

## Cluster Approach to Engineering Training for Machine Building Industry in a Single-Industry Town

Zelenodolsk Branch of Kazan Innovative University named after V.G. Timiryasov (IEML)

**T.A. Chelnokova**

Zelenodolsk Institute of Engineering and Information Technologies (Branch) of Kazan National Research Technical University named after A.N. Tupolev – KAI

**Kh.R. Kadyrova**

**The article describes a cluster approach to engineering training for enterprises of a single-industry town; the case study is a branch of the oldest Kazan technical university. The cluster strategy is implemented via integration of educational institutions and industrial enterprises.**

**Key words:** engineering complex, cluster approach, single-industry town, educational cluster, integration, principle of historicism, social partnership.

Modern machine building industry of Russia involves more than twenty branches and sub-branches, with the enterprises being located in different regions of the country. The machine-building complex of the republic of Tatarstan includes large and medium-sized enterprises relating to this industry (machine-building, compressor-building, aircraft construction, shipbuilding, tool production, etc.).

The development of machine building production correlates to the development of vocational and engineering education system in the republic. The history of Zelenodolsk clearly represents this close relation. The foundation and development of such enterprises as the publicly held company (PHC) "Zelenodolsk plant named after A.M. Gorky" and machine building company named after Sergo Ordzhonikidze (POZIS) are closely linked to the history of vocational schools no. 25 and 22, the shipbuilding school (founded in 1944) and the mechanical technical school (established in 1939). These enterprises were also involved in patronage of some secondary schools of the city. POZIS has been mentoring schools no. 4, 14, and 11 for several decades. Schools no. 1, 3, and 9 are under the patronage of "Zelenodolsk plant named after A.M. Gorky".

The analysis of the past reveals the correlation of production and educational processes that are locally restricted by the same area. This functional dependency should be studied in terms of current situation, and can be a base to solve the problem of single-industry towns. The development of single-industry towns, which are economically dependent on one factory or industry, is a challenge of the national level. To deal with it, the Single Industry Town Development Fund (SITD) was established in September, 2015. Two towns from Tatarstan, one being Zelenodolsk, were included in the list of the towns with the most difficult social and economic conditions. Complex approach used to discover new sources for the regional development implies assessing educational, methodical and scientific potential of the local educational institutions.

Historical review allows revealing characteristic features of the relations developed between the enterprises and educational institutions of Zelenodolsk in the distant and recent past, considering their interaction patterns, and understanding the historic conditions that determined the ways of staff training.

The same principle can be applied to understand the current changes taking place

in modern system of professional education in Russia. Branches of technical universities are being established in small industrial towns; vocational training schools are being integrated with higher education institutions; the staff training process is being reformed. A new model of interaction between enterprises and educational institutions is historically grounded. The model aims at training staff of new generation, and is based on the idea of the educational cluster. The notion "cluster" is applied in many spheres of human activity and defined by a number of researchers both Russian and international ones (G.B. Kleiner, M.A. Mirganyan, M. Porter, D.Yu. Trushnikov, T.V. Tsikhan, et al.) According to M. Porter: "Clusters are geographic concentrations of interconnected institutions and companies from a certain domain. Clusters consist of a group of related industries and other important entities from a competitiveness point of view. These include, for example, specialized input (such as components, machines and services) suppliers or specialized infrastructure suppliers" [1].

Education clusters started to be established in the 90-s of the 20 century. The law support of the cluster policy at the federal level (the RF Government orders of 2006 and 2008) facilitated the development of cluster development in the education system. T.I. Shamova, who was among the first proving the necessity of the cluster approach in education, underlines its capacity in self- and inter-development of the cluster subjects [2]. A.V. Smirnov distinguishes such characteristic of the education cluster as a set of vocational training institutions that are united by their professional areas, and their partnership with the enterprises [3].

The partner relations between enterprises and training institutions play a special role in the development of both stakeholders. Their proximity ensures fast response on the partner's social needs. Rapid response is of special value for problem solving in such kind of towns. Thus, the development of an industrial and logistic area became one of the ways to modernize Zelenodolsk. This fact conditioned a new education programme to

train logisticians.

A government programme for education development contains the idea of the cluster approach to engineering and technical training. It is approved by the document "On the concept of engineering training in Russia" issued by the RF State Duma. According to the document, "it is of special importance for engineering universities to reconstruct such training systems that would ensure regional enterprises' influence on the content and quality of engineering training to provide them in the future with specialists of required competencies and skills" [4]. The education cluster becomes a renovated form of a social partnership that is developed with account of the new requirements to the vocational training system (for example, the employers participate in education programme development to define the competencies to be acquired within the training period; they assess the learning outcomes of the graduates; they take part in certification procedures, etc.).

The Tatarstan government adopted "The concept of education cluster development" (2006) and the programme "Development and distribution of the productive forces based on the cluster approach for the period until 2020 and 2030" (Cabinet of Ministers decision No. 763, dated 22 October 2008), which contributed to the establishment of the education clusters in the Republic, since industrial clusters induced the development of the education clusters focused on training the staff for particular industry needs.

The vocational education clustering is supported by industrial enterprises that promote establishing branches of universities in different towns of Russia. For example, the branch of Kazan National Research Technical University named after A.N. Tupolev (KNRTU-KAI) founded a branch in Zelenodolsk in 2000, which resulted from the staff demand of "POZIS". The company's management established the branch of the higher education institution based on the local vocational technical school, and stayed in close contact with the newly founded institution. In 2008 the branch received the status of institute and has become



T.A. Chelnokova



Kh.R. Kadyrova



Zelenodolsk Institute for Machine-Building and Information Technologies (ZIMBIT), which is KNRTU-KAI's branch.

The clustering process has resulted in diverse models of education clusters. The cluster approach is the base for interaction of vocational educational institutions located in the close proximity of each other (for example, there is a scientific and educational cluster relating to trade, hospitality and service industries; it unites a number of higher schools and schools of vocational training, including Kazan Innovative University named after V.G. Timiryasov (IEML)). The cluster approach is also a base for internal development of most of the universities in Tatarstan. Thus, KNRTU-KAI and its branches is a developed educational net integrated in a united educational environment, with its structural units being vocational institutions, scientific research institutes, and training centers founded in industrial enterprises in Tatarstan. Clustering ensures a vertical educational net with KNRTU-KAI in its center. It provides systematic and continuous training of staff to meet the demand of particular local industrial enterprises. However, the KNRTU-KAI educational cluster is not only the system of vertical links. The development of branches is the development of horizontal relations between the subjects of integration. The members of the horizontal educational net are parties located within the municipal entities of Tatarstan Republic. The integration of their interaction aims at their efficient functioning.

Thus, "Zelenodolsk plant named after A.M. Gorky" used scientific and pedagogical experience of ZIMBIT KNRTU-KAI to train skilled workers, which is a renovation of "vestibule training" model, once had existed. With participation of the branch, the advanced training for the vocational instructors involved in staff training was organized. In its turn, ZIMBIT KNRTU-KAI has a possibility to use the equipment, facilities and specialists of the company for training the students, the future engineering staff of the industry.

Clustering facilitates product promotion in the net. The product of education is

graduates; the product of scientific activity is research and development works ("know how") done with the help of the students. A multifunctional lathe machine, a manipulator, developed with participation of ZIMBIT KNRTU-KAI students and faculty, were offered to be introduced in the production in "Zelenodolsk plant named after A.M. Gorky". Close collaboration between the university and the company allows reducing the demand of the local companies for qualified specialist of new formation.

Scenarios for development of educational clusters have much in common; however, they have their particularities that are conditioned by specific features of a local industrial structure. Thus, the foundation of ZIMBIT KNRTU-KAI was actively supported by POZIS. The education programmes were firstly focused on machine building industry. The demand for qualified staff in the ship building industry led to the changes in the structure of ZIMBIT KNRTU-KAI. It integrated with the Shipbuilding technical school, which was supported by the company "Zelenodolsk plant named after A.M. Gorky". This school had provided the company with highly qualified workers for many decades. Its integration in the environment of the higher education institution, with its high scientific and methodological potential, brought positive changes to the training process at the technical school. The integration resulted in development of new training areas and professional profiles of the education programmes implemented by ZIMBIT KNRTU-KAI.

Cluster approach applied in education focused on needs of modern production and contemporary methodological ideas (for example, the idea of continuous training), implies dialectical development of the previous experience and traditions. The companies' patronage of the secondary schools is a valuable experience in continuous engineering training for machine building industry in Zelenodolsk.

A modern form of such patronage of school No. 4, 11, 14 is the foundation of special classes "Engineers of the future", which were initiated by POZIS. The company

funded additional training courses in physics and mathematics at school to help the pupils enter technical universities. These classes are held not only by school teachers but also by the faculty of ZIMBIT KNRTU-KAI, which allows enhancing career advice service for potential students and adjusting students to the university requirements more easily.

The cluster approach in engineering trainingsystem aims at reducing the disbalance between the employers' expectations from young specialists and the real competency level of the graduates. According to A. Shmarov, A. Adreyenkova, and I. Glinkin, universities often have little understanding of what are the employers' requirements for graduates' mobility, adaptability, and professional self development [5, p. 6]. The vertical and horizontal cluster net of KNRTU-KAI can significantly increase the graduates' mobility, since the production companies are active parties of the net. Within the programme of vocational training students can acquire a working speciality and practice it during their internship.

There are different models of interaction between ZIMBIT KNRTU-KAI and employers. For example, those students who do a special vocational course in "ship building"

have internship in the Training center of "Zelenodolsk plant named after A.M. Gorky" starting with the second year of study. During the internship the students visit all the shops and departments of the plant and communicate with the managers. In the third year of study, the students are distributed in different shops and departments with regard to their wishes and interests for further internship and course paper work. This distribution is a career star for most of the students.

The interaction model implemented in collaboration of ZIMBIT KNRTU-KAI and POZIS has the idea of a dual training system. Based on mutually developed training programme, new work places are created for the students to put their theoretical knowledge in practice during the internship.

Another way to train future employees is to attract leading specialists of the companies to the training process. Such interaction is practiced between ZIMBIT KNRTU-KAI and JSC "Zelenodolsk Company "ERA".

Our own experience in implementing the cluster approach proves its high relevance and value in the education system and single-industry town development".

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