

Digitalization of Production - a New Level of Personnel Safety and Health

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ABSTRACT

Preserving the life and health of employees should be a priority task of a modern leader. It is possible to solve this problem through the use of digital technologies in the management of production processes. Smart solutions are an opportunity to improve production efficiency and the level of occupational safety of personnel, as well as reduce or even eliminate the incidence of injuries and deaths at work. The article discusses the concept of digital technologies in the field of industrial and industrial safety, analyzes the digital technologies currently in use and gives a forecast for the development of this direction for the field of labor protection.

Keywords: *Digitalization, digital technologies, Smart solutions, labor protection, vision zero.*

1. INTRODUCTION

Ensuring the safety of production, preserving the life and health of workers are among the priority tasks of any enterprise. Most of the enterprises set themselves the goal of "zero" in this direction – vision zero injuries and occupational morbidity. Today, large companies around the world are striving to implement smart technologies, advanced digital solutions in the field of labor protection, industrial and industrial safety in order to ensure the safety of workers, reduce the level of industrial injuries and minimize the level of occupational risks. Russian companies are no exception in this regard. In recent years, the demand for digital technologies to ensure the safety of the production process has increased significantly. For example, Rostec Corporation announced the transition to a fundamentally different level of security management [1]. In 2020, Rostec plans to launch the automated system "Management of industrial safety, labor protection, environmental protection of the organization and transport safety."

The tasks of the system will include the remote collection of indicators in these areas, their processing and analysis. Implementation of an automated system should result in an effective industrial safety management tool. The system will allow real-time monitoring of key indicators and timely take the necessary management decisions. The introduction of the system will also make it possible to reduce the time, material and labor costs for the control process, elimination of detected violations and implementation of preventive measures.

The Rostec corporation includes more than 1,300 organizations, including those operating hazardous production facilities [1]. These organizations are located in almost all regions of the country. The introduction of an

automated system will allow managing their security remotely.

Digital solutions for ensuring industrial safety are very actively used in Gazprom [2]. The use of smart technologies makes it possible to turn the process of ensuring industrial safety into a controlled and manageable process. Smart technologies allow you to monitor the health status of employees, register violations, conduct training for employees whose workplaces are located remotely. Thus, the introduction of innovative technologies will improve the labor protection and industrial safety management system.

2. BACKGROUND AND METHODS

In the recent years, many domestic and foreign researchers have been studying the digitalization of labor protection and industrial safety. Thus, at the All-Russian Labor Protection Week held in 2018, a round table was held on the topic "Digital Enterprise and Safe Work" [3]. Within the framework of the round table, issues such as the implementation of effective digital solutions for the protection of labor and health of workers, to ensure industrial safety were discussed. The round table was moderated by the ITPS group of companies, which provides information technology consulting services for large manufacturing enterprises in the field of engineering and system integration. Recognized experts in the field of medicine and telemedicine, IT technologies took part in the discussion. The participants discussed the problems in the field of labor protection at industrial enterprises, the needs of enterprises in smart technologies, the market of current proposals was analyzed.

For example, for workers in the road transport industry, one of the most important needs is the implementation of a system for monitoring and preventing fatigue.

Implementation of a personnel location system to prevent occupational injuries is relevant for enterprises in any industry. Such a system makes it possible to track the location of personnel in real time and promptly give a signal about cases of personnel being in hazardous areas. And in case of an accident, the geolocation system allows you to build individual evacuation routes. Also, in order to prevent occupational injuries for enterprises, it is important to identify persons under the influence of alcohol or drugs. This will keep them out of work.

It is also important and relevant in any area to monitor the work and rest regimes of employees. Modern office workers have 24/7 access to corporate mail and work files. Even while on vacation, they continue to work.

Lothar Schroeder [4], a board member of one of the largest trade unions in Germany, ver.di, notes that it is necessary to establish a framework for the duration and intensity of work. According to the Friedrich-Ebert-Stiftung study "Working with digital technology in Germany: challenges and potential" [4], teleworkers very often sit at the computer early in the morning, late at night and on weekends, and often recycle.

An article by Sergey Strelkov, Director of Software Development at CROC IT company [5], is devoted to the analysis of specialized industrial IT platforms for solving problems in the field of occupational health and safety. In the article, he talks about innovative digital technologies, video analytics systems and tools for effective personnel management that are developing in the company. And also about the culture of safety and the pursuit of zero injuries.

In the fall of 2019, Moscow hosted the first case conference "Safe Digital Manufacturing-2019", at which practical experience in the development and implementation of projects for digitalization of processes in the field of industrial safety and labor protection, the penetration of innovative digital technologies into production, and the introduction of a safety culture were considered. The speakers were the heads of digital projects of enterprises that have successfully implemented projects aimed at reducing injuries, simplifying and automating industrial safety and labor protection procedures.

The conference participants noted that in order to accelerate the penetration of digital innovations, it is important to create an environment within the enterprise that is tolerant to errors, to introduce a culture of effective testing of hypotheses, to create incentives for change, to encourage initiatives and developments, to popularize success.

For the effective and widespread introduction of digital technologies in the activities of industrial enterprises, not only the interest of employers, but also support from the state is important.

3. ENHANCING DIGITAL ECONOMY

In May 2018, by a decree of the President of the Russian Federation, national goals and strategic objectives for the development of the Russian Federation for the period until 2024 were approved [6]. One of the tasks is to ensure the accelerated introduction of digital technologies in the economy and social sphere. To solve this problem, the Government of the Russian Federation, on the basis of the Digital Economy of the Russian Federation program, developed a national program Digital Economy of the Russian Federation.

The implementation of this national program implies the development and implementation of the following federal projects [6]:

- Digital environment regulation;
- Human resources for the digital economy;
- Information infrastructure;
- Information Security;
- Digital technologies;
- Digital public administration.

The implementation of these projects will improve the quality of life and the conditions for doing business.

The Ministry of Labor and Social Protection of the Russian Federation is also involved in the implementation of the Digital Economy of the Russian Federation program in terms of the use of electronic documents in labor relations [7]. The Ministry, together with employers, is conducting an experiment to translate documents and information about an employee on labor relations issues into electronic form. The types of work with documents in relation to which the experiment is being carried out include:

- Conclusion of labor contracts;
- Notification of employees about the constituent parts of wages due to him for the relevant period;
- Registration of vacations and business trips;
- Keeping records of the working time actually worked by each employee;
- Issuance of work permits to employees.

Innovative IT technologies in the field of ensuring the safety of the production process include the following systems:

- A support system for making management decisions to ensure the safety of the production process by monitoring and controlling key indicators;
- A system for monitoring and monitoring the health status of employees;
- Personnel training system for safety issues.

At the same time, it is possible to combine all systems with the combination of their functionality based on an intelligent system for ensuring industrial and industrial safety.

The use of innovative digital solutions ensures a decrease in the level of decision-making errors in creating a safe production environment, expands the possibilities of training personnel in the basics of safety culture. Integration of an intelligent safety management system into the organization's management system creates a universal unified management system, a unified database for making management decisions. The application of such a system in enterprises can be seen as a huge step towards the concept of vision zero.

Depending on the equipment and technologies used, the functional purpose of the measures, the likelihood of exposure to harmful and dangerous factors on the personnel, all digital solutions can be divided into three areas [8]:

- 1) Organizational and organizational and technical;
- 2) Technical and provision of personal protective equipment;
- 3) For training and achieving professional compliance of personnel.

In terms of functional implementation, innovative measures to ensure production and industrial safety of production can also be divided into:

- 1) Organizational measures, including training, training and retraining of personnel;
- 2) Technical measures related to the design of machines, equipment, installations,
- 3) Sanitary and hygienic measures related to general and personal protective equipment for workers.

At the same time, one should take into account the fact that the innovative solutions being introduced will not bring the expected effect if their implementation is unreasonable, if a decision has not been developed on their effective placement, operation and professional support.

The development and implementation of effective solutions for the prevention of industrial injuries and occupational morbidity should be based on prompt, complete and reliable information about the working environment, levels of occupational risks, the technical condition of production equipment, and the safety of the materials used. To obtain reliable information in real time, it is necessary to create an informative database. The absence of such information nullifies the effectiveness of the decisions made.

No innovative solution will bring the expected result without the awareness of its importance and significance by the staff. It is necessary to conduct training of personnel using modern methods of teaching safe skills and techniques, the formation of stable knowledge of employees in the field of production safety.

In modern production, effective methods and ways of creating safe working conditions should be applied, including intelligent information and communication technologies used to support the adoption of operational decisions to ensure safe production and to organize training of personnel on production safety.

Innovative solutions are increasingly used to address issues of industrial and industrial safety in various sectors of the economy. State corporations and the largest enterprises - industry leaders were the first to embark on the path of introducing smart technologies. According to the official website of the Ministry of Digital Development, Communications and Mass Media of the Russian Federation [9], in 2019, 10 state-owned companies developed a digital transformation strategy, and another 20 are to adopt similar documents in 2020. According to Russian and international experts, the average annual growth rate of global markets for solutions based on digital technologies will be from 10 to 50% by 2024, and the markets themselves will have grown to several trillion dollars by that time. Business investment spending on digitalization already reaches 3-5% of GDP [9].

The most widespread digital solutions are in the field of production safety analysis. For example, Visitech [10] offers the following innovative business solutions:

- Digital work permit;
- Personnel and contractor management;
- Production control;
- Incident management;
- Hazardous Conditions / Hazardous Actions.

For example, the "Production control" [11] module allows you to plan activities to determine the current state of working conditions and build a systematic approach in the process of ensuring safety, identifying hazardous factors and reducing the risk of accidents. Visitech also produces animation and video content dedicated to industrial safety and labor protection in order to improve safety culture at the enterprise.

With regard to the above, Lindström implements Internet of Things (IoT) technologies [12]. Its digital Storage Solution allows employees to pick up and return personal protective equipment on their own. Using RFID tags applied to special clothing, Lindström analyzes its life cycle: how many times it has been used and washed, how long the employee has worn it, and whether its pro-

tective properties have been preserved. The service optimizes the use of special clothing, saves time and increases staff satisfaction.

Digital technologies are also actively used in the field of personnel training on industrial safety and labor protection. For example, using virtual reality (VR) technology, you can practice and develop skills in working with technological equipment.

In the field of labor protection and industrial safety in Russia, the companies CROC, Visitech are engaged in the development and implementation of VR technologies in training. The use of VR simulators in the training of personnel allows you to work out various types of incidents: i) non-compliance with labor protection requirements; ii) presence of personnel in the danger zone of equipment or transport violation of fire safety rules, and iii) performance of work on functioning equipment.

With the acceleration of production processes and the transition of personnel to remote work, mobile training applications are gaining popularity. An employee at a convenient time on the job can take training courses and assess the level of his training. Such applications include the Olimpoks software training complex from the Thermika company. To date, more than 400 training courses are available at Olimpoks, which can be downloaded to your phone and viewed even without Internet access. The courses are constantly updated as legal requirements change.

One of the unique digital solutions for the tasks of ensuring industrial and industrial safety is the "Digital Worker" platform from the CROC company [13]. The platform is based on Industry 4.0 technologies for labor protection and industrial safety, taking into account the requirements of the Zero Injury concept. Digital Worker provides real-time monitoring of the safety and productivity of staff and contractors at hazardous production facilities. The platform has found wide application in metallurgical, mining and petrochemical industries. For the platform, CROC has developed an IoT module. The Digital Worker platform allows you to solve several problems simultaneously:

personnel geolocation collection, processing and analysis of data to identify threats and risks of injury, creation of a digital twin of a production facility.

With the development of Industry 4.0 technology, more and more large industrial enterprises create their own innovation research centers. Thus, stimulating the development and widespread introduction of digital technologies in the automation of the safety of production processes.

A separate area of digitalization in the field of industrial and industrial safety is the development of smart personal protective equipment. Their use allows you to

monitor both the state of the protective equipment itself (life cycle, effectiveness of use), and the health status of the employee, and his compliance with safety requirements. Special modules in real time transmit information about the observance of labor safety rules by employees and warn of deviations from the standards. For example, a telemetry module can be installed in a protective helmet, communicating with a cloud platform.

The Ministry of Labor of Russia is an active participant in the process of promoting innovative technologies. One of such examples is the launch of the "I am an inspector" mobile application. Any person, even if he is not an employee of the organization, however, who notices a violation that threatens the life and health of workers, can record it on a smartphone and send it to Rostrud.

The app is available for download on Google Play and App Store. To promote it, a large-scale information campaign was carried out in the media. The result was not long in coming. So, according to the Ministry of Labor of Russia, in the Sverdlovsk region, the use of this application made it possible to reduce the number of insured events related to industrial injuries in 2019 by more than 10%.

4. CONCLUSIONS

Summing up, it can be noted that the main directions of digitalization in the field of labor protection and industrial safety today are the following areas:

- Employee training (interactive training using VR technologies);
- Automation of production processes (digital document flow, control of the execution of managerial decisions, management of the daily routine of personnel);
- Organization of objective control (geo-positioning of personnel, control over personnel health indicators);
- Smart personal protective equipment (IoT).

Over the past five years, the trend of using smart solutions is gaining momentum in the field of occupational health and safety. The attitude of enterprise managers to the introduction of new IT developments in production is gradually changing: the safety of workers, their life and health are becoming a key priority of business process management systems. According to data from the official website of the Ministry of Digital Development, Communications and Mass Media of the Russian Federation, by the end of 2024 it is planned to allocate over 200 billion rubles for the development and implementation of "end-to-end" digital technologies. budget financing and still attract several hundred billion of private funds. In the near future, we can expect an increase in the

development of technologies: modern equipment, software. The indicators of its availability for Russian companies will also grow.

The use of smart solutions will allow in real time to identify incidents in production that could not previously have been identified in any way, for example, violation of the regime of being in hazardous or closed areas by employees, lack of personal protective equipment. In addition, the combination of real-time "digital" information about the types of activities of people, specific work performed per day and automatic measurement of the duration of operations, will make it possible to compile a digital diary or digital model of the working day of all employees and, based on this information, optimize processes at the enterprise.

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