ECONOMIC AND ORGANIZATIONAL FOUNDATIONS FOR IMPROVING THE EFFICIENCY OF PRODUCTION MANAGEMENT IN TEXTILE ENTERPRISES

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Abstract. *This article provides a scientific analysis of the economic and organizational characteristics of production processes in textile enterprises. The study examines the structure of production costs, the specific features of technological processes, production flow organization, quality control systems, and technological modernization. Based on the outcomes of technical modernization implemented in Uzbekistan's textile industry during 2015–2025, the key factors contributing to improved production efficiency are identified. The findings demonstrate that effective management of production resources, the widespread adoption of energy-efficient technologies, optimization of production flows, and the implementation of digital production management systems constitute the principal drivers of enhancing the competitiveness and operational efficiency of textile enterprises. The study emphasizes that the integrated application of modern production management approaches creates favorable conditions for increasing labor productivity, reducing production costs, improving product quality, and ensuring sustainable industrial development.*

Keywords: *textile industry, production management, production efficiency, production costs, technological modernization, production flow management, quality control, energy-efficient technologies, digital management systems.*

INTRODUCTION

The textile industry is one of the strategic export-oriented sectors of Uzbekistan's economy and plays a significant role in enhancing industrial competitiveness, increasing export potential, and ensuring sustainable economic growth [8,9]. In recent years, the establishment of vertically integrated textile clusters, the attraction of foreign investment, and the introduction of advanced manufacturing technologies have created favorable conditions for significantly improving production efficiency. At the same time, the multi-stage structure of production processes, the high consumption of raw materials and energy resources, and the increasing requirements for product quality have intensified the need to further improve production management systems.

Under current economic conditions, improving production efficiency depends not only on the adoption of advanced technologies but also on the optimization of production costs, the efficient utilization of production resources, the effective organization of production flows, and the implementation of modern production management approaches [2,4]. The integrated application of these factors contributes to higher labor productivity, improved product quality, reduced production costs, and enhanced competitiveness of textile enterprises in both domestic and international markets.

LITERATURE REVIEW

The theoretical foundations of production management have been established through the pioneering works of A. Smith, F. W. Taylor, H. Fayol, H. Ford, W. E. Deming, and J. M. Juran.

Contemporary studies identify Lean Manufacturing**,** Just-in-Time (JIT)**,** Six Sigma**,** Total Quality Management (TQM**)**, and Industry 4.0 as the principal approaches for enhancing production efficiency and improving operational performance [5,7].

Research on production management in the textile industry has primarily focused on technological modernization, energy efficiency, production cost reduction, and the development of quality management systems. These studies emphasize the importance of digital transformation, process optimization, and sustainable manufacturing practices in strengthening the competitiveness of textile enterprises. However, comprehensive assessments integrating the economic and organizational characteristics of production processes remain relatively limited in the existing literature, indicating the need for further research in this area [14,15].

RESEARCH METHODOLOGY

The study employed a combination of economic-statistical analysis**,** comparative analysis**,** the systems approach**,** economic generalization**,** and graphical and tabular analysis to investigate the research problem. Statistical data on the development of Uzbekistan's textile industry during **2015–2025**, including the structure of production costs, the outcomes of technological modernization, and the main stages of the production process, were systematically analyzed to identify the key factors influencing production efficiency [8,10].

The methodological framework enabled a comprehensive assessment of the economic and organizational characteristics of production processes in textile enterprises, as well as the identification of opportunities for improving production management efficiency through resource optimization, technological upgrading, and the adoption of modern management practices. The findings were interpreted using a systematic analytical approach to ensure the reliability and scientific validity of the research results.

RESULTS AND DISCUSSION

The economic and organizational characteristics of production processes in textile enterprises are inherently complex and multifactorial, encompassing interdependent dimensions of resource management, production technology, and organizational governance. The efficiency of production activities is largely determined by the effective coordination of these interconnected components, which collectively influence operational performance and enterprise competitiveness.

A well-structured production system, the rational utilization of material, labor, and energy resources, robust quality control mechanisms, and the implementation of modern production management practices constitute the fundamental determinants of sustainable production efficiency. The integration of these elements enables textile enterprises to optimize production processes, minimize operational costs, improve product quality, strengthen their export capacity, and enhance their competitive position in both domestic and international markets.

These findings suggest that improving production management efficiency requires not only technological advancement but also the systematic integration of economic and organizational management mechanisms. Such an integrated approach provides a solid foundation for sustainable industrial development, increased productivity, and the long-term competitiveness of textile enterprises.

Table 1

Classification of Production Costs in Textile Enterprises[1]

Cost Category	Share in Total Production Cost (%)
Raw cotton, yarn, and chemical materials	60-70%
Labor costs	10-15%
Energy resources	12-18%
Other production costs	5-10%

The economic essence of textile production is intrinsically associated with the efficient utilization of raw materials, labor resources, technological processes, and energy inputs. From an economic and managerial perspective, textile production is characterized by the following fundamental features.

a) High material intensity. Raw materials and auxiliary inputs account for approximately 60–70% of the total production cost. This proportion highlights the economic significance of applying standardized raw material consumption norms, minimizing production waste, and strengthening technological discipline to improve production efficiency.

b) Labor-intensive production processes. Manual labor remains a substantial component of spinning, weaving, and garment manufacturing operations. Improvements in labor productivity can be achieved through:

- technological modernization;
- optimization of work organization;
- continuous education and professional development of employees.

c) High energy consumption. Dyeing, drying, and finishing processes require considerable amounts of electrical and thermal energy. The introduction of energy-efficient equipment can reduce energy consumption per ton of finished products by approximately 10–15% [11], thereby decreasing production costs and improving overall operational efficiency.

d) High working capital requirements. Due to the multi-stage nature of textile production, substantial financial resources remain tied up throughout the production cycle during the transformation of:

- raw materials into semi-finished products; and
- semi-finished products into finished products.

Accordingly, effective inventory management and supply chain optimization facilitate faster working capital turnover, improve liquidity, and strengthen the financial sustainability of textile enterprises.

e) Types of production flow. Textile enterprises generally employ three principal production flow systems.

1. Continuous production flow (spinning and weaving lines). These operations are performed using automated production equipment operating under a continuous production rhythm.
2. Batch production system (dyeing department). Production orders are processed in batches, and operational efficiency depends on the proper sequencing of technological operations.
3. Make-to-order production system (garment manufacturing). Production activities are organized according to customer requirements concerning product design, size, and model specifications.

[1] Compiled by the author based on the research findings.

f) Quality control system. In textile enterprises, quality control is implemented through a three-stage inspection system, ensuring quality assurance at the stages of raw material inspection, in-process production control, and final product evaluation.

The organizational structure of textile enterprises is closely integrated with the technological sequence of manufacturing operations, production flow organization, and quality management systems. Efficient coordination of these components contributes significantly to enhancing production efficiency and maintaining product quality.

Uzbekistan's textile industry is based on a fully vertically integrated cluster system, covering the entire value chain from cotton cultivation to the production of finished garments. This cluster-based production model has experienced rapid development since 2017, and by 2025, more than 150 textile clusters were operating across the country [10].

Cotton ginning represents the first stage of Uzbekistan's textile value chain. During the period 2015–2025, the widespread adoption of advanced cotton ginning technologies, particularly Lummus equipment and Turko technologies from Turkey, significantly improved production performance and increased cotton fiber quality by approximately 20–25%.

The main technological stages of cotton processing include:

1. Reception and drying of seed cotton;
2. Cleaning of seed cotton;
3. Cotton ginning (fiber separation from cottonseed);
4. Fiber cleaning and baling;
5. Storage of processed cotton fiber and transportation to spinning mills.

Table 2

Key Technological Performance Indicators [2]

Indicator	2015 y.	2020 y.	2024 y.
Average fiber yield, (%)	31-32	33-34	34-35
Energy consumption in cotton ginning, (kwh/ton)	55	41	37
Share of obsolete equipment (%)	48	33	19

Spinning, including ring and rotor spinning technologies, has undergone the most significant technological modernization within Uzbekistan's textile industry. The proportion of technologically advanced spinning facilities increased from 27% in 2015 to 78% in 2024, demonstrating the rapid adoption of modern production technologies and the industry's ongoing transition toward more efficient and competitive manufacturing systems[3].

Table 3

Analysis of Resource Consumption in Uzbekistan's Spinning and Textile Production Processes (2015–2025)[4]

Production Process	Water Consumption (L/kg)	Energy Consumption (kWh/kg)	Chemical Consumption (g/kg)

[2] Compiled by the author based on the research findings and industry statistical data.
[3] Compiled by the author based on the reports of the Uzbekistan Textile and Garment Industry Association (Uztextileprom Association), 2024.
[4] Developed by the author based on the results of the study.

Cotton cleaning	3-5	0,04	-
Spinning	0-2	3,5-6	5-12
Weaving	8-15	0,8-1,4	-
Knitting	4-8	0,5-0,9	-
Fabric dyeing	50-110	1,5-3,8	220-420
Finishing (final processing)	10-25	1,0-2,0	30-55

Two principal fabric manufacturing technologies are employed in the textile industry:

- Woven fabric production, including denim, poplin, satin, and twill fabrics;
- Knitted fabric production, including rib, interlock, and single jersey (kulir) fabrics.

During the period 2015–2025, knitting technologies experienced the most rapid technological modernization within Uzbekistan's textile industry. By 2024, the share of production based on modern knitting technologies had increased to 54%, reflecting the accelerated adoption of advanced manufacturing equipment and innovative production processes.

Table 4

Main Types of Textile Production Technologies[5]

Technology	Production Capacity	Water Consumption	Energy Consumption	Current Status (2024)
Shuttle Looms	Medium	Low	Moderate	Obsolete (40% of equipment)
Air-Jet Looms	Very High	Very Low	High	Widely Used in Modern Production
Rapier Looms	Medium	Low	Low	Widely Adopted
Circular Knitting Machines	High	Very Low	Moderate	Market Leader

Table 5

Share of Obsolete Equipment: Level of Technical Depreciation by Technological Production Stage (%)

Technological Stage	2015 y.	2018 y.	2021 y.	2024 y.	2025 y.
Cotton Ginning	48	41	33	24	21
Yarn Spinning	42	31	22	14	10
Fabric Weaving	55	46	38	30	27
Knitting	39	31	26	19	17
Fabric Dyeing	52	48	43	36	33
Finishing (Final Processing)	57	49	41	34	31

As shown in Table 5, the level of technical depreciation of equipment across all technological stages of the textile industry exhibited a consistent downward trend during the period 2015–2025. Specifically, the depreciation rate declined from 48% to 21% in cotton ginning, from 42% to 10% in yarn spinning, from 55% to 27% in fabric weaving, from 39% to 17% in knitted fabric production, from 52% to 33% in fabric dyeing, and from 57% to 31% in the finishing (final processing) stage.

[5]Author's compilation based on data obtained from the Textile Exchange Open Resource (2024) and the UNIDO Weaving Benchmark Report (2023).

This trend indicates the gradual implementation of technological modernization across textile enterprises, accompanied by the renewal of production capacities and increasing investment in fixed assets. The most significant reductions in equipment depreciation were observed in the yarn spinning and cotton ginning stages, suggesting that these production segments have been prioritized for technical upgrading and capital investment. Overall, the findings demonstrate the industry's ongoing transition toward more modern and technologically advanced production systems, which is expected to enhance operational efficiency and strengthen the competitiveness of textile enterprises.

CONCLUSION AND RECOMMENDATIONS

The findings of this study demonstrate that improving production efficiency in textile enterprises is closely associated with the optimization of production costs, the acceleration of technological modernization, the wider adoption of energy-efficient technologies, and the digitalization of production processes. The integrated implementation of these measures enhances resource utilization, increases operational efficiency, and strengthens the long-term competitiveness of textile enterprises.

The analysis further indicates that during the period **2015–2025**, the substantial reduction in the level of equipment obsolescence, together with the modernization of cotton ginning and spinning operations and the introduction of advanced production technologies, significantly contributed to enhancing the production capacity and technological capabilities of Uzbekistan's textile industry.

Based on the research findings, it is recommended that textile enterprises accelerate the integrated implementation of Enterprise Resource Planning (ERP)**,** Manufacturing Execution Systems (MES)**,** Supply Chain Management (SCM)**,** the Internet of Things (IoT)**,** and Artificial Intelligence (AI) technologies within production management systems. Furthermore, establishing real-time monitoring of production costs and developing an integrated production management framework will improve managerial decision-making, optimize operational performance, and further strengthen the international competitiveness of textile enterprises in the global market [6,7,15].

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