Digitalization of technical service

Grigory Iovlev
The Department of Transportation and Technological Machines and Service
Ural State Agrarian University
Ekaterinburg, Russia
gri-iovlev@yandex.ru

Irina Goldina
The Department of Transportation and Technological Machines and Service
Ural State Agrarian University
Ekaterinburg, Russia
ir.goldina@mail.ru

Anatoly Nesgovorov
The Department of Transportation and Technological Machines and Service
Ural State Agrarian University
Ekaterinburg, Russia
ag.nesgovorov@gmail.com

Vladimir Zorkov
The Department of Transportation and Technological Machines and Service
Ural State Agrarian University
Ekaterinburg, Russia
zorkov-1956@yandex.ru

***Abstract*—The article describes the direction of digitalization development in technical services: management and document flow; digital diagnostics of transport and technological machines; digital service book; staff training. The key points of each of the directions of the development are taking into account. The management and the document flow: software is used in production activities and it contributes to managing the sales of services, goods and labor; the automated document flow; the ability to create a database for the required period of time and to securely store it; manage the flow of material and technical resources, financial resources, etc. The digital diagnostics of transport and technological machines are implemented in three ways: the embedded diagnostics, the computer diagnostics and online diagnostics. Digital service book: a secure online database, which stores the entire service history of the transport and technological machines. Personnel training: modern special diagnostic equipment is used: readers, motor testers, special simulators, smart glasses, etc. A new working profession has emerged – a diagnostician.**

Keywords*— *digitalization, technical service, software, computer diagnostics, self-diagnosis, online diagnostics, digital service book, management information systems.

I. Introduction

A new and promising topic for the global economy is the development of digital activities in various areas of the national economy.

This activity is defined by the following documents:

1. Order of the Government of the Russian Federation of 28.07.17, No. 1632-p on approving the program "Digital Economy of the Russian Federation", which defines the goals and objectives of the development of the digital economy in the Russian Federation for the period up to year 2024.

2. Presidential Decree No. 204 of May 7th, 2018 "The national goals and strategic objectives of the development of the Russian Federation for the period up to year 2024".

Digital transformation of industries has already become a reality in the public sector: e-government services, e-signature, e-procurement, etc.; in the financial sector: automation of business processes in the banks, electronic mobile payments, etc.; in the social sphere: electronic appointments to visit a doctor, electronic medical record, electronic diary, distance education, etc. [4].

II. Literature review

In the publication of Gabitov I.I., Negovora A.V., Fedorenko V.F. "Intellectualization of the technical service of diesel fuel injection systems" in the section "Prospects for technical services and digital technologies", the authors describe the use of digital technologies in the technical service system, their capabilities and future development prospects.

The article of Kats B.A., Molchanova A.Yu. "Digitalization of the management processes of maintenance: problems and solutions" concerns the management processes in technical services using digital technologies - these are accounting for production assets and standards for their operation, work planning and accounting for their implementation, registration and processing of defects and failures, accounting technical resources, etc.

The authors B. Bank, V. Butenko, I. Kotov, G. Rubin, S. Tushen, E. Sycheva talk about the new world trend – the digitalization of the world economy in their article "New Wave of the Digital Revolution", and about its progressive influence on the national economy of countries including in Russia.

The same authors in the article "The Importance of Digitalization for the Branches of the Economy" consider how effectively digitalization is used in the sectors of the Russian economy. We are talking about retail, rail transport, health care and cultural sphere.

The article of Khalina V.G., Chernova G.V. is very informative. "Digitalization and its impact on the Russian economy and society: advantages, challenges, threats and risks", which details the history of digitalization, the impact on the Russian economy and the status, objectives and prospects of this process.

III. Methods

The topic of digitalization of technical services is not studied enough. The authors of the article have used the method of analysis as a method of scientific knowledge and have formulated their vision of the formation of this process.

What is digitalization? One of the concepts sounds like this: "Digitalization is the result of shifting to the

environment that is used to describe objects of daily activities, using mathematical laws, management functions and production activities, previously performed by a certain group of employees or departments of an organization, by using computer technologies" [1].

The technical service industry also plans to switch its activities to digital technologies. The digitalization process opens up new opportunities for better and more efficient provision of services and performance of work for the consumer.

Some several areas of development of digitalization in technical service:

- The word "data" is plural, not singular. management and document flow;
- digital diagnostics of transport and technological machines;
- digital service book;
- staff training.

Digitalization of management and document flow, with the maintenance of transport and technological machines, is necessary for improving the profitability of production and is the key to its sustainable development. The operating systems for managing funds used in production have the ability to manage the sales of services, labor and goods for various purposes; to control the process of passing the orders, payment for resources, labor and services, control over the movement and availability of commodity balances, mutual settlements of participants in production relations (suppliers, clients) and other information ensuring effective work with clients and suppliers: the document flow automation, the ability to create a database for the required period of time and to securely store it, to manage the flow of material and technical resources, financial resources, etc.

Production asset management information systems ensure the implementation of the following activities in the technical service:

- organization and managing;
- -production and technology;
- installation and commissioning;
- service and operational.

There is experience in implementing operational systems in the Russian Federation, for managing funds used in production activities based on domestic software, presented in Table 1.

TABLE I. SOFTWARE FOR THE TECHNICAL SERVICE

Program title	Function	Brief description
AutoSoft: AvtoPredpriyatie (Auto company)	Processing documents of service centers, motor vehicle companies	It is applied for the organization of the warehouse account of materials, spare parts, knots and units; production evaluation; registration of all acceptance and accounting documentation; keeping statistics, analytics, reporting.
AutoSoft**:** AvtoKatalog (Auto catalogues)	Document flow of service centers, motor vehicle companies	It is used as an electronic version of the catalogs on paper carriers for domestic and foreign cars and engines.
AutoSoft: AvtoSalon (Auto salon)	The preparation and printing of documentation; for computer reporting, printing them or exporting to internet; for rating the labor with the customers and suppliers of spare parts, materials, etc.	The documents can be of any complexity; The possibility of transmitting information to interested parties.
AutoSoft: AvtoEkspertiza (Auto expertise)	For service centers, insurance companies	The program makes an assessment of the cost of transport and technological machines. It is based on its technical condition, operating time or mileage, service life, cost of proposed spare parts, work and materials needed to restore it to a state that meets general technical safety requirements.
AutoSoft: Normi Vremeni (Time standards)	For service centers	Full database of standards for labor on foreign cars with illustrations [7]
1C-Rarus: Upravlenie avtotransportom Standart (Maintenance of transport Standard)	For motor vehicles	It creates conditions for solving the following main tasks: to place orders for vehicles, form a daily distribution list and route lists; extract and processing of waybills of trucks and cars, other transport and technological machines; determination of fuel consumption rates, accounting for the movement of fuel and lubricant materials; accounting of routine maintenance and rolling stock.
1C-Rarus Alfa-Avto: Avtosalon +Avtoservis+Avtozapchasti (Auto salon +service+components)	For full computerization of accounting at dealers, auto centers, service centers and other technical service enterprises	Used in all types of services
1C-Rarus: Alfa-Avto: Avtosalon +Avtoservis+Avtozapchasti i PROF (red. 5) (Auto salon +service+components and PROD (ed. 5)	For dealers, auto centers, service centers and other technical service enterprises	Program features: - promotion of orders for sales of motor vehicles; - the implementation of the full range of technical impacts from the pre-sale preparation of vehicles, maintenance during the warranty period, as well as maintenance and repair of vehicles in the post-warranty period; - organization of wholesale, small wholesale and retail trade in spare parts, accessories, fluids; - organization of work of warehousing; - accounting of the movement of funds between customers and a service center, between a service center and suppliers of spare parts, components, assemblies and other material resources
1C-Rarus: Avtokhozyastvo (Auto establishment)	For large motor enterprises (100-500 cars)	Required for automated discharge of various documents used to ensure the operation of road transport enterprises; calculating and

		determining the cost of transport services through the accounting of fuel and lubricants, spare parts, drivers' wages; planning accounting and controlling the main indicators determining the effective use of rolling stock of the motor transport enterprise [8]
Programniy kompleks TRIM (Programme complex TRIM)	For the organization of management of fixed assets and the corresponding processes of maintenance, logistics, warehousing	The following software modules are included: - TRIM-M – «Maintenance»; - TRIM-W – «Stock»; - TRIM-C – «Catalogue»; - TRIM-DOC – «Document flow»; - TRIM-A – «Administration» and other documentation [6]

The result of the introduction of computerization and digitalization of document processing in service production was the streamlining and reduction of processing time for paper-based documents, the improvement of the main activities of the enterprise through the operational implementation of decision-making processes, as well as an increase in the level of efficient operation of the enterprise as a whole.

Information systems for managing production assets are being improved and more sophisticated software tools are emerging [10].

The key moment for each owner of the transport and technological machine is the maximum extension of its service, excluding additional maintenance costs. Therefore, it is imperative to keep the proper attention to the issues of diagnostics of transportation and technological machines, which involves the use of specialized digital technology. Digital diagnostics of transportation and technological machines are implemented in three ways: embedded diagnostics, computer diagnostics, and online diagnostics.

All the modern automated control systems, designed to improve the operation of transportation and technological machines and to inform the driver about faults, are equipped with self-diagnostic systems. This includes various sensors and special control devices installed into the corresponding systems with signals to the instrument panels that transmit constant information to the operator (driver, tractor operator, combine operator) about the current technical condition of individual components and assemblies of the machine [5].

The computer diagnostics of transportation and technological machines is a process of reading, decoding the codes of possible malfunctions and failures on the main components and assemblies and the removal of these codes and their subsequent editing. Scanners, recommended by manufacturers, and other diagnostic systems are used for these purposes. These may include the original diagnostic equipment developed by the manufacturer, multifunctional stands, portable readers. Modern instruments and diagnostic tools and their software allow you to identify and record the slightest changes in the operation of engine tuning systems, transmissions, all this is fixed by on-board computers and is often reflected in the instrument panel. The most recognized dealer software for the diagnosis and repair has the following companies: VW-Audi (ELSA), BMW (BMW TIS), Ford (Ford TIS), Mercedes (Mercedes WIS), Opel (Opel TIS), Renault (Dialogys), Volvo (VADIS) etc.; as well as spare parts catalogues VW-Audi (ELCA), BMW (BMW ETK), Mercedes (Mercedes EPC), etc.

Remote online diagnostics will take the lead in digital diagnostics in the near future. The place of computer diagnostics in technical services will be taken by a regular server. When information about any error arrives at the server, in some engine system or another unit, the diagnostics program based on the data bank will check the relevant parameters, make a diagnosis and make the appropriate decision to eliminate the error. The solution may be as follows: sending a code signal to the vehicle's computer, correcting the error or connecting a backup system; in case of failure for some reason, the driver will be sent information about the nearest service center where they can eliminate the fault; as well as the information about the scope and cost of work and recommending information about the urgency of the work. Moreover, the server program will take into account current discounts, promotions, accumulated bonuses, etc. A report on the performed work and the condition of the vehicle from the service center will be sent right to the server.

The advantage of online diagnostics is primarily in a more qualitative and well-timed operations related to the maintenance of the technical condition of transportation and technological machine; the secondary – is the economic component: there is no need for a master, storekeeper, diagnostician.

As a convenient and more reliable confirmation of the maintenance and repair of transportation and technological machines, foreign equipment manufacturers and dealerships offer a digital service report or digital service book. Such offers come from the companies as “Mercedes-Benz”, “Mazda”, “Ford”. This is an electronic service system – a secure online database, where the entire service history of the transportation and technological machine is stored.

The great advantage of a digital service report or a digital service book is that all reports on the technical condition of the machine (which contains comprehensive data on the service works performed and on restoring operational status) are securely stored in a central database in a digital format throughout the entire service period, and is protected from access by unauthorized persons.

A new modern transportation and technological machine is a complex mechanism consisting of high-tech, expensive components and assemblies, instruments and equipment, which undoubtedly requires an increase in the level of training and qualification of personnel engaged in technical services. A new working profession has emerged – a diagnostician. Modern special diagnostic equipment is used in the process of training: readers, motor testers, special simulators, smart glasses, etc. Smart glasses have the function of augmented reality. Complicated repair and monitoring of the exact sequence of maintenance operations using smart glasses implies its virtual accompaniment and audio visualization of serviced components and assemblies [3, 9].

IV. PRACTICAL MEANING

The use of digital technologies in technical services is a force for the development of the industry. The obtained data were tested at the international scientific-practical conference "Digital Agriculture – The Development Strategy" (2019). Also used in the educational process and the preparation of teaching materials for the discipline "Technologies and equipment in the agricultural sector".

V. CONCLUSION

An analysis of the state of digitalization of technical services has shown that the changes and innovations that are taking place contribute to the further improvement of the current maintenance and repair of transportation and technological machines. There is a modernization of technology, when the machine becomes "smart and intelligent", due to the installation of satellite navigation; remote control; replacement of electronic equipment and sensors with more advanced, capable of self-assessment of performance indicators; using online technologies. In the processes of management and organization of production, accumulation and synchronization of flows of industry information is carried out; reducing the cost of searching, processing and storing data; reduction of costs for the promotion of products and services to the consumer. The process of digitization continues [2].

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