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FOURTH INDUSTRIAL REVOLUTION IN THE TEXTILE AND GARMENT MANUFACTURING

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Objective. This article is devoted to an overview of the current state, problems and prospects for the development of domestic textile and garment manufacturing, means and methods of process automation using the fourth industrial revolution (Industry 4.0). The necessity of introducing new technologies, computerization and automation of production, the use of machine learning technologies and artificial intelligence is substantiated.

Methods. The analysis is based on a recent research by Asian Development Bank (ADB), Leveraging the Fourth Industrial Revolution through Skill Development in High-Growing Industries in Central and West Asia. The research methodology is based on general scientific approaches of data mining, grouping and comparison, information visualization. The fundamentals of information theory, the theory and methods of solving optimization problems, the theory and technologies for the use of intelligent systems, databases and programming are used.

Results. By 2025, the desire to introduce 4IR technologies in various fields of activity will be a priority for companies, including textile and light industry enterprises. Textile and apparel companies estimate that the adoption of 4IR technologies will increase labor productivity by 68% in the long run. The study estimates that the introduction of 4IR technologies in the textile and clothing industry will create a net increase in jobs by introducing 4IR technologies through movement and productivity. The number of new jobs created by increased productivity through the introduction of 4IR technologies will exceed the number of jobs displaced by automation. It is expected that more jobs will be created as a result of the introduction of 4IR technologies - 100,000 new jobs in the textile and clothing industry of Uzbekistan and 334,000 new jobs in the construction industry. This goes beyond the usual job growth in a non-4IR scenario, which means these jobs.

Conclusion. More collaboration is needed with industry and academia about future skills needs. Communication technology (ICT) skills, creative thinking, design skills will be the most valuable skills by 2025 and it is essential that educational institutions are equipped to prepare workers for these skill changes. In the survey data, about 60% of the surveyed enterprises are trying to implement IoT technologies, but only 30% of educational institutions offer IoT-related courses. Collaboration with industries and higher education institutions can help alleviate potential resource constraints faced by institutions (such as lack of equipment or qualified instructors), while ensuring that training programs are aligned with industry needs.

Keywords: Industry 4.0, textile manufacturing, light industry, artificial intelligence, internet of things, industry transformation map, echnical and vocational education and training.

Introduction. Modern economic conditions put before the management of enterprises the task of ensuring and planning competitiveness, which is inextricably linked with the activities of introducing innovations, including in production processes. The expected effects from the introduction of innovative technologies are the acceleration of the production cycle and the reduction of production costs, which will undoubtedly lead to an increase in the financial profit of the enterprise [1]. And if cost reduction often cannot be corrected and depends on external factors, then technological improvement and acceleration of the product production process can be constantly worked on. Each new generation of breakthrough technologies has its own unique power, it is the collective potential of these technologies to increase the productivity and quality of goods and services that has the greatest prospects for influencing public value and influence [2].

Blurring the boundaries between the physical, digital and biological worlds, 4IR technologies, including artificial intelligence, robotics, the Internet of Things, 3D printing, genetic engineering, quantum computing and machine learning are rapidly becoming indispensable in modern working life, and in the daily lives of citizens.

And most importantly, the question is not how to prepare for 4IR technologies in the near future, but how to help individuals, enterprises and higher education institutions use them effectively to increase productivity and competitiveness today.

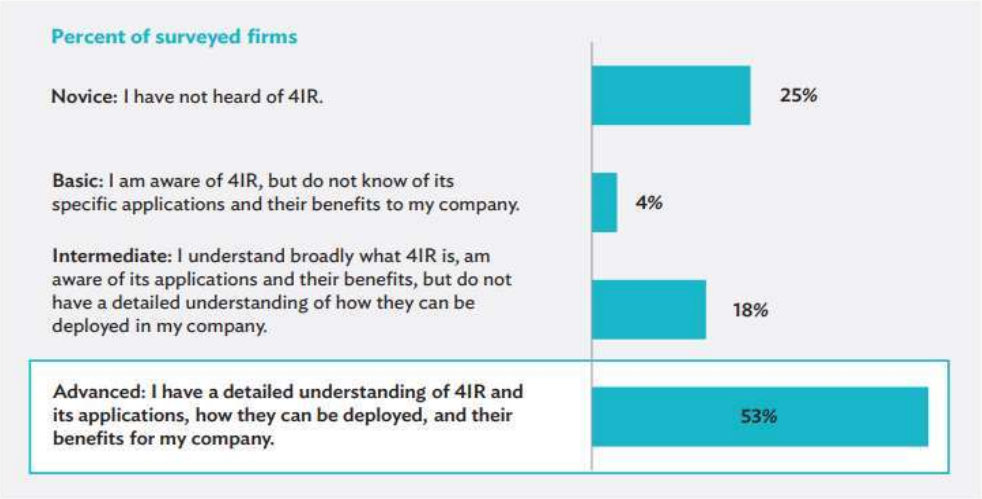
The rapid introduction of technologies of the Fourth Industrial Revolution (4IR) will create an additional 100,000 jobs in the textile industry in Uzbekistan, which have significant untapped growth potential [4].

Research methods and techniques. Modern production sets its main task not only to manufacture high-quality consumer products for the market, but also to maximize efficiency and, as a result, profitability of production. Given the pace of active introduction of digital technologies among foreign companies, domestic enterprises are gradually coming to understand the inevitability of digital transformation and digitalization of production. Automation of production at modern light industry enterprises is one of the leading areas of digital transformation, since the introduction of automation tools leads to increased efficiency and lower costs by reducing production costs [5].

The technologies of the Fourth Industrial Revolution open up significant potential for textile and clothing enterprises to increase labor productivity. According to analysts, the full implementation of Industry 4.0 technologies in the textile and clothing industry, the production value chain can reduce working hours by 40-70% [6]. Statistical forecasts show that the industry of Uzbekistan meets these expectations. Textile manufacturers have a good

The decisive link in the use of 4IR technologies is the investment of personnel in skills such as artificial intelligence, the Internet of Things, robotics, machine learning, 3D printing, genetic engineering and others [4]. The coronavirus pandemic (COVID-19) caused an intrusion into business processes, which led to the acceleration of the introduction of digital solutions in the market. Due to the growing digital talent gap, organizations in both the public and private sectors need to invest in retraining and advanced training for new and transforming jobs through the introduction of technology.
understanding of current technologies, with 53% reporting a deep understanding of Industry 4.0 and its applications. According to the survey, firms expect labor productivity to increase by an average of 68% by 2025 with the introduction of 4IR technologies (Fig.1).

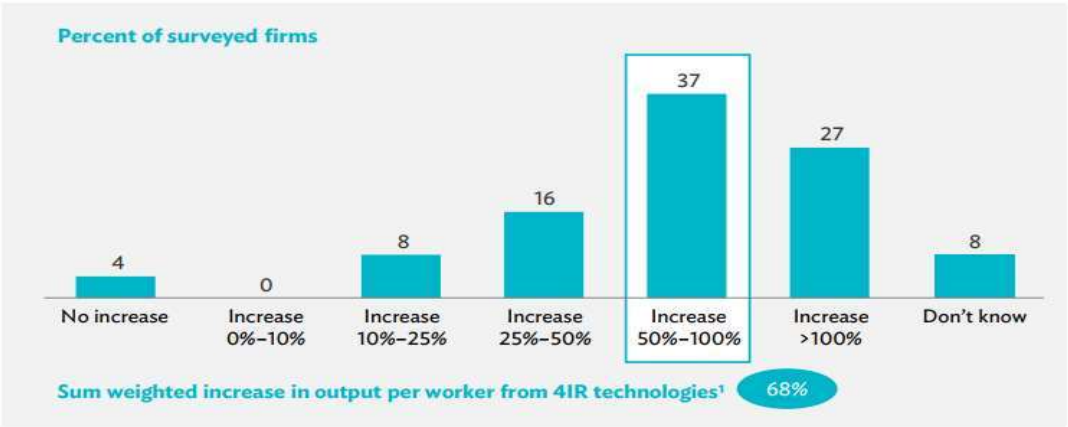
A good awareness of Industry 4.0 technologies is supported by government policies aimed at encouraging textile producers in Uzbekistan to introduce innovative production methods. Especially, the 2017 Presidential Decree “On measures to accelerate the development of the textile, clothing and knitwear industry” (UZ Daily 2017) establishes measures to modernize production processes; introduce advanced information and communication technology (ICT) technologies; and to introduce international standards to improve product quality in the textile industry. Despite the many benefits of new technologies, more than a quarter of the SMBs surveyed have limited understanding of Industry 4.0 technologies. Despite the fact that SMEs make up a significant part of the economy of Uzbekistan, employing about 80% of the labor force (OECD, 2017). Therefore, it is necessary to adopt targeted programs to ensure the distribution of 4IR technologies in this sector.



4IR = Fourth Industrial Revolution.
Note: Based on survey of employers in the textile and garment manufacturing industry between June and September 2021 (n=51).
Source: Asian Development Bank (Sustainable Development and Climate Change Department).

Fig. 1. Understanding of Industry 4.0 technologies by entrepreneurs in the textile and clothing industry in Uzbekistan

In accordance with the deep development of Industry 4.0 technologies and their application, the textile industry of Uzbekistan expects that new technologies will bring a significant increase in productivity. According to the analysis of the study, thanks to the introduction of appropriate technologies in the textile and clothing industry, productivity can be increased by 21-46%. In the textile industry of Uzbekistan, companies are more optimistic and expect an increase in labor productivity by an average of 68% by 2025 with the introduction of 4IR technologies (Figure 2).

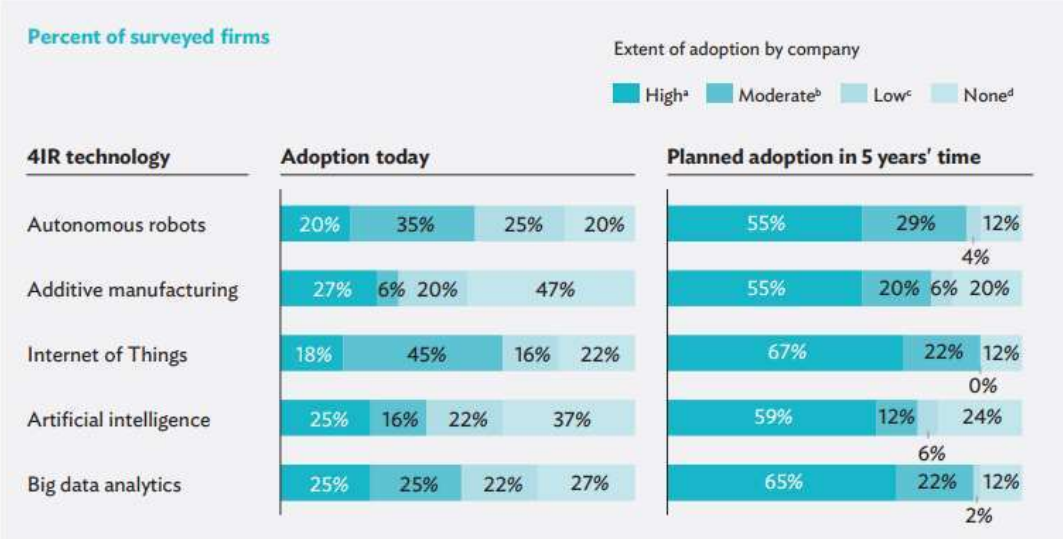


4IR = Fourth Industrial Revolution.
Notes: Based on survey of employers in the textile and garment manufacturing industry between June and September 2021 (n=51). Calculated using sum-weighted average of output increase by the number of firms indicating different levels of expected increase in output, i.e., 0%, 0%–10%, 10%–25%, 25%–50%, 50%–100%, and over 100%. The midpoint of the range for each option for expected increase in output is used; for expected output increase of over 100%, the lower bound of 100% is used.
Source: Asian Development Bank (Sustainable Development and Climate Change Department).

Fig. 2. Expected increase in work efficiency due to Industry 4.0 technologies in the textile and clothing industry of Uzbekistan, 2020-2025

High hopes for labor productivity growth correspond to the plans of firms to

significantly expand the introduction of Industry 4.0 technologies over the next years. (Figure 3). Automated systems demonstrate the highest level of implementation among the surveyed firms; it is assumed that by 2025 the introduction of Artificial Intelligence technologies, the Internet of Things and big Data analytics will increase several times. Currently, 80% of the surveyed firms in Uzbekistan more or less use autonomous robots. For example, ARTEX Group, one of the largest textile companies in the country, uses fully automated yarn and fabric dyeing processes [6].



4IR = Fourth Industrial Revolution.

[a] "High": Firm has fully deployed the technology across all possible functions in the enterprise and/or has plans to fully deploy the technology across all possible functions in the future.

[b] "Moderate": Firm has implemented the technology, but not fully deployed across all possible functions in the enterprise and/or plans to implement the technology across a few functions in the future.

[c] "Low": Firm is experimenting with the technology at a limited scale within the enterprise and/or plans to experiment with the technology in the future.

[d] "None": Firm has not used technology at all within the enterprise and/or has no plans to use the technology in the future.

Note: Based on survey of employers in the textile and garment manufacturing industry between June and September 2021 (n=51).

Source: Asian Development Bank (Sustainable Development and Climate Change Department).

Fig. 3. Comparative analysis of the introduction of 4IR technologies in the textile and clothing industry in Uzbekistan

Research results and discussion. Now consider some applications of Industry 4.0 technologies, external relation to the textile industry: robotics and smart manufacturing, 3D printing and knitting, virtual and augmented reality, and artificial intelligence.

Robotics and smart manufacturing. Advanced technologies in the textile industry have brought a new vector to smart manufacturing, referred to as smart factories, thereby further pushing the boundaries of traditional automation [7]. Benefits of data-driven manufacturing using Dig Data technologies can organize production more flexibly and efficiently by collecting and analyzing real-time data from connected production systems, in addition to existing data. These latest technologies are helping businesses adjust more flexibly to the current competitive world by giving them the advantage of being able to predict supply and demand, eliminating supply chain-related problems in a timely manner [8].

In the text industry of the development of robotics, the automation of accidents in this area of labor-intensive

work, like sewing, has come. With the help of machine vision, sewing robots can detect fabric defects and make the necessary adjustments [9]. For example, Tianyuan Garments, the main manufacturer of branded sportswear such as Reebok and Adidas, has fully automated the T-shirt production line, using robots to cut out fabrics and sew T-shirts in a matter of minutes [10].The company also uses work in the warehouses of the enterprise to increase the flexibility and speed of delivery.

3D knitting and 3D printing. Another of the modern technologies in the field of textiles, 3D printing, or the so-called additive manufacturing, creates 3D objects from a digital file. This is a new additive manufacturing process that is created by adding successive layers to a material called filaments [11]. This is a print head or extruder technology that fuses a filament that turns into a 3D model of the product. Another use is 3D knitting, using knitting needles to recreate entire pieces of the required piece of fabric, preventing production waste [12]. Both of these technologies increase efficiency in production by configurable reducing manual labor and production processes.

3D printing and 3D knitting technologies are used for productivity and hyper-personalization. They reduce waste, lead times and manufacturing costs by minimizing manual labor and simplifying the manufacturing process [13]. The troublesome work oriented to the desire of individual clients, hyper-personalization and digitization, which required more time and money for the entrepreneur, is also solved by 3D knitting.

Augmented and Virtual reality. Virtual Reality (VR) technology creates a digital real environment that is almost indistinguishable from the natural environment. This artificial environment helps reproduce the desired image without leaving the room [14]. And, augmented reality (AR) technology, by adding the desired content to the real environment by the computer, helps to mix the digital and physical world.

The use of VR and AR technologies opens up incredible opportunities for textile and clothing manufacturers. The flexibility of technology contributes to hyper-personalization, buyers can try on clothes without leaving home, order certain models for different tastes, or add the desired attributes to an existing model.

Artificial intelligence (AI). Artificial intelligence (AI) is an area of machine learning where machines mimic human cognitive functions such as pattern recognition, sensation, and learning [15]. Artificial intelligence manages a set of algorithms with the help of a computer, processing and recognizing limitations in large amounts of data. Based on this data, he can predict, correct errors, select panels, make recommendations, and others [16].

One of the differences between AI and humans is that it is able to process any big data quickly and reliably. Consequently, new technologies make extracting information from big data a more flexible, cost-effective process, increasing scalability [17]. Explore and analyze customer database AI can simplify many corporate tasks, from pricing to product recommendations [18].

The possibilities of AI are endless, predicting trends in the textile industry, AI makes it possible to automate a number of top management tasks, such as decision making in production, marketing, product pricing, process chain adjustment, smart use of enterprise warehouses, development of new products based on demand, and others [19].

Another of the possibilities of AI is deep personalization for the client, analyzing personal data and based on the uniqueness of the style, wardrobe of clothes, AI recommends to buyers the appropriate size, color, style of clothing [20]. It also recommends products with

individual preferences based on past purchase history and customer reviews.

Conclusion. As a result of the study of modern sources in relation to the experience of past years, it became obvious that the introduction of Industry 4.0 technologies in the textile and clothing industry can not only cause job losses, but also the basis for the emergence of new professions, usually more high-tech and highly paid. Forecasts in the textile industry of Uzbekistan prove that the use of 4IR technologies will increase labor productivity by an average of 68% by 2025.

With the growing digital talent gap, organizations in both the public and private sectors need to invest in reskilling and upskilling for new and transforming jobs. This requires closer cooperation between higher education institutions and industry in order to supply highly qualified personnel to our developing economy.

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METHODOLOGY FOR ASSESMENT OF EXTERNAL FACTORS AFFECTING THE FINANCIAL SECURITY OF BUILDING MATERIALS INDUSTRY ENTERPRISES

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Abstract:

Objective. This article analyzes the external factors affecting the financial security of construction materials industry enterprises and reveals the specific features of the construction industry in ensuring financial security at the micro level. The author has thoroughly analyzed the world's existing methodology for assessing the financial security of the enterprise. Taking into account that the method of determining the level of financial security of the enterprise based on the assessment of the internal and external environment is universal, it can be used in construction industry enterprises, taking into account the specific characteristics of the construction industry network.

Methods. The methodological foundations of the financial stability of enterprises, its gradual increase by improving the financial management, the development of the financial strategy of enterprises, and the assessment of financial stability were theoretically studied through the methods of scientific abstraction and observation.

Results. During the research, local economist B. Tursunov adapted the external environment assessment criteria to the construction industry, including: the stability of the banking system, the development of mortgage loans, competition in the domestic market, and factors such as the demographic situation in the country, which are considered to be the main factors that shape the demand for housing.

Conclusions. In the scientific work, the methodology for assessing the financial security of previously existing enterprises was supplemented with criteria taking into account the specific characteristics of the construction industry. This methodology is based on the application of the scoring method and uses weighting coefficients. It allows to determine the level of effectiveness of the management process of ensuring financial security in construction industry enterprises.

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