UDC 377
DOI: 10.23951/2782-2575-2022-1-23-30

# CLUSTER-BASED TRANSFORMATION OF REGIONAL EDUCATION*

***Y.V. Kalinyuk*[1], *L.G. Smyshlyaeva*[2], *D.M. Matveev*[3]**

[1] *Department of Vocational Education of Tomsk region, Tomsk, Russian Federation*
[2] *Tomsk State Pedagogical University, Tomsk, Russian Federation*
[3] *Tomsk College of Economics and Industry, Tomsk, Russian Federation*

**Abstract.** The article deals with the development trends of the modern Russian system of secondary vocational education (SVE). The current state of SVE in the Tomsk region is described. Regional peculiarities and strategic goals of transformation of SVE in the context of socioeconomic development of the region are presented. A theoretical rationale for the cluster approach to the development of the SVE system is provided. The need for productivity changes in the regional SVE system using the cluster approach is demonstrated. A project for updating the SVE infrastructure in the Tomsk region, reflecting the principles and mechanisms of cluster policy, is proposed. The basic characteristics of two clusters – educational clusters and educational-industrial clusters – are presented. Scientifically justified hypotheses about the regularities and the effective functioning of these clusters are formulated. Cluster-driven organizational and pedagogical methods of integrating SVE practices and continuous professional development of the current personnel of the real economic sector are pointed out. Methods, management tools, and conditions for successful integration are mentioned. Conditions for the realization of pedagogical interaction between subjects participating in industrial cluster communities are presented. The existing practical experience of the Tomsk region with clusters in SVE transformation is summarized. Socioeconomic and pedagogical prospects of interaction between clusters and networks in SVE for solving urgent and future tasks at the regional level are predicted. The materials of the article are based on the results of educational design and research methods of theoretical analysis, survey, and expert method.

**Keywords:** *socioeconomic development of the region, secondary vocational education, cluster approach, cluster policy, cluster-network interaction, education-industry cluster.*

The modern phase of educational development in Russia is associated with a number of serious challenges in the modern world. These include uncertainty, diversity, a new economy, and new labor markets [1]. All these challenges reflect the problem of transition to another technological era. This new era is characterized by the digitalization of all aspects of life, artificial intelligence, and a complete cultural transformation of society. These social development trends can be identified as universal modern characteristics of all economies in the world.

The main changes associated with the transformation of the economy and social structure in Russia are set out in the Presidential Decree "On the National Development Goals of the Russian Federation for the period up to 2030" dated 21.07.2020 № 474. This decree sets out the following national development goals of the Russian Federation (hereinafter referred to as national goals) for the period up to 2030:

- Maintaining the population, health, and well-being of people.
- Opportunities for self-realization and talent development.

* *Original Russian language version of the article:* Kalinyuk Y.V., Smyshlyayeva L.G., Matveyev D.M. Proektirovaniye izmeneniy v sisteme professional'nogo obrazovaniya regiona: klasternyy podkhod [Designing Changes in Secondary Vocational Education System in the Region: Cluster Approach]. *Nauchno-pedagogicheskoye obozreniye – Pedagogical Review*, 2021, vol. 6 (40), pp. 84–94. DOI 10 23951/2307-6127-2021-6-84-94

- A comfortable and safe living environment.
- Efficient work and successful entrepreneurship.
- Digital transformation [2].

Vocational education is an important tool to solve the above problems of the national development of Russia. Today, the main task of the vocational education system is to ensure the quality of education of graduates according to the requirements of the market. These requirements are determined by professional standards, the needs of the regional economy, and the requirements of industrial partners. The success of training competitive specialists of a new type depends on many factors. One of these factors is the interaction of industry partners and vocational training institutions (VTI), taking into account the specifics of the region.

If we consider this task from the perspective of scientific pedagogy, it becomes clear that it is necessary to determine the conceptual foundations and appropriate theoretical approaches for the effectiveness of such interaction.

The analysis of the literature and expert opinions that we have conducted in connection with the above problem has shown that the cluster approach can be an effective solution to this problem [3–10].

In 1990, M. Porter defined Cluster as a group of geographically adjacent, interconnected companies and related organizations in a certain area, characterized by a common activity [4]. The essence of this concept did not change significantly when it was analyzed in the works of other researchers (A.P. Gavrilova, V.T. Volov, N.B. Nagrudnaya, L.S. Markov, N.S. Rychikhina, A.P. Sokolov). The analysis of these interpretations allows us to distinguish a number of the most common characteristics of a cluster as a system, namely: geographical concentration; specialization; competition and cooperation; cluster-oriented projects; costs in relation to the expected effect from the implementation of these projects; competitive advantages in the area where the cluster is located [5, 6].

As a form of cooperation, the cluster reflects the principles and mechanisms of the law of the triple helix: “business, science, government” (G. Etzkowitz). Moreover, each of these elements involved in the cluster provides certain advantages (strategic, financial, technological, reputational, personnel) [11].

As experts note, cluster systems are characterized by high stability, efficiency, and effectiveness in relation to the common and specific goals of the participants of the cluster cooperation. However, clusters can easily change as needed to adapt to changing conditions, being a manageable structure. Another important characteristic of clusters is that they rely primarily on internal resources. The analysis of global trends in socioeconomic development shows that the formation of clusters has become an important part of public policy in the field of regional development in many countries of the world since the beginning of the 21st century.

The term Cluster has become popular in the field of vocational education. It has begun to complement pedagogical science and serves as a prerequisite for the creation of new models for realizing the socioeconomic potential of various vocational education practices.

Meanwhile, in Russian scientific and pedagogical literature, there are many definitions of the concept of Educational Clusters (S.V. Krivykh, N.S. Rychikhina, E.R. Skoryakova, N.D. Frolova, G.R. Khamidullina).

Thus, E.R. Skornyakova considers that an Educational Cluster (hereinafter EC) is a flexible network structure that includes groups of interconnected objects (educational institutions, public and political organizations, scientific schools, universities, and research organizations) united by innovative educational activities to solve certain problems and achieve a certain result (product) [9]. We agree with this definition when we understand the essence of the term Educational Cluster.

We consider that the educational institutions located in the region (general education, secondary vocational education, and higher education, depending on the specifics of EC) are the system-building elements of the educational cluster. In addition, other organizations and institutions relevant to all cluster participants are part of the cluster cooperation.

The relevance of the cluster approach in the development of educational systems is determined primarily by the advantages of this format in achieving synergistic effects in various educational outcomes. It should be emphasized that a common goal is a central point in educational clusters. The common goal guides the participants in the interaction to choose the content, communication, and technology aspects of the cluster interaction to achieve the outcomes.

According to many experts, the clustering of educational areas is an essential factor in solving the problems of modernization of education, the transformation of its content, and organizational-technological formats.

It is important to note that the cluster approach in education promotes synergistic processes (combination of goals, resources, and efforts). These processes act as an effective mechanism for creating conditions (environments, spaces, events) to develop human capital, human well-being, and maximum self-realization. Russian academic A.G. Asmolov rightly calls the development of human potential the highest priority in pedagogical practice, using the metaphor of Anthropological Change (ACh) in education [12–16].

It is vital to outline the goals, characteristics, and mechanisms of implementing the cluster approach at the regional level. In the following, we will explain the reasons and results (regional practical experience) of planning such changes in the example of the Tomsk region.

According to many experts, the clustering of educational areas is an important factor in the priorities for socioeconomic development of the Tomsk region are as follows:

- New technologies
- Human capital
- Investment and business development
- Effective territorial policy
- Effective management [17]

The economy of the Tomsk region is characterized by the following features: well-established production facilities associated with large investment projects of national significance; a special economic zone for the development of high-tech enterprises; a large number of small and medium-sized enterprises; a strong scientific and educational complex for scientific research and its commercialization for implementation in production.

The modern tasks of transforming the SVE system in the Tomsk region in the framework of the region›s socioeconomic development priorities are associated with creating new organizational and educational mechanisms for training qualified personnel to meet the requirements of the digital economy and high-tech industries. Let us outline the list of these tasks.

1. The redesign of the VTI infrastructure based on the economic clustering and strategic priorities of regional development.

2. Creating effective management mechanisms for implementing the federal Young Professionals project at the regional level.

3. Ensuring conditions for implementing the federal project Digital Educational Environment at the regional level.

4. Creating a regional model for the development of the human resources capacity of the VTI system, aimed at the constant and timely updating of the competencies of management and pedagogical staff in accordance with modern challenges.

5. The introduction of integration-oriented mechanisms for socialization, self-realization, and professional development of students in the region.

In the Tomsk region, strategic planning of secondary vocational education development (from 2017 to 2019) took place with the participation of heads of vocational education institutions of the region and representatives of executive authorities and industrial partners. The cluster approach was chosen as the conceptual basis for change management in this segment of the regional education system, focusing on the possibility of its integration with network and competency-based approaches. These approaches are relevant to solving the problems of regional education system functioning aimed at innovative development [17, 18].

*Educational clusters* and educational-industrial clusters were defined as basic working concepts for shaping changes in the SVE system of the Tomsk region based on cluster policy.

An *educational cluster* is an association of several VTI institutions providing education in the region for a specific area (cluster). An education cluster may also include general education organizations, continuing education institutions, and non-formal education practices (e.g., non-formal professional communities).

An *educational-industrial cluster* (hereinafter EIC) in the Tomsk region is a systemic association of various subjects (educational organizations, executive and legislative authorities, local self-government bodies, enterprises), which makes it possible to take advantage of interaction within the cluster to modernize educational organizations and increase the competitive potential of the local economy.

The driving factor for the creation of an EIC is the training of VTI graduates for a specific job with clearly defined technological characteristics.

*The goals of the educational-industrial cluster are:*

– Increase the level of competitiveness of the Tomsk region through the modernization of secondary vocational education.

– Improve the quality of vocational education by focusing on practice – based on the integration of SVE and production.

*The objectives of the educational-industrial cluster are:*

– To pool the resources of vocational education institutions, various enterprises, public associations, and executive and legislative bodies to develop the SVE system of the Tomsk region.

– Identifying and developing public-private partnership mechanisms for educational institutions and businesses.

– Monitor and forecast labor market needs in the Tomsk region in terms of quantity and quality of labor force.

– Increasing the attractiveness of SVE institutions for graduates of educational institutions of the Tomsk region.

– Development and strengthening of the material and technical base of secondary vocational education in the region.

Productive coherence of the cluster is ensured by networking both within the EIC and at the level of cooperation of different orientations. This is an organizational and activity mechanism that enables the simultaneous participation of several organizations in achieving any goals through the consolidation of resources [7, 10, 18, 19, etc.].

In the context of developing regional SVE practices by using the principles of cluster and network approaches in their integration, we believe the following opportunities are significant in the context of leveraging the resources of cluster network participants:

● Clear alignment between the needs of industry partners and EIC educational programs (alignment of professional work with training of specialists for this work, training of readiness to perform work functions according to the technological specificity of a particular production).

● Continuous immersion of students in a real professional environment representing different areas of their future professional activity.

● Increasing the number of technological platforms for practical training of SVE students.

● Ensure continuous professional development of staff in vocational education/additional vocational education.

● Promote individual professional development pathways for SVE students.

● Provide ongoing professional development for SVE teachers based on practice-oriented principles.

● Update and expand the forms and methods of professional and pedagogical support.

These factors determine qualitatively new features of the value and the substantive, organizational and active aspects of SVE in the region, which can be called its transformation.

When elaborating the region's new SVE project in accordance with the cluster policy, experts considered it useful to create nine secondary vocational education institutions.

By September 2021, the following educational-industrial clusters were organized in the Tomsk region: Agribusiness Cluster (leading VTI – Tomsk Agricultural College), Health Cluster (leading VTI – Tomsk Basic Medical College), Information Technology Cluster (leading VTI – Tomsk Information Technology College), Education and Culture Cluster (leading VTI – Tomsk State Pedagogical College), Services Cluster (leading VTI – College of Industry and Food, Trade and Services), Transportation Cluster (leading VTI – Tomsk College of Civil Transportation), Wood Industry Cluster (leading VTI – Asino College of Industry and Services), Industry Cluster (leading VTI – Tomsk College of Business and Industry), Construction Cluster (leading VTI – Tomsk College of Community and Construction). Such clustering of the SVE system of the Tomsk region is suggested by a detailed analysis of the region's economic geography (20 municipalities – 4 town districts and 16 municipal districts; 7 economic clusters).

The education-industry cluster, uniting the interests of various subjects in the innovation chain – academia-collaboration-industry, makes it possible to use the advantages of interaction within the cluster to develop educational organizations and increase the competitiveness of the Tomsk region economy. Each EIC includes representatives of industrial enterprises and employers' associations, governmental and administrative authorities, and public organizations. Coordination and expert councils are formed from the representatives of each cluster.

The EIC Coordination Council is a permanent governing body uniting the EIC participants – representatives of the executive and legislative branches, heads of the VTI, and representatives of Tomsk region enterprises. The EIC Coordination Council is established to define the strategic policy of cluster development on the territory of the Tomsk region.

The EIC Expert Council is a public expert advisory body in the structure of cluster association management. Firstly, the presence of the Expert Council in the management of the regional EIC network provides an opportunity to objectively assess the effectiveness of EIC activities as a whole and the quality of processes and results of individual cluster subjects. Secondly, with the help of the Expert Council, the necessary adjustments in the activities of the EIC subjects can be made in time.

It is useful to outline another essential aspect of projecting changes in the regional SVE system based on the cluster approach. It is about improving the competencies of the region's VTI managers and teaching staff in connection with the effective solution of the functional tasks of the VTI in the cluster policy of the region, the tasks of vocational-educational interaction [20, 21].

As part of such regional practice, the continuing education program "*SVE as a Resource for Regional Human Capital Development: Cluster Policy*" (72 hours) was developed and implemented in the 2021/2022 academic year.

The program demonstrates the relationship between the activities of the region's SVE organizations and the development of their human potential and capital, as well as an understanding of the socioeconomic impact of cluster policies in SVE and how to achieve it. The program unfolds conceptual-theoretical foundations and organizational-methodological mechanisms of human capital development in the context of the region's socioeconomic development priorities based on the principles of the cluster approach.

This training program aims to develop the following professional competencies in SVE specialists: "Ability to perform effective (pedagogical) management activities in organizational formats of educational and industry clusters of regional SVE systems, including network scenarios."

The program includes the following modules:

1). Human potential development as a task of secondary vocational education. Human potential and human capital in the region.

2). Human capital as a priority of the socioeconomic development of a region.

3). Cluster policy in the SVE of the region: principles and ways of implementation. Socioeconomic impact of cluster policy in the SVE.

4). Using the cluster approach to design the vocational education system changes at the regional level.

5). Designing a new SVE system based on cluster policy: a case study.

6). Cluster network scenarios for the development of SVE practices in the region.

7). Organizational/educational activities in education and education-industry clusters: competency training.

As a final certification process in this educational program, students are expected to present an individual case representing the forms, ways, and means of professional involvement in EIC practices that are professionally aligned for their educational organizations.

This educational program, as mentioned above, is intended for the management and teaching staff of the SVE system in the region.

This program is organized at Tomsk State Pedagogical University for the specialists of all VTI (pilot practice) in the Tomsk region. One of our further research tasks is to analyze the impact of this educational program on the effectiveness of VTI leaders and teachers in the region. This observation will be guided by the principles of cluster policy in the regional SVE system to make the necessary adjustments in this emerging professional practice and its further application.

The implementation of this educational program and a series of seminars for professionals of vocational training institutions in the region on different aspects of the transformation of SVE based on the cluster approach is also seen as a way to transform this educational field in the context discussed.

## Conclusion

Thus, a number of conclusions can be drawn, such as:

● The cluster approach to the development of the SVE system in the region is an effective way to realize the socioeconomic potential of vocational education. It ensures the match between the needs of the real economic sector and the content-technological content of the VTI education programs.

● Applying the cluster approach in the context of SVE transformation provides a value-based focus on human capital development.

● The education-industry cluster is a productive way to realize the interaction between industrial enterprises and vocational training institutions in the context of regional labor markets and human capital development in the region.

● An important prerequisite for achieving the goals of cluster interaction between SVEs and the region's industrial complex is the professional development of VTI management and teaching staff in terms of their ability to work effectively in cluster practices.

## References


1. Asmolov A.G. Psikhologiya sovremennosti: vyzovy neopredelennosti, slozhnosti i raznoobraziya [Psychology of modernity: challenges of uncertainty, complexity and diversity]. *Psikhologicheskiye issledovaniya – Psychological Studies,* 2015, vol. 8, no. 40 (in Russian). URL: http://psystudy.ru/index.php/num/2015v8n40/1109-asmolov40.html (accessed: 12 March 2021).
2. *Spravochno-pravovaya sistema "Garant"* [Information and legal support "Garant"] (in Russian). URL: https://base.garant.ru/74404210/ (accessed: 12 March 2021).
3. Gavrilova A.P. Klasternyy podkhod na primere Tomskoy oblasti [Cluster approach on the example of Tomsk region]. *Tarifnoye regulirovaniye i ekspertiza,* 2018, no. 1, pp. 12–13 (in Russian).
4. Porter M. *Konkurentsiya* [Competition]. Moscow, Vil'yams Publ., 2005. 608 p. (in Russian).
5. Markov L.S. *Teoretiko-metodologicheskiye osnovy klasternogopodkhoda v ekonomike.* Avtoref. dis. dokt. ekonom. nauk [Theoretical and methodological foundations of the cluster approach in the economy. Abstract of thesis doct. of econ. sci.]. Novosibirsk, 2014. 46 p. (in Russian).
6. Sokolov A.P., Klimyuk L.Ya. Klasternaya sistema kak osnova povysheniya konkurentosposobnosti regional'noy ekonomiki [Cluster system as the basis for increasing the competitiveness of the regional economy]. *Biznes. Nauka. Obrazovaniye: problemy, perspektivy, strategii: sbornik materialov rossiyskoy nauchno-prekticheskoy konferentsii s mezhdunarodnym uchestiyem: v 2 chastyakh* [Business. Science. Education: problems, prospects, strategies: Collection of Materials of Russian Scientific-Practical Conference with International Participation in two parts. Part 1]. Vologda, Vologda Institute of Business Publ., 2015, pp. 95–97 (in Russian).
7. Krivykh S.V., Kirpichnikova A.V. *Klasternyy podkhod v professional'nom obrazovanii* [Cluster approach in professional education]. Saint Petersburg, INOV Publ., 2015. 140 p. (in Russian).
8. Rychikhina N.S. Obrazovatel'nyy klaster kak strategiya razvitiya sfery obrazovaniya [Educational cluster as a strategy for the development of education]. *Professional'noye obrazovaniye – Professional Education,* 2014, no. 19 (346), pp. 39–46 (in Russian).
9. Skornyakova E.R. Upravleniye sovremennoy shkoloy na primere obrazovatel'nogo klastera [Management of modern school on the example of educational cluster]. *IXMezhdunarodnaya nauchno-prakticheskaya konferentsiya "Problemy i perspektivy razvitiya obrazovaniya v Rossii"* [IX International Scientific-Practical Conference "Problems and prospects of education development in Russia"]. Novosibirsk, 2011 (in Russian). URL: http://www.zrns.ru/2konf_arhiv_pn9.html (accessed: 7 September 2021).
10. Fadina T.V. Obrazovatel'nyy klaster kak mekhanizm realizatsii potrebnosti na rynke obrazovatel'nykh uslug [Educational cluster as a mechanism for implementing the needs in the market of educational services]. *Vestnik Nizhegorodskogo universiteta im. N.I. Lobachevskogo – Bulletin of N. I. Lobachevsky Nizhny Novgorod University,* 2007, no. 5, pp. 100–114 (in Russian).
11. Itskowitz G. *Troynaya spiral. Universitety – predpriyatiya – gosudarstvo.* Pod redaktsiyey A.F. Uvarova [The triple spiral. Universities – enterprises – state. Ed. A. F. Uvarov]. Tomsk, Tomsk State University of Control Systems and Radioelectronics Publ., 2010. 238 p. (in Russian).
12. *Strategiya sotsial'no-ekonomicheskogo razvitiya Tomskoy oblasti do 2030 goda. Prilozheniye k postanovleniyu Zakonodatel'noy Dumy Tomskoy oblasti No. 2580 ot 26.03.15* [Strategy of socio-economic development of the Tomsk region until 2030 Decree of the Legislative Duma of the Tomsk region No. 2580 of 26.03.15] (in Russian). URL: https://www.tomsk.gov.ru/ctrategija-sotsialno-ekonomicheskogo-razvitija-tomskoj-oblasti-do-2030-goda (accessed: 2 October 2021).
13. Khamidullina G.R., Timiryazova A.V., Gafiullina L.F. *Modernizatsiya professional'nogo obrazovaniya v sisteme ekonomicheskogo razvitiya regiona* [Modernization of professional education in the system of regional economic development]. Kazan, Poznaniye Publ., 2009. 128 p. (in Russian).

14. Sukhanova E.A., Zobnina A.A. Obrazovatel'nyy potentsial mezhorganizatsionnogo setevogo vzaimodeystviya (na materiale vzaimodeystviya organizatsiy vysshego i obshchego obrazovaniya) [Educational potential of inter-organizational network interaction (on the material of interaction between organizations of higher and general education)]. *Pedagogicheskiy imidzh – Pedagogical image,* 2017, no. 2 (35), pp. 77–85 (in Russian).
15. Smyshlyayeva L.G., Voytekhovskaya M.P., Vesnina L.V., Kolesnikova E.V., Matveyev D.M., Vysokomornaya Yu.I. Proyektirovaniye protsessa bakalavrskoy podgotovki pedagogov dlya sistemy professionalnogo obrazovaniya v usloviyakh standartizatsii professional'noy deyatelnosti [Designing the process of bachelor teacher training for professional education system in conditions of standardization of professional activity]. *Nauchno-pedagogicheskoye obozreniye – Pedagogical Review,* 2017, vol. 2 (16), pp. 131–143 (in Russian).
16. Kolesnikova E.V., Sheremetieva U.M., Kobyakova V.N. Istoriya razvitiya i nekotoryye aspekty stanovleniya professional'nogo obrazovaniya na fakul'tete tekhnologii i predprinimatel'stva TGPU [History of development and some aspects of the formation of professional education at the Faculty of technology and entrepreneurship TSPU]. *Nauchno-pedagogicheskoye obozreniye – Pedagogical Review,* 2013, vol. 1 (1), pp. 16–20 (in Russian).
17. Bermus A.G. Klasterno-modul'nyy podkhod k proyektirovaniyu obrazovatel'nykh programm v sisteme nepreryvnogo obrazovaniya [Cluster-modular approach to the design of educational programs in the system of continuous education]. *Nepreryvnoye obrazovaniye: XXI vek – Lifelong Education: the XXI century,* 2015, vol. 4 (in Russian). URL: http://LLL21.petrsu.ru (arcessed: 2 October 2021).

**Kalinyuk Y.V.,** Department of Vocational Education of Tomsk region (Frunze, 14, Tomsk, Russia, 634029).
E-mail: kalinuk@dpo.tomsk.gov.ru

**Smyslyaeva L.G.,** Doctor of Pedagogical Sciences, Associate Professor. Tomsk State Pedagogical University (Kievskaya str., 60, Tomsk, Russia, 634061).
E-mail: laris.s@mail.ru

**Matveev D.M.,** Candidate of Historical Sciences, Associate Professor. Tomsk College of Economics and Industry (Irkutsky Trakt str., 175, Tomsk, Russia, 634040).
E-mail: director@tept.edu.ru