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APPLICATION OF NEW TECHNOLOGIES AND ECONOMIC EFFICIENCY ANALYSIS IN THE PRODUCTION OF OUTERWEAR FROM NATURAL LEATHER

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Abstract
The article analyzes the results of research conducted at “IDEAL TEKSTIL-ORZU” LLC aimed at improving the production technology of outerwear made from natural leather. During the 2023–2025 research period, a new method of leather processing was developed, and the deformation characteristics of the products made using this method were studied experimentally. The results show that the new technology not only improves product quality, strength, and aesthetic performance but also provides significant economic benefits by reducing production costs. According to calculations, the production of 10,000 units per year yields an economic gain of 182.2 million UZS, with a specific efficiency of 18,220 UZS per product unit.

Keywords: natural leather, garment manufacturing technology, deformation characteristics, production efficiency, economic analysis, innovative technology.

Introduction

In recent years, the demand for natural leather products in the clothing industry has been steadily increasing. The superior strength, hygienic properties, long-term preservation of aesthetics, and environmental safety of natural leather make it more advantageous than other materials [1]. However, traditional leather production technologies still face several challenges, such as raw material waste, complex technological processes, and low production efficiency [2].

According to the Concept for the Development of the Textile and Leather-Footwear Industry of the Republic of Uzbekistan [3], the main priorities include manufacturing finished products from local raw materials, enhancing export potential, and introducing advanced technologies.

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Therefore, improving leather processing technologies and implementing new approaches in outerwear production have become urgent scientific and practical tasks.

The purpose of this study is to develop new technological methods for producing outerwear from natural leather, determine their technical and economic efficiency, and assess their practical applicability.

LITERATURE REVIEW AND RESEARCH METHODOLOGY

Natural leather — an organic, collagen-based material obtained from animal hides — possesses a complex fibrous structure with high mechanical strength, elasticity, and deformation stability. The quality and physical-mechanical properties of leather largely depend on the orientation, density, and thickness of collagen fibers, as well as the technological methods applied during processing [4].

The leather production process includes several technological stages: design development, preliminary treatment, mechanical processing, cutting, sewing, and final finishing. At each stage, maintaining the deformation stability and shape retention of the leather is of great importance [5].

In modern leather industries, there is a growing trend toward the use of environmentally safe reagents in chemical treatment processes — such as formaldehyde-free tanning agents, bio-based lubricants, and water-soluble plasticizers. These innovations improve the plasticity, viscosity, tensile, and compressive strength of the leather while ensuring environmental safety. In addition, the use of automated systems that regulate heat and moisture conditions during production enhances process stability and reduces waste [6].

Scientific literature emphasizes that the technological response of natural leather to processing is directly related to the inter-fiber bonding strength and its liquid absorption capacity. Therefore, in mechanical treatments such as stretching, compressing, and polishing, the optimal selection of pressure, temperature, and humidity plays a crucial role in determining final product quality.

This study was conducted between 2023 and 2025 in collaboration with Namangan State Technical University and “IDEAL TEKSTIL-ORZU” LLC. The main goal was to develop a new technological method for processing natural leather that enhances deformation stability in leather outerwear production and improves economic efficiency.

The research was carried out in the following stages:

Development of a new processing method. At this stage, a technological regime that preserves deformation stability during mechanical stretching of natural leather was developed. Through experimentation, temperature, pressure, humidity levels, and processing duration were optimized.

Determination of deformation properties. To determine the physical and mechanical properties of the leather, laboratory tests were conducted — including static (tensile, compression, elasticity), dynamic (abrasion, flexibility), and heat resistance analyses. The

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obtained results were compared with existing industrial standards, confirming the advantages of the new method.

Technological testing stage. Leather outerwear samples produced using the new technology were tested under industrial conditions at "IDEAL TEKSTIL-ORZU" LLC. The stability of the production process, seam strength, and leather elasticity were evaluated.

Economic analysis stage. Production cost, capital investment, specific efficiency, and payback period for introducing the new technology were calculated. The results showed that the developed method ensures resource efficiency and high economic profitability.

The findings of the study contribute to improving the quality, durability, and aesthetic appeal of outerwear made from natural leather, as well as promoting environmentally friendly production systems. Consequently, the practical importance of introducing innovative leather-processing technologies in the industry has been scientifically substantiated.

RESULTS AND DISCUSSION

The research results show that the developed new technology not only improves the physical and mechanical properties of natural leather but also significantly enhances production efficiency.

Reduction of material consumption: As a result of the new technological regime, leather waste was reduced by 15–20%, which lowered production costs and ensured more efficient use of resources.

Process optimization: Due to the implementation of mechanized methods, the production cycle was shortened by 12%, increasing labor productivity and production speed.

Product durability: Experimental results revealed that leather products manufactured with the new technology demonstrated a 28% increase in tensile strength and a 22% improvement in abrasion resistance. These outcomes scientifically confirm the increased inter-fiber bonding density, optimized chemical processing, and improved surface structure of the leather.

The implementation of the new technology in production led to reduced manufacturing costs, lower unit prices, and a stable increase in production volume. The calculated economic indicators are as follows:

Annual economic benefit: 182.2 million UZS
Specific efficiency per product unit: 18,220 UZS
Payback period for capital investment: 2.5 years
Increase in labor productivity: 16%

These results indicate that modernization of the production technology enables rapid investment returns and strengthens the enterprise's economic stability.

The introduction of the new technology also produced positive social and environmental effects:

- New jobs were created, improving employment opportunities for skilled specialists.
- Enhanced product quality increased consumer trust and expanded domestic market demand.

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- The use of environmentally safe reagents reduced negative environmental impacts and minimized waste generation.

Thus, the developed technology demonstrates high efficiency not only from technical and economic perspectives but also in terms of social and environmental sustainability. It is recommended as a promising direction for modernizing the leather industry and establishing environmentally friendly production systems.

CONCLUSION

Based on the results of the conducted research, the following scientific and practical conclusions and recommendations have been developed to improve the technology of natural leather outerwear production.

Effectiveness of the new technology. The innovative technology developed for the production of outerwear from natural leather significantly enhanced product quality indicators. The deformation stability, tensile strength, and abrasion resistance of the leather were improved, leading to longer product life and better preservation of aesthetic appearance.

Material and resource efficiency. The new technology reduced leather consumption by 15–20% during production. This decrease in material usage lowered production costs and enabled more efficient utilization of raw materials and energy resources.

Economic efficiency. The introduction of the developed technology into production resulted in an annual economic benefit of 182.2 million UZS. The specific profit per product unit was 18,220 UZS. With a payback period of 2.5 years, the technology proves to be highly attractive from an investment standpoint.

Competitiveness and import substitution. Leather garments produced using the new technology possess superior quality and durability, making them competitive in the domestic market. Consequently, this reduces the need for imported leather apparel and strengthens the potential of local manufacturers.

Social and environmental benefits. The use of eco-friendly reagents and waste-free technologies ensures that the production process does not harm the environment. At the same time, new jobs have been created, contributing to employment among skilled professionals.

Future research directions. Further studies should focus on the full automation of leather processing stages, the implementation of energy-efficient technologies, and the development of bio-based and waste-free production systems.

Overall, the newly developed technology not only increases the technical, economic, and environmental efficiency of natural leather outerwear production but also represents an important step toward the innovative development of the leather industry.

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