MAINTENANCE AND REPAIR OF THE MACHINERY IN THE AGRICULTURAL SECTOR OF BULGARIA

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Abstract: *For the rapid restoration of the efficiency of agricultural machinery it is necessary to build a system for servicing of machinery, including the effects of maintenance and repair of agricultural machinery, the supply of spare parts, training of staff and others.Under the system in general systems theory means an organized set of interacting elements forming a unified whole. An analysis of the operating system in particular and sales-service can be done through modeling. Under the model system will not understand the whole multitude of interconnected characteristics of a real object, but only a number, in which the relationship between the characteristics of the present stage of the study of the system can be finalized and reported using mathematical and logical formulas or rules.*

Keywords: *agricultural machinery, the supply of spare parts, basic numerical inflow*

I. INTRODUCTION

In the process of use of the machines, different random factors, the size of the structural parameters of the individual elements extend beyond the limit value, resulting in disturbing their performance. Naturally aspiration is possible to quickly return performance of the machine you are going through adjustments, replacement of abandoned items or whole units. We often have cases where failures in complex systems such as tractors are of unknown nature. For their discovery is the use of special diagnostic equipment and sophisticated diagnostic equipment For the rapid restoration of the efficiency of agricultural machinery is necessary to build a system for servicing of machinery, including the effects of maintenance and repair of agricultural machinery, the supply of spare parts, training of staff and others.

Under the system in general systems theory means an organized set of interacting elements form a whole. Repair - service system, such as station maintenance and repair of agricultural machinery is a set of interrelated elements (vehicles, repair and maintenance contractors) required to maintain and restore the operability of the objects entering the system.

II.EXPLANATORY

System status can be changed under the influence of many factors, including in and purposeful human activity (maintenance and repair). The nature of these amendments is judged primarily by the state of the outputs of the system. Sets of variables by which the output of the system can be brought into a desired position, will call management, and some general characteristics of management - management strategy or only strategy.

The analysis of the system, in particular and sales-service can be done through modeling. Under the model system will understand not all the multitude of interconnected characteristics of a real object, but only a number, in which the relationship between the characteristics of the present stage of the study of the system can be finalized and reported using mathematical and logical formulas or rules .

In a study of complex objects it is assumed that they are characterized by the availability of a significant number of input parameters, each of which affects the values of the output parameters. This feature requires the study and management of the site is based on experimental studies and modeling them to use different approximations and partial or complete ignorance of dependence associated with the source inputs; continuous nature of the dependencies of input and output parameters. This means that the parameters of the site are expressed mathematically by continuous functions of the factors affecting the state of the technological system; negligible duration transients and possible existence of time delays, significantly exceeding this duration; availability of uncontrollable parameters and noise that determine the random nature of the amendment to the baseline. This feature requires mandatory to use statistical methods in modeling and management of sites.

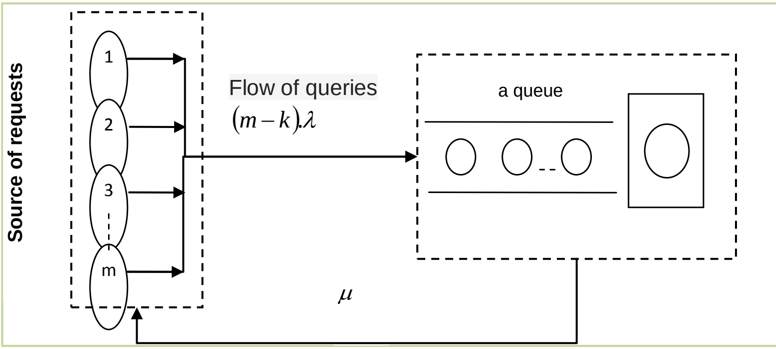
Designation load station maintenance and repair of agricultural machinery

The general methodology adopted the necessary number of workers moving units with the help of which perform maintenance and repair of agricultural machinery is given by the following formula (1):

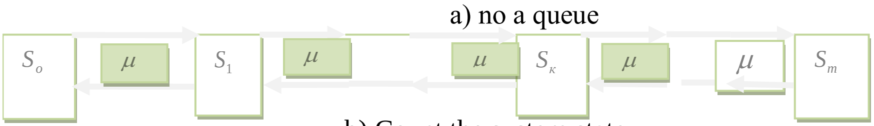
$$N_P = \frac{\sum T}{\Phi_{P.B}} \qquad (1)$$

where $\sum T$ is the total labor intensity of all effects; $\Phi_{P\,B}$ is Fund of time a worker for the planned period of time.

Stream of requests coming from the m number of machines in a random point in time. Some of the machines are in the system and on them the service is performed, others wait in line to be served, and the remaining work. The closed nature of the system is characterized by limited amount attached to the department of agricultural machinery.



a) no a queue



b) Count the system state.

Fig.1. Model of organization of work of system maintenance

Shown scheme is characterized by certain conditions (Figure 1.б.) under which it can accept (m + 1) meanings. Each of them has a probability, ie .: when the park machines is rampant and needed services; we have failures in 1, 2 .... m machines and they must be removed in specialized units. Each of the typical conditions $P_h(t)$ $(0 \le k \le m)$ can be described with the relevant equationsProbability in the service system to find "k" number of machines, can be represented by the formula (2).

$$P_k = \frac{m!}{(m-k)!}\left(\frac{\lambda}{\mu}\right)^k .P_o \qquad (2)$$

where the probability of good condition of the park machines. For the determination of the value of it is necessary to use the condition (3)

$$\sum_{k=0}^{m} P_k = 1$$

where

$$P_o = \left[\sum_{k=0}^{m} \frac{m!}{(m-k)!}\left(\frac{\lambda}{\mu}\right)^k\right]^{-1} \qquad (3)$$

The resulting equations allows finding any state of the system maintenance and repair. With the help of probability can be defined quantitative characteristics, evaluating the quality of the organization of preventive and repair work, namely the length of stay in the system and related losses.

Machine downtime can be estimated by using a factor of technical use ($K_{ТИ}$) and service unit with its load factor (K). (4):

$$K_{TИ} = 1 - \frac{\sum_{k=1}^{m} k.P_k}{m} \tag{4}$$

Employment of the specialized unit is characterized by the use of working time and reporting the probability of the absence of a request in the system (P_O). The load factor extraction follows (5):

$$K_H = 1 - P_O \tag{5}$$

The feature amount of allowances Z (m), falling on a machine is defined by formula

$$Z(m) = \frac{1}{m}\left(C_a.\vartheta + C_3 P_O\right) \tag{6}$$

where the average number of machines in the queue for service; Accordingly downtime of the machine unit and per unit of time of their work.

The length of the tail depends on Sport adopted in order to conduct scheduled maintenance. If the machine requiring scheduled maintenance is called for it at a time when sport is not busy, the number of machines in the queue can find the following formula (7):

$$\vartheta = \frac{\lambda_p}{\lambda_p + \lambda_{TO}} . \sum_{k=2}^{m} (k-1).P_k \tag{7}$$

where they are respectively the intensity of requests for repair and maintenance.

Insofar as in this case-stay waiting for planned repairs, no place, then the coefficient of technical use CTI can be found by using the formula (8):

$$K_{TИ} = 1 - \frac{\sum_{k=1}^{m} K.P_k - \frac{\lambda_{TO}}{\lambda_p + \lambda_{TO}} \sum_{k=2}^{m} (k-1) P_k}{m} \tag{8}$$

The waiting time in the queue, by virtue of the probabilistic nature of submission of applications and duration of service, also appears to be a random variable. Therefore the likelihood waiting time in the queue to neprevishi TD can find a formula (9):

$$P\{\ \gamma \geq t_Д\ \} = \sum_{k=1}^{m} P_k \sum_{S=0}^{k-1} \frac{(\mu t)^S}{S!} . e^{-\mu t} \tag{9}$$

Light of the aforementioned analysis can draw the following conclusion: Displayed quantitative characteristics sufficiently fully reflect processes of IT and P machines and on their basis can establish optimal loading stations for maintenance and repair of agricultural machinery, as well as their quantitative composition. Using the parameters of service station maintenance and repair of agricultural machinery can make a quantitative assessment of its activities. So their knowledge and determination are essential for us. Using the theory of mass servicing of agricultural machinery can present it as a system of mass service (SMS) on the parameters that identify it.

The activity is related to the receipt and processing of requests for maintenance and repair of machines. The random nature of the submission of applications and their service need to have a random character. It is likely that at any point of time in the queue is formed at the entrance to have a certain number of queries. In theoretical consideration these probabilities is one of the key parameters to be determined. In turn, they will provide an opportunity to get an idea: the average number of requests queued (expected queue length); for the average waiting time of one application and possible deviations from it. The period of employment channels (P) is another important parameter. This is the length of the time interval at any time during which at least one of the channels for the service is busy. Another important parameter is that the number of serviced requests in the period of employment (P) .This parameter is essential in the design of the production activity of individual channels of sports. When you know what will be the size of the flow of requests, the channel must be ready for continuous service.

It was found that the stationary mode, there is not any system. Systems with many channels and extremely limited number of seats for waiting always stationary mode when the average duration of service and the average time between two consecutive admissions applications are final.

When are final and queues is not limited, fixed mode does not exist at while otherwise the system is always stable over time. In magnitude and probability P unit are limited (end).

The number of requests d by the time the system $\vartheta(t)$ is another important parameter. Them we can divide such applications are currently being serviced and others waiting in line to be served. This is a random variable and has all mobile feature. If a is n number of channels, it is therefore $\vartheta_1(t)= \max(0, \vartheta(t))$

and represents the number of requests waiting in queues at the entrance of the shop. it is customary to call a virtual queue length. The parameter may take the value of 0, 1,2 .... n, therefore, is defined by the distribution of probabilities

$$P_k(t) = P\{\vartheta(t) = k\} \tag{10}$$

The determination of $P_{K(T)}$ is a reason to believe that we know the transient mode.

In service systems, such as for agricultural machinery with n number of channels is valid the following relation (11), which determines the probability of all channels are busy:

$$\sum_{\kappa=n}^{\infty} P_k(t) = 1 - [P_o(t) + ... + P_{n-1}(t)] \tag{11}$$

The average number of requests waiting to be serviced at a point in time t can determine addictive (12):

$$\bar{\vartheta}_1(t) = \sum_{k=n}^{\infty} (k-n).P_k(t) \tag{12}$$

The average number of channels present in the stay is equal to (13)

$$\bar{n}(t) = \sum_{k=o}^{n} (n-k).P_k(t) \tag{13}$$

The average number of applications found in the service node (in the queue and channels) can be determined using the dependence (14)

$$\bar{\vartheta}(t) = \sum_{k=o}^{\infty} k.P_k(t) \tag{14}$$

In $n.b<a$, where a is the average time between arrivals of bids; b - the average service time of individual requests from one channel and t - time.

$$\text{If, } m \to \infty \text{ then, } P_k = \lim_{t\to\infty} P_k(t), \qquad (15)$$

From the foregoing it follows that here:

$$\lim_{t\to\infty} \bar{\vartheta}_1(t) = \bar{\vartheta}_1, \qquad \lim_{t\to\infty} \bar{n}(t) = \bar{n}, \quad \lim_{t\to\infty} \bar{\vartheta}(t) = \bar{\vartheta}, \qquad (16)$$

in single-line (single channel) system $n = 1$ in which, the employment rate ρ can be determined by the following relationship (17):

$$\rho = \frac{b}{a}, \qquad (17)$$

Likelihood channel idle we can determine from dependence (18)

$$\rho_o = 1 - \rho, \qquad (18)$$

For n number of channel service system, the employment rate is defined by the relationship $\frac{n.b}{a}\left(npu\ \frac{n.b}{a} < 1\right)$ system is called nonstationary.

The waiting time of the application, if arrive in time t, called the possible (virtual) waiting times. This element is one of the nonstationary characteristics of the system. When the system is stationary characteristics. The waiting time of the request to be handled, appears to be one of the main variables presented by inflow requests. It is most often involved in the possible economic performances in solving the problems of the theory of mass service.

These indicators and others such as load factor of channels (K) Economic indicator for selecting the best option in design and Gzag. and others. describe probabilistic behavior of the workshop for agricultural machinery. For their determination to make the necessary mapping service center which examined by the Earl of states showing the various states and incoming (outgoing) flow of events (Fig. 2.).

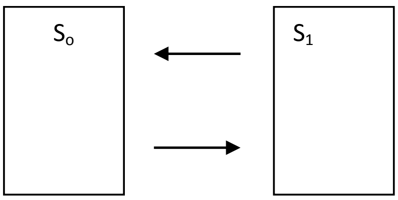


Fig. 2. Count the state

Fig. 2 shows an example of a dispute that goes from state So in S1, a stream of requests having the density and vice versa - from the state S1 able So, with intensity. If we assume that we know all possible states reporting of all states of the studied sports, we can build corresponding graph of states reporting of all characteristics of the incoming and outgoing flows.

III. CONCLUSION

Using these calculations can draw the following conclusions: With the increase in the number of machines attached to a specialized unit, level of load increases and the rate of technological use reduced. Optimal ratio is determined by economic criterion for minimization of allowances stay of machines and units. From made to this analysis can draw the following conclusion: Displayed quantitative characteristics enough fully reflect processes of IT and P machines and on their basis can establish optimal loading stations for maintenance and repair of agricultural machines, as well as their quantitative composition .

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