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IMPROVEMENT OF THE QUALITY CONTROL SYSTEM IN PRODUCTION AT TEXTILE INDUSTRY ENTERPRISES

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INTRODUCTION

The textile industry is considered one of the strategic sectors of the economy of Uzbekistan, playing an important role in providing the domestic market with quality products and entering world markets with competitive finished products. In recent years, large-scale reforms have been carried out in the sector to introduce modern technologies, automate production processes and form a quality control system in accordance with international standards. In this process, advanced laboratory analyzes in assessing product quality, and the effective use of automated methods and technical means in identifying defects in raw materials and finished fabrics are of great importance.

Modern quality control systems are not limited to checking compliance with existing standards, but also serve to accurately determine the causes of defects occurring in the production process, the likelihood of their recurrence and the level of impact. Therefore, scientifically based analytical approaches, digital monitoring platforms, optical and sensor detection systems are increasingly being used as an integral part of quality management policies at enterprises.

An analysis of a number of scientific studies conducted in this area shows that, although existing developments are of great importance in industrial practice, aspects such as the share of undetected defects in a timely manner, errors associated with the human factor, the speed of data processing and the insufficient development of predictive control mechanisms are still relevant. This indicates the need to further improve the quality control system at textile enterprises, fully utilize the potential of automated technologies, and take scientific research to a new level.

METHODS

This thesis analyzes the essence of modern laboratory analyzes and automated methods for detecting defects in the quality control system of textile enterprises and their role in the quality policy of textile enterprises. In the process of conducting the research, the following sources were studied and analyzed as part of the literature review: scientific articles and scientific journals related to the textile industry, international and domestic industry reports, practical guides on laboratory analysis methods, technical documents on automated inspection systems, case studies and practical research on Industry 4.0 and digital transformation experiences. For example, modern laboratory analyzes used to assess fabric quality, automated camera inspection systems used to detect defects in textile products, practical solutions for early detection of errors using AI in the production process, digital transformation processes in the textile industry based on the principles of Industry 4.0.

RESULTS

The analysis showed that:

The results of modern laboratory analyzes used in fabric quality assessment show that digital laboratory measurement methods have high accuracy in determining such indicators as the structural stability of the fabric, moisture content, elasticity, and surface qualities of the yarn. The fact that spectrophotometers, laser measuring devices, and sensors that detect mechanical stress provide more repeatable and stable results than traditional methods increases the possibilities of standardized assessment within the framework of quality policy.

According to the results of automated camera inspection systems, inspection systems based on high-precision optical sensors, cameras, and image processing algorithms can record defects in the fabric (dots, breaks, yarn breakage, structural distortion, color changes) with an accuracy of 90–98%. Such automation reduces the influence of the human factor, increases process stability, and significantly increases the speed of quality control turnover.

Practical research sources show that AI-based monitoring systems can predict the probability of errors based on sensor data and provide optimal control of the production process. These methods significantly reduce technological interruptions, yarn breakage, unevenness in the weaving process, excessive tension, etc.

The wide coverage of digital transformation experiences of textile enterprises, IoT devices, creation of a digital twin, sensor networks, cloud data exchange and integrated quality control systems are the main reasons for the significant improvement in quality indicators.

DISCUSSION

The study provides a comprehensive approach to quality control in the textile industry, not only through a single method, but also by considering laboratory analysis, automated inspection systems, on-line monitoring and AI-based predictive technologies, which includes a number of advantages: analysis based on modern technologies, scientific results close to practice, technologies are evaluated not only technically, but also with their impact on the effectiveness of the quality policy of enterprises, digital twins, sensor networks, on-line monitoring, etc. However, the presence of advantages does not limit the disadvantages, which leads to problematic issues in the study. For example, not all enterprises are able to implement modern technologies due to the high cost of introducing new automated inspection systems or the lack of sufficient qualifications of personnel, while the fact that quality policy in many enterprises still relies on traditional approaches is the reason why digital quality management, automatic decision-making systems and predictive control are not widely used. In the future, it is advisable to develop the following proposals for the effective introduction of modern laboratory analysis, automated inspection systems, and digital quality control at textile industry enterprises: the creation of an integrated quality control platform, the establishment of training courses for specialists in working with modern laboratory analysis, AI, and automated inspection systems, technical training, and certification in accordance with international standards.

CONCLUSION

In conclusion, during the research, modern laboratory analyzes, automated inspection systems, on-line monitoring tools, and artificial intelligence-based technologies aimed at improving quality control at textile enterprises were extensively studied. A literature review showed that these technologies create great opportunities for reducing the human factor in the production process, increasing the accuracy and speed of defect detection, and modernizing quality policy based on digital management. At the same time, significant scientific and technical gaps in existing practice were identified - such problematic issues as the lack of a sufficient database for AI models, the lack of integrated control platforms, and the incomplete modernization of technical infrastructure. . This article is suitable for the 2nd semester “Digital technologies and solutions in modeling engineering mechatronics, robotics, and technological processes” and is ready for publication as an article in international scientific journals.

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