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Digital Transformation Research on the Organization and Management of Labor Protection in Manufacturing Enterprises and Their Impact on Labor Safety

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Abstract

The process of developing a conceptual and methodological foundation for the launch of "smart" and other promising technologies, as well as technologies that handle massive volumes of data across many economic sectors, is currently being carried out at a quick pace[1]. Through mutually connected and automated systems, digital transformation technologies are significantly altering the way that labor protection is organized and managed in production firms, particularly with regard to employee safety and health [2]. These technologies make it possible for businesses to track, control, and identify threats [3].

Key words: production enterprise, labor protection, digital transformation, organization, management

Introduction

The process of incorporating contemporary technologies into businesses and radically altering organizational procedures, activity kinds, and management systems is known as digital transformation. These modifications give businesses the chance to lower expenses, boost worker productivity, and enhance worker safety and health [4].Numerous studies have examined the effectiveness of digital transformation technologies, such as automation systems, IoT, Big Data, and AI, in enhancing occupational health and safety in industrial organizations [5]. Research on IoT technologies, Big Data,automation, artificial intelligence (AI), and AR/VR has examined the effects of digital transformation on worker safety and health in the processes of organizing and managing labor protection in production organizations [6].

Materials and Methods

Internet of Things (IoT) technologies are being used to construct security monitoring systems

for the administration and organization of labor protection in industrial companies. These systems offer the ability to monitor the activities of people and equipment and identify dangers in real time (Fig. 1 [13]). Sensor-equipped PPE (helmet, special clothes, etc.) keeps an eye on workers' access to hazardous areas or detects when equipment is overheating and sounds an alert in a timely manner. Accidents and injuries can be decreased in this way. Research from the McKinsey Global Institute indicates that the number of injuries in the industrial industry can be considerably decreased by using safety monitoring systems via the Internet of Things [7]. By using this technology, the level of safety is increased by automatic warning and early identification of risky circumstances.



Figure 1. Security monitoring systems through Internet of Things (IoT) technologies

Research has been done on how labor protection is organized and managed in production companies, as well as how to forecast and avoid variables that endanger worker safety by analyzing vast amounts of data using analytics and Big Data (Fig. 2 [14]). This method offers more thorough and precise information regarding employeehealth, risky procedures, and mishaps. Automatic analysis of sensor and security camera data identifies high-risk regions and develops the necessary countermeasures. Studies published in the Harvard Business Review have shown that process monitoring and safety planning using Big Data analysis can help reduce risk and accident likelihood by as much as 30%[8].



Figure 2. Analyzing large volumes of data using Big Data and analytics

Artificial intelligence opens up a wide range of technology possibilities for labor safety management in industrial companies' labor protection organization and management operations. Automated systems powered by AI are able to recognize unsafe conditions or risky behaviors and react swiftly. Artificial intelligence analyzes data gathered by cameras and sensors in real time. The device will alert the worker or automatically stop the machine in a hazardous condition if he disregards safety regulations. AI-enabled safety solutions may cut human error in industrial processes by 50%,according to research by Deloitte, which dramatically lowers the amount of accidents and injuries [9].Robots and automated technologies can take the position of workers in production firms when it comes to organizing and managing labor protection procedures. This is especially true for heavy and hazardous tasks (Fig. 3 [15]). Automation greatly improves safety, particularly in risky operations like handling chemicals or moving large objects. Robots and automated conveyors can do labor-intensive or hazardous tasks without the need for human assistance, saving lives and preserving health. aids in doing. According to World Economic Forum research, using autonomous robots in manufacturing companies dramatically lowers employee risk [10]. Specifically, the industrial revolution's automation lowers the risk of injuries by 35% [12].



Figure 3. Robots and automated technologies

Employee safety training using virtual and augmented reality (VR/AR) technology is more successful when it comes to the organization and administration of labor protection in production firms (Fig. 4 [16]). By mimicking actual circumstances in a secure virtual environment, employees can learn how to behave in risky situations. Through virtual reality simulations, hazardous operations ina factory or business are replicated, and staff members learn safety procedures based on actual experience. According to studies from Stanford University, safety training delivered via virtual reality guarantees that staff members acquire practical knowledge more quickly and accurately [11]. This raises the likelihood of making an

accurate and timely decision in risky situations in real life.



Figure 4. Training of security personnel through virtual and augmented reality (VR/AR) technologies

Digital transformation is also of great importance in the field of occupational safety, providing new opportunities to reduce risks and create a safe environment through various technological approaches. Research on the impact of digital transformation on labor safety and key technologies have been reviewed above.

Results and Discussion

Utilizing IoT, Big Data, and data analysis technologies, industrial firms can execute the influence of digital transformation on labor safety with remarkable effectiveness in the organization and management of labor protection operations. This is because, with the use of IoT technology, manufacturing companies will be able to keep an eye on incidents in real time and take action to swiftly leave hazardous circumstances, hence lowering the frequency of accidents and injuries. Additionally, by gathering and evaluating a lot of labor safety data, it is feasible to foresee hazardous locations and procedures for workers and enhance their safety. Making decisions based on data facilitates the efficient planning of upcoming security measures. As a result, it becomes possible to analyze occupational diseases and injuries of employees in production enterprises.The following conclusions have been drawn from several research that have examined the benefits of digital transformation for workplace safety and health to date:Research indicates that predictive and warning systems for processes greatly improve worker safety when artificial intelligence is incorporated into safety systems. AI, for instance, has improved the efficiency of identifying infractions and prompting staff to leave hazardous situations.Rapid risk identification in the production environment is made possible by real-time security monitoring via IoT systems. Specifically, the industrialsector makes extensive use of IoT-based fire and technical accident prevention techniques.

Conclusion

Digital transformation creates strong technological opportunities in the organization and management of labor protection in production enterprises. IoT, Big Data, AI, automation and AR/VR technologies help to automate security measures, analyze processes and reduce risks. These technologies allow not only to improve labor safety, but also to increase production efficiency and reduce overall costs for enterprises. At the same time, security controls and risk minimization have become much simpler and improved thanks to digital technologies.

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АВТОМАТИЗИРОВАННЫЙМНОГОВАРИАНТНЫЙМЕТОДРАСЧЕТАПОКАЗАТЕЛЕЙБЕЗОПАСНОСТИФУНКЦИЙЗАЩИТВСИСТЕМАХУПРАВЛЕНИЯТЕХНОЛОГИЧЕСКИМИПРОЦЕССАМИ. СКРЫПНИКОВАМ.К.1. https://doi.org/10.31145/1999-513x-2023-1-32-40

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