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MONITORING development trends in maintenance and repair of forest EQUIPMENT

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The question of monitoring systems maintenance and repair of machines. Analyzed research and publications on matter of this theme.The basic components of information provision and monitoring system.

Engineering, monitoring, machine, maintenance and repair.

Problem. Effectiveness of forest complex of Ukraine is largely determined by its technical equipment, and in particular this applies to logging companies. One of the main areas of sustainable forest development aimed at strengthening the environmental, social and economic functions of forests is the use of environmentally machines and mechanisms [1, 2, 8, 14]. The volume of products, works and services forestry in Ukraine is growing every year, and in 2013 amounted to 6.3639 billion. UAH., Which is almost 2 times more than in 2007 (3.3827 billion. UAH). [11].

It should be noted that these volumes generated by increasing logging, which respectively increased from 3.5302 billion. USD. in 2010 to 4.0958 billion. USD. in 2013, with even better results in 2011 and 2012 respectively.

One of the main trends of the forestry sector is increasing the speed of technological change, which leads to the introduction of new types of equipment - a multifunctional more perfect. Increasing technical level logging machines (LZM) and tools for wood processing (FAR) comply with the more advanced system to ensure efficiency machines. In the current conditions and trends of LZM FAR is a complication of their designs, new kinds of machines that can be represented as a complex technical system "man - machine - environment" (CCC "LMS"). Means of maintenance and repair (p) and technical services (TS) must be prepared to ensure the efficiency of fleet vehicles, which is possible only on the basis of the use of modern technology management efficiency. One of the promising directions of PAGE and TC is to attract manufacturers of machinery and equipment in the implementation PAGE its products in warranty periods of operation.

Analysis of recent research. There are several main routes in this area: the development of a network of branded TS centers and improve the technical level of operational bases logging companies.

3000 ' machines and chip DC-7, MTBF which is correspondingly 150,4 h. and 734.6 hours. The authors of scientific overalls [8, 14] focuses on the fact that for efficiency shaving machines and cutters proposed a set of measures that include: increased wear resistance and durability knife straps and fasteners drive by coating surfaces using durable material and friction

strengthening; cleaning materials before feeding into the machine; improving the design of metal detector; increasing longevity sieve plates. But at the same time, considering measures to ensure the reliability of components "machine" and "environment" stations and plants for the production of chipboard, the authors are not considered such an important part of CTC as a "human operator."

As noted in [2, 13], while exploiting LZM 40% of the total number of failures are productive failure, 33% - performance, 20% - constructive, 7% - due to the "moral" of aging. Reliability LZM number of elements, as shown in observation, standard operation [2, 13], insufficient, and indicators of longevity are distributed quite widely. Thus, 80% -e developments to resource failure with confidence probability is 90%, for the equalizer - 2100 operating hours .; for suspension springs - 2200 operating hours .; for different transmission gears in the range of 1700 to 2900 operating hours. Noteworthy developments of the author, in which using queuing theory model reasonably ensure the reliability of technical LZM by the mobile service workshop. It can provide a high level of technical applications LZM. But, as the analysis in research is not considered such an important component in ensuring reliability CTC as a mobile workshop staff and engineering services company Forest Complex.

An important area to ensure the quality of the TOR and TS is training and skills development workers forest complex. A significant contribution to the organizational and methodological foundations of training made research [3, 5]. However, for systems maintenance service and repair LZM FAR and these issues are poorly understood. To solve this article in goal and improve the reliability and efficiency of machines forest complex in [3, 5] proposes to improve organizational forms, technological training and staffing companies. Noteworthy scientific and practical studies [4, 6], used as a model of technological preparation of production service companies, and processes TOR and TC are as complex dynamic systems that are connected to a single system: "The machine - the machine - Parts - Means of technological equipment - Personnel ".

The purpose of research. In connection with the above, the purpose of the article is to improve methods LZM increase operational reliability and FAR through the application of information technology, methods of structural analysis of complex technical objects, queuing theory, logic-simulation and improvement p.

Results. In the current conditions in the forest sector of Ukraine had studied the following pieces of STS operation "LMS", which is LZM FAR: the state of the existing fleet, including modernization of secondary and higher reliability; technology training companies TC and repair facilities; Staffing companies with regard to the quality and efficiency of service delivery. These are the main areas we selected for further studies.

We studied the technical condition of machines in Kiev, Zhitomir and Chernihiv region in accordance with the method of monitoring. The main methods of monitoring are necessary to ensure the reliability and LZM FAR, as observed in research [6] include: analysis using information from public

sources; Benchmarking assessment of production processes; application of methods of economic benefits; Cooperation with the owners and staff of enterprises executing manufacturing processes and operators; involvement of independent experts; using the method of economic benefits. The main methods of monitoring represented as the authors of studies [4, 6], is an analysis of available information from public sources. The analysis of information from open sources, including annual reports of forestry enterprises, found that technological park and transport machines in forestry and forest enterprises have a high degree of wear. About 60% of tractor T-150K service for more than 8 years and beyond '10 operated 74% MTZ-80 (82).

As for the cars used in forestry enterprises sector, the results of the monitoring revealed that about 65% of KamAZ service for more than 8 years and beyond 10 years in operation is about 85% ZIL.

To ensure the efficiency of cars increased role of CT systems and TOR. In these circumstances, it is important to market formation technology reuse, which has been in operation and requires modernization or influence of TOR. The analysis shows that in recent years, state forestry enterprises engage for transport and technological machines to individuals and private companies for the use of which is carried out works on modernization and refurbishment special equipment.

In recent years, domestic and foreign practice, evaluation of technical machines to conduct life cycle stages such as design, decision on mass production and the stage production. At the same time, not enough attention is paid to assessing the technical condition of LZM and FAR are in use. Proposed methodology for the formation of TOR LZM and FAR are considered in a relationship as a system consisting of subsystems and components. From the standpoint of reliability simplified block diagram derevopodribnyuyuchoyi machine DP 660R can be represented as a series-connected components subsystems: the loading mechanism; shredding mechanism; discharge mechanism. Such legitimate representation based on the fact that the failure of any of the subsystems leads to failure of the whole system. In the operation of FAR (derevopodribnyuyuchoyi machine DP 660R) can be in different states, due to its ability to work, or the need for maintenance and repair. Count of possible states derevopodribnyuvalnoyi machine during its operation is shown in Fig. 1.

Based on the calculations, the marginal probability $P_{пк1}, P_{пк2}, P_{пк3}, P_{пк4}, P_{пк5}, P_{пк6}$ PC subsystems stay in one of the states S1, S2 ... S6 depending on which item is refused can add to this form [7]:

$$\begin{cases} P_{пк1} = \left(1 + \frac{\lambda_{12}}{\mu_{21}} + \frac{\lambda_{13}}{\mu_{31}} + \frac{\lambda_{14}}{\mu_{41}} + \frac{\lambda_{15}}{\mu_{51}} + \frac{\lambda_{16}}{\mu_{61}}\right)^{-1}; \\ P_{пк2} = \frac{P_{пк1}\lambda_{12}}{\mu_{21}}; \\ P_{пк3} = \frac{P_{пк1}\lambda_{13}}{\mu_{31}}; \\ P_{пк4} = \frac{P_{пк1}\lambda_{14}}{\mu_{41}}; \\ P_{пк5} = \frac{P_{пк5}\lambda_{15}}{\mu_{51}}; \\ P_{пк6} = \frac{P_{пк6}\lambda_{16}}{\mu_{61}}. \end{cases} \quad (1)$$

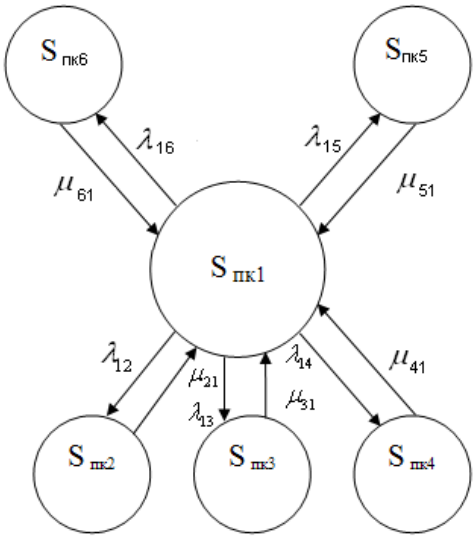

Fig. 1. Count the possible states and transitions them to crush mechanism derevopodribnyuyuchoyi machine DP 660R: Spk1 - PC serviceable condition; Spk2 - refusal knives; Spk3 - refusal spacer bushings; Spk4 - failure of bearings; Spk5 - failure of the shaft; Spk5 - failure of the pipeline.

Failure rate λ_{First} intensity and updates μ_{i1} PM subsystem tree crush cars DP 660R with the healthy state S1 in one of the states S2, S3 ... S6 can be calculated using the appropriate formulas and taken for these theoretical intensity distribution laws. We analyzed the reliability of crush mechanism DP 660 R. Disc shredding mechanism consists of a shaft, two cutters knives and counter blade. Previous studies have found that the MTBF knives are 85-95 tonnes of shredded wood. That is, the failure rate is 0,011 - 0,012 1 / t. Reliability crush rotor blades limit. According to the recommendations of the manufacturer knives should be changed after 18 hours. work. In fact, for sharpening knives off 1 time per month. That is, the shredding machine DP 660 is used at low settings crush mechanism, which reduces its performance and increase power consumption.

We also analyzed the technological preparation of production enterprises providing TOP LZM FAR and influence to ensure their reliability. As a result of monitoring processes that are used in repair shops for efficiency techniques found that most old equipment is of metal. Particularly low rate of technological reliability of operations machining. The research found that repair shops SOEs forest complex of about 80% lathes, milling and 70% of drilling machines used for over 30 years.

In addition to fleet renewal and adjustment repair Bench and mechanical equipment, quality assurance important reserve machining is to develop a system of maintenance (SZTOR), which would give the ability to search and use these analogies: individual and group processes, information about the complexity of processes Means of technological equipment, load equipment, the need for tools and supplies.

One of the key indicators to measure the efficiency of enterprises with machines TOR is efficiency performance of services. Therefore, an important reserve in ensuring reliability CCC "LMS", which is a forest machines and tools for wood processing is to train personnel for enterprises engaged TOP machines. Therefore, priority research component CTC "human operator" is monitoring, classification personnel of enterprises; qualification requirements and professionally important qualities of employees; state level and training of employees.

Practice shows that the majority of enterprises Ukraine forest complex system of training does not provide regular updates and replenishment of knowledge workers. On average, the economy of Ukraine is busy worker training once in 13 years, with, in building - once in 28 years, transport - once in 12 years in public administration - once in 10 years. But given the fact that in today's knowledge aging period is on average 3-5 years, we can conclude that the current system is not training to ensure updating of knowledge, and therefore does not provide reliability personnel as part of JTS "LMS". The relevance of training workers in the enterprise can be concluded with the following information: the frequency of additional training in Ukraine on average about 11 years, while in Russia - 7 years in Western Europe and Japan - 3.5 years. Table 1 [10-12], the dynamics of change in level of training and skills development in Ukraine for certain types of economic activity, including agriculture, hunting, forestry in 2010-2013. The analysis shows that in agriculture, hunting, forestry economy there is a tendency to reduce the number of employees for the period from 2011 to 2013 mastered new professions and raised their qualifications. The largest percentage of employees trained and skills development in Ukraine falls on industry. As the statistical analysis [11], in Ukraine in 2013, according to various economic activities in the production of new professions studied 196,9 thousand. People, representing only 3.2% of full-time employees of the total number of employees, and up to standards 1020, 9 thousand. people that amounted to 9.9%.

1. Indicators of training and skills development in Ukraine of economic activity in 2011-2013. [10-12].

Performance	Years		
	2011	2012	2013
Agriculture, hunting and forestry			
Learned new professions, thsd.	4.3	4.0	4.4
From registration number of full-time employees,%	0.8	0.7	0.9
Improve skills, thsd.	9.0	9.6	8.1
From registration number of full-time employees,%	1.6	1.7	1.6
Industry			
Learned new professions, thsd.	158.5	149.5	138.1
From registration number of full-time employees,%	5.6	5.4	5.2
Improve skills, thsd.	399.1	402.7	403.3
From registration number of full-time employees,%	14.0	14.6	15.1

The analysis shows that manufacturing plants LZM and FAR must address the issue of their products specifications and technical documentation, spare parts, after sales service, training of personnel. Currently, there is urgent need to provide businesses with harvesting and wood processing information controls the operation of their machines and equipment. The efficiency of woodworking machines still not used the theory of reliability of complex systems. As one of the ways to ensure safety during all stages of the life cycle of machines can be used unreliable backup subsystems and components based on structural analysis of their reliability. Therefore, it is advisable to ground set elements to crush backup mechanism, propose ways to improve the durability of the blades.

Conclusion. Background improve the reliability and LZM FAR is an important and versatile, so even small results towards improving reliability these funds and individual problem solving in the art suitable for practical applications. Development of new methods and approaches to assess and ensure the reliability and LZM FAR is a promising direction in improving efficiency of complex technical systems "LMS".

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Rassmotrenы question of monitoring systems tehnycheskoho Maintenance and repair of machines. Proanalyzyrovanы Studies and Publications in question, kotorыh kasaetsya эta theme. Obosnovanы Main sostavlyayuschye is information and Provision of monitoring systems.