining the liquidation value, account must be taken of their peculiarities and possibilities for further use of parts (parts, assemblies and aggregates) of the derecognised machines.

The purpose of the report is to propose an improved methodology for determining the liquidation value of agricultural machinery when decommissioning / derecognition. When the machine ceases to bring economic benefits to production due to physical or moral degradation, it must be written off from the company's balance sheet. If the write-off of the machine is due to physical or moral degradation, several methods for determining the liquidation value can be applied:

![Fig.1. Distribution of failures due to occurrence: ПЕ - continuous operation; ЕИ - natural wear; КИ - quality of production; KH - structural disadvantages; НПЕ - violation of exploitation rules; KP - quality of repair.](image-url)
- the whole machine is considered scrap. The approach is applicable to working machines and attachments to self-propelled agricultural machinery;
- the whole machine is classified as scrap but is dismantled and divided according to the type of scrap (ferrous and non-ferrous metals). The approach is applicable to retractors and attachments to self-propelled agricultural machinery as well as stationary machinery for primary production processing;
- the machine is rated as scrap of ferrous and non-ferrous metals and second-hand spare parts. The approach is only applicable to physically worn machines.

When the machine is physically or morally worn and cannot be used (due to lack of residual resource or economic benefit), then the basis for determining the liquidation value of the machine is the cost of scrap. The machine is rated as scrap.

\[ C_{ln} = G_{M} \cdot C_{ck} - (C_{tp} + C_y + C_T) \]

Where:
- \( C_{ln} \) - is the liquidation value of the machine, BGN;
- \( G_{M} \) - is the weight of the machine, t;
- \( C_{ck} \) - is the cost of scrap, BGN/ton;
- \( C_{tp} \) - cost of dismantling elements and transport;
- \( C_y \) - is the cost of utilization of elements and parts, BGN;
- \( C_T \) - are costs paid under the effective legislation when scrapping the machine.

Because of the great difference in prices of the purchase of ferrous and non-ferrous metals, it is in many cases appropriate to dismantle and remove metals / copper, aluminum, bronze, etc./ In this case, the machine is disassembled into elements of ferrous and non-ferrous metals and the liquidation value is determined by the formula:

\[ C_{ln} = \sum_{k=1}^{K} G_{ke} \cdot C_{uu} + \sum_{l=1}^{L} G_{wu} \cdot C_i - (C_p + C_y + C_T + C_{tp}) \]

Where:
- \( C_{ke} \) - is the weight of the k-th element of non-ferrous metal, t;
- \( C_{uu} \) - is the price of non-ferrous metal scrap, BGL/ton;
- \( k \) - is the number of non-ferrous metals;
- \( G_{wu} \) - is the weight of the l-th element of ferrous metals, t;
- \( C_{wu} \) - is the price of ferrous metal scrap, BGL/ton;
- \( l \) - is the number of ferrous metal elements;
- \( C_p \) - are costs of separation of non-ferrous metals, BGN.

This approach is most commonly applied to one of the harvesting and combination machines with active working bodies, aggregated to tractors and stationary machinery for primary processing of the product - a machine consisting of a small number of elements (aggregates, assemblies and parts) with a relatively simple construction.

The durability and flawlessness of each machine depends on a number of subjective and objective factors such as: qualification of the staff, working environment, nature of the load, periodicity of service and the quality of its performance, etc. When working, even identical elements of a machine refuse through different periods of time. This is true in the case of self-propelled agricultural machinery and there is sufficient reason to assume that taking into account the wear of the individual elements with the valuation of their residual resource is the correct way of determining the liquidation value of the machine. Figure 2 shows the residual resource of basic elements of universal tractors with mechanical transmission after 10 years of use at an average annual load of 600 to 800 mph [2,3].

**fig.2. residual resource of basic elements of tractors belarus and zetor after scrapping after 10 years of use at an average annual load of 600-800 hours: HC- hydraulic lifting system; K-cabin; Д- engine; ЗМ- rear axle; СК- gearbox.**

Valuation of the residual resource requires the use of reliable statistical information about the average resource of the main elements of the machine, the market prices of the new and second-hand spare parts, the requirements and the time for the disassembly and installation of the elements, the need for specialized equipment for settings and adjustments, etc. In this case, it is necessary to perform: disassembly of the machine into elements, verification and separation of the elements of groups with and without residual resource, evaluation of the elements without residual scrap resource and evaluation of the residual resource elements as such second-hand use.

For average resource of a new or after a major repairs of a machine, such manufacture is accepted in which its main
elements reach a frontier state. Generally, it can be determined by the formula:

\[ t_p = \prod_{i=1}^{n} t_{ie} \left( n, V_i \right)^{-1} \]

Where \( t_p \) is the resource of the machine till repairs, moto hour or liter of fuel;
\( t_{ie} \) - the resource of the i-th element till reaching the limit state, the moto hour or liter of fuel;
\( n \) - number of the elements, which the machine is divided;
\( V_i \) - the manufacturing cycle in which the main aggregates and assemblies are expected to reach a limit state.

Hence, the determination of the residual value of the individual elements of the machine on the basis of their unused scrapping resource can be made according to the formula:

\[ C_{oi} = k_i \left( \frac{t_{ie} - t_p}{t_{ie}} \right) C_{me} \]

Where \( C_{oi} \) is the residual value of the i-th element of the machine, BGN;
\( k_i \) - the coefficient counting the number of identical elements of the machine;
\( C_{me} \) - the price of a new item, BGN.

The dismantling of the machine and the separation of elements is labor-intensive, and labor and material costs for doing so (costs of dismantling, cleaning and commercialization and temporary storage until the sale) should also be taken into account. Where the items have a residual resource, there are two options for further use: to be offered for sale as second-hand items or to be used by the owner of the spare parts machine. In the first option,

\[ C_I = \sum_{k=1}^{K} G_{ku} C_{qm} + \sum_{i=1}^{L} G_{mi} C_{me} + C_p + \sum_{m=1}^{M} k_m \left( \frac{t_{me} - t_p}{t_{me}} \right) C_{me} + \left( C_{am} + C_{cm} + C_{cm} \right) \]

Conclusions:
1. The reasons for the physical and moral wear of the machinery used in agricultural production have been examined.
2. An improved methodology for estimating the liquidation value of the three basic groups of agricultural machinery after moral and physical wear with and without elements of residual resource

the owner has to specify a sale price for the item. It is calculated by the formula:

\[ C_{ie} = k_i \left( \frac{t_{ie} - t_p}{t_{ie}} \right) C_{me} + \left( C_{ai} + C_{am} + C_{cm} \right) + H_p \]

Where \( C_{ie} \) is the sale price of i-th second-use item, BGN;
\( C_{ai} \) - is the value of the disassembly work on separating the i-th element of the machine, lv;
\( C_{am} \) - the cost of the cleaning and commercialization of the i-th element, BGN;
\( C_{ci} \) - Are the cost of storing the i-th element, BGN;
\( H_p \) - - the normative profit, BGN.

With the second option, the owner needs to capture the balance sheet items of his enterprise by residual value. The total value of the residual resource elements that can be used as second-hand spare parts can be determined by the expression:

\[ C_o = \sum_{m=1}^{M} k_m \left( \frac{t_{me} - t_p}{t_{me}} \right) C_{me} + \left( C_{am} + C_{cm} + C_{cm} \right) \]

\[ C_{o} \] is the residual value of the machine elements, lv;

\[ m = 1 - M \] the number of machine components that meet the profit condition, BGN

Then the liquidation value of the machine will be:

References:
2. М. Михов Дисертация "Иследване разпределението на запасите от обменни елементи за тракторите", София 1995 г.