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Textile Cluster in the Vitebsk Region: Identification and Directions of Formation in the Conditions of the Economy Digitalization

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Abstract. The current direction of sustainable development of industries and regions is clustering, which consists of the creation of innovative and industrial clusters. The main trends in the development of textile clusters in foreign countries have been identified. A typology has been developed and characteristics of various types of clusters have been given according to the level of development of cluster relations: potential, emerging, acting. The criteria for the typology of clusters according to the level of development of cluster relations have been substantiated: the coefficient of specialization, the coefficient of localization, the presence of initiative groups, a registered non-profit organization, joint projects with cluster members. A diagram of a textile cluster in the Vitebsk region has been constructed based on the developed methodology for identifying and structuring clusters. The analysis of the quality of network cooperation in clusters based on the developed typologization criteria allowed concluding that the textile cluster in the Vitebsk region has potential. In order to create an operating cluster, methods have been developed based on the use of ICT and the possibility of digitalization of communications and cooperation of stakeholders in the cluster.

INTRODUCTION

The current direction of sustainable development of industries and regions is clustering, which consists of the creation of innovative and industrial clusters.

Cluster policy in the Republic of Belarus is becoming an important tool for stimulating the innovative development of the economy. At the same time, clustering processes are not active enough in comparison with foreign countries. About a third of the total number of employees are involved in clusters of foreign countries, and labor productivity is 40% higher. According to the Ministry of Economy of the Republic of Belarus, currently only 3 clusters and 12 cluster initiatives have been created [1].

An important factor that influenced the transformation of the cluster concept is the Fourth Industrial Revolution (Industry 4.0), which is changing the economy and society. It is rapidly rebuilding the business environment [2, 3]. In this context, the main feature of successful economies will be their ability to be flexible, adapt to changes, and have new factors corresponding to Industry 4.0, such as the Internet of Things; artificial intelligence, machine learning, and robotics; cloud computing; Big Data; additive manufacturing; cybersecurity; integration system; modeling; augmented reality.

Industry 4.0 will allow domestic enterprises not only to increase their own profits by reducing costs and increasing labor productivity, but also to reach a new technological level of development and find new market niches, as well as integrate into global value chains.

The purpose of the study: to identify a potential textile cluster in the Vitebsk region, to analyze cluster connections and to develop directions for organizing an existing textile cluster based on digitalization.

The objectives are as follows:
- to develop theoretical and methodological aspects of identification and structuring of textile clusters;
- study examples of best practice in the development of textile clusters and identify existing trends;
- to identify and structure a textile cluster on the example of one of the regions of the Republic of Belarus - the Vitebsk region and to suggest the directions of its development in the conditions of Industry 4.0.

MATERIALS AND METHODS

The research materials were the scientific works of foreign scientists (M. Best, M. Porter, S. Rosenfeld, H. Schmitz, M. Enright, etc.), Belarusian scientists (D.M. Krupsky, L.N. Nekhorosheva, V.V. Valetko, N.G. Sinyak, et al.). The analysis was based on the materials of the National Statistical Committee of the Republic of Belarus. The following methods were used: general scientific methods – perception, analysis and synthesis, comparative analysis, the method of analogy, etc.; special methods – economic and statistical, input-output, interview.

RESULTS AND DISCUSSION

To Develop Theoretical and Methodological Aspects of Identification and Structuring of Textile Clusters

An important methodological aspect in the study of clusters is the typologization according to the level of development of cluster relations. The following criteria for the typology of clusters according to the level of development of cluster relations have been substantiated: the coefficient of specialization, the coefficient of localization, the presence of initiative groups, a registered non-profit organization, joint projects with cluster members. Active, emerging, and potential types of clusters were determined based on these criteria.

Active clusters are clusters that have formed as a legal entity, have been organizationally formed, have elected the Cluster Council, implement a formalized cluster development strategy (cluster project), and regularly carry out activities in agreed areas of activity.

Emerging clusters are the localization of legal entities that have initiative groups for their creation, have formed Cluster Councils, and have also taken the first steps in cooperation based on the cluster development model.

Potential clusters are an agglomeration of legal entities that are localized on the same territory, create a production chain, produce a key product, and are connected by formal relations.

An effective innovation process within a cluster requires a geographical, institutional, cognitive, and social proximity (Camarena-Gil, Garrigues and Puig, 2020) [4]. In addition, there is a multiple set of overlapping networks in the structure of successful clusters, which can be divided into business knowledge networks and technical knowledge networks. Business knowledge networks are a set of links between cluster members on business issues that are based on market, social and institutional relationships. Technical knowledge networks are informal networks that connect firms through knowledge transfer aimed at solving complex technical problems and include a community of technicians and entrepreneurs (Tomás-Miquel et al. 2019) [5]. Jose-Vicent Thomas-Miquel et al. we have proved that the relations within the technical knowledge networks in textile clusters are deeper and are aimed at solving specific problems, many of which are usually related to the technical aspects of products and processes of the textile industry (Tomás-Miquel et al. 2019) [5]. Thus, an important direction for improving the innovative characteristics of cluster structures is the organization of the exchange of technical knowledge between their participants, as well as their joint actions within the framework of research projects.

The cluster identification and structuring methodology includes two stages: cluster identification and structuring [6].

The task of the identification stage is to identify potential subjects of the cluster. It is proposed to identify the subjects of the clusters based on the definition of the "key" product (assortment group of goods, which has the largest share in the volume of industrial production of the sub-industry); analysis of inter-industry relations in the region based on the calculation of the total cost ratio identification of cluster subjects and products using in-depth

interviews with managers and specialists of manufacturing enterprises and organizations, for which a questionnaire has been developed.

The task of the structuring stage is to establish the strength of connections between subjects and build a cluster scheme. The strength of ties between the subjects of the cluster to clarify its composition is proposed to be determined based on the coefficient of the strength of ties, calculated as the ratio of the volume of supplies/supply of products of an industry entity for a given cluster to the total volume of sales of products of the entity. The cluster includes manufacturers along the technological chain, whose bond strength coefficient is in the range from 0.08 to 1 (which is determined on the basis of empirical research). Next, horizontal links in the production chain are identified to identify producers of by-products or services. On the next step, the infrastructure entities, which create conditions for production and development - research, educational, marketing, etc, are determined and shown on the cluster diagram.

Examples of Best Practice in the Development of the Textile Industry Clusters

As practice shows, the most successful cluster projects in the textile industry in terms of their contribution to regional development are characterized by a number of distinctive features. Let's consider these signs in more detail and outline the trends in the development of cluster projects with the participation of the textile industry enterprises.

Successful cluster projects are characterized by the active participation of SMEs, which integrate into supply chains with large enterprises in the textile industry, research organizations and universities. Cluster organizations also take on functions with high added value, such as research and development, design, or marketing. For example, the Italian cluster "OTIR2020 - Tuscany Fashion Cluster" (OTIR2020 – TFC) unites about 480 companies from the Tuscany region working in the value chain of fashion clothing (textiles and technical textiles, clothing, leather, tanning, shoe manufacturing, jewelry). The overwhelming majority (93.8%) of the cluster members are SMEs [7]. The Spanish cluster Asociación de Empresarios Textiles de la Comunidad Valenciana (ATEVAL) unites 364 companies of the Valencia region integrated into the value chains of textile products, 96.2% of which are SMEs [8]. Many SMEs carry out a variety of activities, from spinning to dyeing, printing or weaving. This cluster employs 22,695 workers with a production value of around €1,975 million in 2016, according to the Spanish Inter-Textile Council (CITYC). In addition, it accounts for 19 percent of the entire Spanish sector.

Through the development of cluster links, textile companies seek synergies with other sectors, expanding their product range, for example, by developing new technical textiles for cars, construction, and healthcare, and intensifying the development of innovative products in new market niches (Tomás-Miquel et al. 2019) [5]. Valencia has traditionally been involved in the production and commercialization of a wide range of products for the home, including blankets, upholstery and curtains. The growing competition has forced many Valencian firms to change the specialty of their production, and in some cases completely switch to technical textiles with high added value, mainly intended for technical clothing and footwear, automotive, transport, and healthcare. Such a transformation allowed the cluster to get a new impetus for development. According to CITYC, the Valencian Textile Cluster showed a 13% increase in turnover and 20% in exports in the period 2012–2016.

There is a tendency to create super-cluster formations and megaclusters based on special partner platforms that contribute to the formation of groups of specialists working to solve specific problems of cluster participants, including the introduction of Industry 4.0 technologies and the development of inter-cluster relations. For example, the French research cluster UP-tex is involved in the implementation of ambitious plans to create a network of European clusters operating in the field of searching and marketing new applications for advanced textile materials.

The project "Textile Clusters for Industrial Modernization" (Tex4IM) unites the main European textile clusters in regions where the textile and clothing industries make up a significant share of the regional economy [9]. The TEX4IM partnership is a collaboration tool between the major textile cluster players in the European Cluster Partnerships for smart specialisation investments - ESCP-S3. The project is funded under the EU program "COSME" (Competitiveness of Enterprises and Small and Medium-sized Enterprises), which has been implemented since 2014 with a budget of EUR 2.3 billion and is aimed at improving the competitiveness of SMEs [10].

Tex4IM participates in the RegioTex initiative, which is one of the key initiatives of the European Technology Platform in the Textile Industry - Textile ETP [11]. The initiative brings together partner and observer regions, which together account for 28% of employment in the textile industry and 23% in the EU garment industry. The RegioTex platform aims to provide, among other things, appropriate policy tools to increase the potential of textile innovation and increase the competitiveness of European SMEs at the global level. The RegioTex initiative has launched an Interregional partnership for intellectual specialization on the integration of SMEs into Industry 4.0, one

of the thematic areas of the thematic platform for industrial modernization. Industrial Modernization is one of three thematic platforms launched in 2015 by the European Commission services under the EU Intelligent Specialization Platform (S3). The main topics of the partnership: production performance monitoring systems; predictive modeling and support; virtual reality and modeling technologies; smart logistics and network management; cybersecurity for industry and simplified, and secure access to the cloud (Tex4IM, 2020) [9].

Thus, it is recommended to use the following algorithm for the identification, structuring and development of the textile cluster:

1) identification of potential subjects of the cluster (assessment of geographical proximity);

2) initiation of the cluster creation (the formation of institutional proximity);

3) organization of joint events for members of a potential cluster with the participation of SMEs included in the value chain of the textile industry (formation of social proximity);

4) creation of an electronic platform for organizing joint research projects (cognitive proximity);

5) organization of cooperation with other clusters and the formation of inter-cluster initiatives.

Identification and Structuring of a Textile Cluster in the Vitebsk Region of Belarus

A potential diagram of a textile cluster in the Vitebsk region (Figure 1) has been constructed based on the developed methodology for identifying and structuring clusters [6]. Analysis of cluster connections resulted in the following conclusions.

Firstly, the coefficient of specialization in textile production in the Vitebsk region was 2.15, which is more than 1, therefore, it is possible to create integration structures in this type of economic activity, the localization coefficient was 1.14 (more than 1), which means that textile and clothing production enterprises were concentrated in this region.

Secondly, the institutional structures that ensure cooperation between the subjects of textile production in education, science, marketing, have not been created. In particular, the subjects of the textile industry are not united in an association or a union. The key enterprise is the Republican Unitary Production and Trade Enterprise "Orsha Linen Mill". It is associated with 9 linen plants, a trade and intermediary organization of JSC "Vitebskoblen". Scientific and educational organizations for textile production in the Vitebsk region are the Educational institution "Vitebsk State Technological University", the Republican Scientific Subsidiary of the Unitary Enterprise "Linen Institute". Educational institutions for training personnel for textile production in the region are Educational Institution "Vitebsk State Industrial and Pedagogical College", Educational Institution "Vitebsk State Polytechnic College of Light Industry", Educational Institution "Vitebsk State Professional Lyceum No. 4 of Light Industry", Educational Institution "Orsha State Professional Lyceum of Textile Workers", Educational Institution "Orsha State Professional Lyceum of Light Industry").
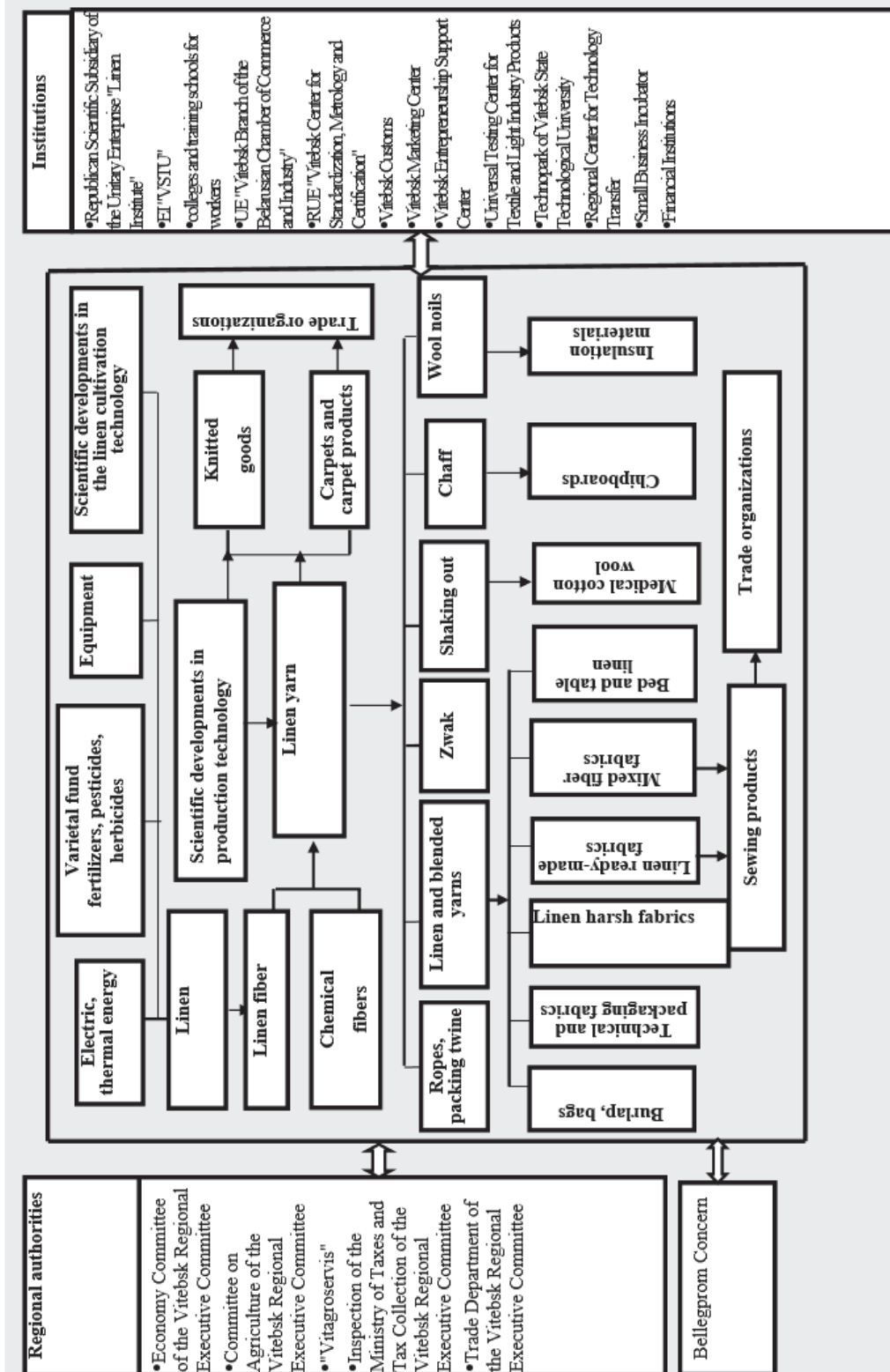
FIGURE 1. Potential textile cluster in the Vitebsk region.

Source: compiled on the basis of [6].

Third, the analysis of cooperative relations has shown that they are not sufficiently developed. Quite close cooperation in the field of research projects was established between Vitebsk State Technological University and RUPTE "Orsha Linen Mill". In particular, the university together with the RUPTE "Orsha Linen Mill" completed 2 main tasks within the Industry Scientific and Technical Program "New Materials in Light Industry" in 2018-2019, on the topic:

- Development of manufacturing technologies and an assortment of linen-containing jacquard decorative fabrics of large width with a monorapport pattern on new weaving equipment with electronic control;

- Development of manufacturing technologies for linen-containing clothing of multi-color jacquard fabrics of new double-sided tapestry structures for the manufacture of suits, jackets, and coats with a mono-rapport pattern.

Currently, the products developed within the tasks of the Industry Scientific and Technical Program "Light Industry" are being manufactured in accordance with the approved development plans for 2018-2019, where the concern "Bellegprom" was the state customer. According to the technologies developed during the fulfillment of tasks, the RUPTE "Orsha Linen Mill" produced 4,580 linen-containing jacquard decorative fabrics in the first half of 2020, for the amount of RUB 44,059.60 ($18,875.00), and 8,653 running meters of linen-containing garment multicolor jacquard fabrics for the amount of RUB 117,760.14 ($50,450.00).

However, there is no network cooperation in the field of marketing and sales within the potential textile cluster of the Vitebsk region. There were no joint projects between the cluster members in this area. Thus, the analysis of the type of textile cluster according to the criteria of cluster typology and according to the level of development of cluster relations showed that the textile cluster in the Vitebsk region has a potential.

CONCLUSION

Therefore, the main conditions for the successful development of cluster projects in the textile industry in modern conditions, as evidenced by examples of best practice, are active participation of small businesses in cluster initiatives; development of inter-cluster relations aimed at expanding the range of final products with high added value; creation of super-cluster formations and mega-clusters based on technological platforms in order to organize joint high-tech projects aimed at introducing Industry 4.0 technologies.

As a result of the study, a potential textile cluster in the Vitebsk region (Republic of Belarus) was identified and directions for its development were proposed, including:

1) the formation of institutional structures that ensure the cooperation of textile production entities, including SMEs in education, science, marketing;

2) creation of an electronic platform for the implementation of innovative projects in the field of Industry 4.0;

3) organization of inter-cluster interactions in order to include textile production in the supply chain and expand the range of finished products.

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