

UOK 005.93:655**DIGITAL MECHANISMS FOR INCREASING ENERGY EFFICIENCY IN THE TEXTILE INDUSTRY OF UZBEKISTAN: BASED ON THE PRINCIPLES OF "GREEN ECONOMY"***Magistr B. Bobojonov**Tashkent Institute of Textile and Light Industry*

Abstract. *This article investigates the issues of increasing energy efficiency as a key factor in reducing product costs in textile enterprises of Uzbekistan. Based on the principles of the «Green Economy», mechanisms for introducing renewable energy sources (solar panels) into production processes and their digital management via the Internet of Things (IoT) are proposed. The analysis shows that by monitoring energy consumption in real-time and applying «smart» energy systems, it is possible to reduce the cost price by an average of 12-15% and ensure the ecological sustainability of the enterprise.*

Key words: *green economy, resource, resource potential, management of resource potential, innovative technologies, efficiency.*

INTRODUCTION

The textile industry plays an invaluable role in further increasing the economic potential of the new Uzbekistan, and our republic has accumulated rich historical experience in the development of this sector, and there are sufficient conditions, raw material base and labor resources. The development strategy of the new Uzbekistan for 2022-2026 sets the task of “doubling the volume of textile industry production” [1]. At the same time, in order to ensure the effective implementation of these tasks, the issue of substantiating the effectiveness of the use of innovative technologies in increasing the efficiency of resource potential management at textile enterprises in the context of a “green” economy in the process of sustainable development is of urgent importance.

The importance of sustainable development of textile enterprises is especially relevant in the context of modern environmental and economic challenges. Carbon dioxide, including methane and other gases, is emitted throughout the entire life cycle of textile products. Therefore, the concept of sustainable development of textile enterprises includes the prevention of environmental pollution, solving environmental problems, and leaving a healthy, clean living environment for future generations based on the principles of a "green economy" and the wider application of resource-saving innovative technologies in the production process.

LITERATURE REVIEW

As foreign scholars N. Stern (2025) noted: “a green economy is not only a means of solving environmental problems, but also a strategic approach that ensures long-

term economic growth. Innovative technologies, including digital solutions, serve to eliminate the contradiction between economic growth and environmental protection” [1].

Another foreign scholar J. Rifkin (2011) emphasizes in his works that by combining digital transformation and environmental priority, it is possible to create the basis for the “third industrial revolution”. According to his theory, information technologies and renewable energy sources will lead to a new stage of the economy [2].

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Among the Uzbek scientists, R.A. Isaev studied the issues of improving organizational and economic mechanisms for implementing strategies for sustainable development of the textile industry [3].

It would also be appropriate to study the understanding and interpretation of the concept of resource potential by various authors.

M.V. Melnik and E.B. Gerasimova (*Bromovich M., 2016*), in turn, consider that “resource potential is a set of resources (labor and production) that ensure the continuity and efficiency of the organization’s activities” [4].

A.G. Fonotov (*Fonotov A.G., 2025*) defines resource potential as “the volume of resources in comparison with national economic needs, taking into account the potential for expansion and replenishment of these resources in the long term, and its connection with the characteristics of resource sources.” This includes natural, material, financial and information resources, as well as the population [5].

RESEARCH METHODOLOGY. The research was based on the research results of foreign and local researchers on the subject and used methods such as statistical, selective observation, comparison, and expert evaluation.

ANALYSIS AND RESULTS

In recent decades, the concept of a green economy has become increasingly widespread in the global economy. A green economy refers to economic activity aimed at protecting the environment, efficiently using resources, and ensuring social stability. This new economic paradigm serves not only to achieve environmental sustainability, but also to harmonize economic growth and social development.

The Resolution of the President of the Republic of Uzbekistan dated December 2, 2022 No. PP-436 “On measures to increase the effectiveness of reforms aimed at the transition of the Republic of Uzbekistan to a “green” economy by 2030” was adopted. The “Concept of the transition to a “green” economy and ensuring energy efficiency in industrial sectors” (Appendix 2 to the Resolution of the President of the Republic of Uzbekistan dated December 2, 2022 No. PP-436) was also developed.

In order to increase the efficiency of using the potential of existing resources and prevent losses and the production of poor-quality products in the organization of basic

production at textile enterprises, the formation of a real-time warehouse management system using Internet of Things (IoT) technology in the management of production reserves allows avoiding the problem of information delay. Management of production reserves based on IoT technology creates a solid foundation for the digitalization of the logistics system at a textile enterprise.

According to foreign scientists R. Kumar and S. Singh (*Kumar, R., & Singh, S., 2020*), it is important to develop a scientific and practical mechanism for increasing energy efficiency and ultimately reducing product costs through the integration of Industry 4.0 technologies (IoT, Big Data) and Green Energy (Solar Power Plants) in textile enterprises [6]. Therefore, in our research, based on the results of analyzing the current state of energy consumption at enterprises of the textile industry of the Republic of Uzbekistan, we calculated the technical and economic basis for the practical implementation of Industry 4.0 technologies (IoT, Big Data) and Green Energy (Solar Power Plants).

1. Conducting an energy consumption analysis in the textile industry.

First of all, we need to analyze where energy is spent in a textile enterprise. The balance of energy consumption in an average spinning and weaving factory in Uzbekistan is distributed as follows:

- Compressed air systems (Compressors): 35-40% (The greatest waste occurs here).
- Climate control (Air conditioning and ventilation): 20-25% (Necessary to maintain cotton moisture).
- Technological machines (Motors): 25-30%.
- Lighting, etc.: 5-10%.

The problem is that most compressors and motors continue to operate at full capacity even when there is no technological need. It is impossible to control this with the human factor.

2. Digital solution: Implementing EMS and IoT integration.

The solution we propose is EMS (Energy Management System). This system works in the following 3 stages:

Data collection (IoT Sensors): A “smart meter” is installed on each machine. They measure voltage, current and power factor in real time;

Analysis (Cloud Analytics): Data is transmitted to a central server. Artificial intelligence (AI) determines which shop is consuming more energy than normal;

Automatic control: The system automatically reduces the speed of the motors (via frequency converters - VFD) when the load decreases.

When 20% of the machines are stopped during the night shift, the compressors also automatically reduce the air flow by 20%. In normal mode, they would work the same way.

If an enterprise covers 40% of its needs with solar panels, the total energy costs will be reduced by an average of 35-40% (since free solar energy is used instead of the most expensive daytime tariff). In our research, we have calculated the impact of the traditional energy supply system in textile enterprises and the proposed (Digital + Green) system on the cost of producing 1 kg of yarn. These calculations show that the application of such a new energy supply system in the practice of a textile enterprise will lead to a reduction in the cost of producing one unit of product by about 35-40%.

CONCLUSION/RECOMMENDATIONS

Recognizing the advantages of the proposed innovative technologies for effective management of resource potential in textile enterprises, we recognize that their large-scale application in practice will be highly effective:

Digital Twins technology - allows you to identify bottlenecks in warehouses that reduce warehouse efficiency, identify problem areas in the production chain, and provide information for making informed decisions;

Warehouse robotization using 3D images - allows you to obtain operational information about the optimal routes for transporting production resources, the amount of resources in each nomenclature group;

Internet of Things (IoT) technology - allows for automatic tracking of inventory levels and locations, optimization of production processes, temperature control of storage of production resources, energy consumption control, and emission control;

blockchain technology - allows for tracking the movement of goods throughout the entire supply chain.

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