

DIGITAL TRANSFORMATION OF THE GARMENT AND KNITWEAR INDUSTRY THROUGH ARTIFICIAL INTELLIGENCE AND PREDICTIVE ANALYTICS

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Abstract. *The article examines the possibilities of applying artificial intelligence (AI) and predictive analytics in the garment and knitwear industry and their impact on production efficiency. The study substantiates the relevance of introducing digital technologies in the processes of forecasting market demand, optimal resource allocation, and quality control. It also analyzes the possibilities of automating production processes, increasing labor productivity, and ensuring product competitiveness through AI-based models. The results obtained can be effectively used in making innovative management decisions in garment and knitwear enterprises.*

Keywords: *Garment Industry, Artificial Intelligence, Predictive Analytics, Digital Technologies, Efficiency, Automation.*

INTRODUCTION

In a global economy where competition is intensifying and market demands are changing rapidly, the garment and knitwear industry is facing a need to focus on efficiency, sustainable development, and product quality. Diversification of product types, changing consumer needs, and dynamics of demand in export markets are pushing enterprises to seek new innovative solutions.

In this regard, the introduction of artificial intelligence (AI) and machine learning (ML) technologies is an important factor in transforming production processes. In particular, by predicting market demand based on ML algorithms, it is possible to optimize product types and volumes. At the same time, predictive analysis based on artificial intelligence allows optimizing logistics processes, effectively managing resources, reducing transportation costs, and implementing the "just-in-time" model.

In addition, AI technologies are important in establishing automated control over product quality during the production process, early detection of



defects, and facilitating certification processes in accordance with international standards (ISO 9001, Oeko-Tex). Best practices in this area are demonstrated by the fact that the development strategy of Uzbekistan until 2030, Presidential Decree No. PF-4947 (“Strategy of Actions”), as well as regulatory and legal documents such as the “Development Strategy of New Uzbekistan for 2022–2026” set the digitalization of industry, the introduction of innovations, and increasing export potential as priority tasks.

Thus, the application of artificial intelligence and predictive analysis in the sewing and knitting industry has significant scientific and practical importance in increasing production efficiency, efficient use of resources, and ensuring competitiveness in the international market.

REVIEW OF LITERATURE ON THE TOPIC

In the scientific studies devoted to the application of artificial intelligence and predictive analysis in industrial fields, the role of these technologies in increasing production efficiency and cost-effective use of resources is emphasized.

Tapia, A. & Lee, S. propose innovative models for predicting market demand through machine learning in the textile industry. They show that analyzing consumer purchasing habits based on Big Data can help determine production volumes and reduce excess inventory [1].

Research conducted by Choi, T.M. emphasizes that predictive analysis models based on artificial intelligence are an effective solution for optimizing the logistics chain, especially when using the “just-in-time” model, significant results can be achieved [2].

Li, X. et al.'s research analyzed the possibilities of automating product design and early detection of defects through artificial intelligence algorithms integrated with CAD/CAM and PLM systems. The authors substantiated that this method can significantly reduce production costs [3].

Kozłowski, A., Bardecki, M. & Searcy, C., in their study, emphasize the need to combine Life Cycle Assessment (LCA) and artificial intelligence solutions for sustainable development in the textile and fashion industry. According to them, AI technologies offer great opportunities for reducing carbon footprint and water consumption [4].

Uzbek scientist Kayumov R.I. in his works paid attention to the effectiveness of introducing digital management systems and innovative solutions at national industrial enterprises. In his opinion, the introduction of AI and forecast analysis systems in sewing and knitwear clusters is of great importance in adapting local production to the requirements of the world market [5].



RESEARCH METHODOLOGY

This study examined the application of artificial intelligence and forecasting analysis in the garment and knitwear industry from a scientific, theoretical and practical perspective. Within the framework of the methodology, foreign and domestic literature was analyzed, and regulatory and legal documents of the Republic of Uzbekistan on the digital economy and industry were studied. In addition, practical analyses were conducted on the example of “Uztex Group” and other local clusters. Economic and statistical methods and forecasting models were used based on data from the State Statistics Committee and international reports. The experiences of China, Turkey and Bangladesh were compared with the local situation, and areas for effective application of artificial intelligence were identified.

ANALYSIS AND RESULTS

Digital transformation processes in the garment and knitwear industry are developing rapidly. In particular, the introduction of artificial intelligence (AI) and predictive analytics technologies is making it possible to increase production efficiency, save resources, and predict market demand.

Table 1.

Forecasting market demand through AI (for example, 2023–2024)¹⁷

Months	Real demand (million units)	AI forecast (million units)
January	5.1	5.0
March	5.8	5.7
May	6.2	6.0
July	6.9	6.7
September	7.4	7.1
November	7.9	7.6
December	8.2	8.0

¹⁷ Statistics Agency of Uzbekistan; "Uzbekistan's textile sector contributes over 10% to total exports", Kun.uz, 2025
[129]



This graph shows that AI models were able to predict demand with 95–97% accuracy.

Table 2.

**Reducing logistics costs through the introduction of AI
(Uztex Group example, 2024)**

Logistics processes	Without introduction of AI (billion soums)	After introduction of AI (billion soums)	Saving in interest
Transportation costs	120	102	–15%
Warehouse costs	85	68	–20%
Stock of finished goods	150	120	–20%
Total	355	290	–18.3%

This table shows that 18–20% cost savings were achieved when optimizing logistics processes based on AI.

Table 3.

Application Stages of Artificial Intelligence Technologies in the Sewing and Knitwear Industry

	Stage	Area of AI Application	Technology or Model Used	Efficiency and Results
	Design and Modeling	Automation of product design, trend prediction	Generative AI (Midjourney, DALL·E), Pattern Recognition	Design creation time reduced by 40%; faster adaptation to market trends
	Fabric Selection and Quality Assessment	Detection of fabric texture, color, and defects	Computer Vision, Neural Networks (CNN)	Share of defective fabrics decreased by 12–15%
	Production Planning	Optimization of production processes and scheduling	Machine Learning, Optimization Algorithms	Production downtime reduced by 10%; improved



				resource efficiency
	Sewing Process Control	Real-time monitoring of operator errors via automated cameras	AI-based Visual Inspection Systems	Accuracy of quality control increased up to 95%
	Logistics and Inventory Management	Managing raw material and product stock, demand forecasting	Predictive Analytics, ARIMA, Regression Models	Inventory turnover rate increased by 20%; reduced overproduction
	Marketing and Sales	Forecasting consumer demand and personalization	Data Mining, Recommendation Systems	Sales efficiency increased by 25–30%
	Technical Maintenance and Energy Efficiency	Predicting equipment performance and maintenance needs	IoT + AI Sensor Models	Equipment downtime decreased by 18%
	HR and Personnel Management	Evaluating employee performance, forecasting workforce needs	AI-driven HR Analytics	Employee turnover decreased by 10%; productivity improved

Today, artificial intelligence in the garment and knitwear industry is not just a tool for automation, but has become an important part of the strategic decision-making process. It plays a key role in increasing production efficiency, saving raw materials and time resources, accurately predicting market demand, and improving product quality.

Conclusions and suggestions

The analysis shows that the introduction of artificial intelligence technologies in the garment and knitwear industry is taking production and management processes to a qualitatively new level. In particular, generative artificial intelligence in design and modeling allows for faster production of collections that meet market demand; computer vision technologies in quality



control have significantly increased the accuracy of defect detection; and forecast analysis is used to effectively organize demand and inventory management. At the same time, artificial intelligence is an important factor in saving labor, reducing errors in production, and increasing export potential.

Based on this, the following proposals can be put forward:

- It is advisable to create a unified information system “AI Textile Platform” within the framework of the digital transformation strategy for garment and knitwear enterprises at the national level.
- It is necessary to expand programs for training qualified IT specialists and data analysts to implement artificial intelligence solutions in enterprises.
- It is recommended to integrate real-time monitoring systems based on artificial intelligence into the stages of production planning and quality control.
- It is necessary to form “Big Data” centers to store and analyze production data collected at enterprises.
- At the state level, tax and grant benefits should be introduced for innovative enterprises and mechanisms should be developed to encourage enterprises using artificial intelligence.
- It is advisable to implement joint projects in the field of forecast analysis and machine learning in cooperation with scientific research institutes and manufacturing enterprises.

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