

## **The Industrial-Educational Cluster Environment as a Tool of the Staff Capacity Forming of the Russian One-Company Towns**

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### **Abstract**

*The article presents the outlooks of cooperation between educational institutions and employers in Russian mono-towns. The experience of designing industrial-educational cluster environment on the example of the Arsenyev is dominant local employer of the Far East region. Proposed domain structure of each domain of the cluster, reveals the content and features of each domain. It shows the trajectories of the interaction of all the subjects of the cluster environment.*

**Keywords: professional partnership, academic and manufacturing cluster, one-company towns, educational institutions, employers, integration, personnel training.**

## 1. Introduction

In modern social and cultural environment, partnership of educational institutions and employers considered as an institutional arrangement of competitive human capacity formation and also as a necessary criterion to improve the quality of education. The modification of conditions and content of economic activity, developed in our country, pointed out a range of requirements on the part of employers for the quality of graduate training. The problem-solving ability and the commitment to the occupational role in an appropriate sphere of production of science or business are considered to be one of the most pacing factors when concluding professional contracts. Educational system responds to these requirements with quite elective development of intervention mechanisms of educational process, contributing to the formation of professional self-determination indicators, personal characteristics and basis of professional competence. The strategic cooperation is extensively implemented by means of rather local academic and manufacturing branch “university-enterprise”. However, it is important to note, that in Russian Federation there are territorial units for which the problem of extension of entities’ interaction and the identification of status and functionality of all concerned parties is actualized. This refers to Russian small towns (one-company towns) in which generally there are one or several dominant local employers and there is also a chain of educational institutions of middle, middle-professional and high levels of qualification. According to the latest sociological studies, in most mono-cities modern enterprises fall under staff scarcity of not only top level professionals, but also of blue-collar jobs and middle-ranking specialists of staff levels. It is quite clear that for an effective and dynamic development of such one-company towns, a unified academic structure that is only focused on staff needs satisfaction of present economic entity has to be organized.

It appears that one of the prospective lines to solve this problem is the organization of strategic partnership between employers and educational institutions organized in terms of cluster type. Cluster approach represented one of the directions of system concept to solve problems concerning the competitive regional growth and this approach was initiated by professor of Harvard Business School Mr. Porter [1]. Extra attention in regional development has been paid to the approach based on clusters in Russia recently [2, 3, 4, 5, 6, 7]. Foreign researchers also pay attention to given problems [8, 9, 10, 11, 12]. Conception of the long-term social-economic development of Russian Federation until 2020 suggests creating the web of the territorial-manufacturing and innovative high-tech clusters on the territory. Principles of the cluster organization and forming, mechanisms of the clusters development support are stated in the methodical recommendations of the cluster-based policy realization in Russian Federation regions [13, 14].

Occurrence and necessity in the formation of cluster-based educational milieu in Russian one-company towns is determined by the following factors:

- all parties of strategic partnership are geographically localised, in other words, the occurrence for current development of education, production and information infrastructure is provided;
- all contributors adjust a multilevel training system of specialists for necessary qualification:
- integrating of enterprises and educational institutions into clusters in one-company towns – is a beneficial co-operation in terms of product’s competitive growth, cost reduction and most importantly training of qualified specialists suitable for specific nature of cluster:

This paper describes an experience of organizing academic and manufacturing cluster-based

environment in Arseniev the city of Far Eastern Federal district. The structure of academic and manufacturing cluster is presented and the mechanism of all cluster parties interaction is outlined.

## 2. Materials and Methods

Primorie region is one of the most southern regions of the Far East Federal district, which is notable for great resource base and advantageous geopolitical position in the center of the Asia-Pacific region that are strategic factors for social-economic development of the territory. In the Soviet Union this region was notable for a high rate of the population growth due to renew effect of the migration process on the age-related structure. The territorial usage effectiveness depends a lot on the special integrity development. The Primorie specific feature is the presence of the small towns, which are the certain base of the region, and in the different historical periods of the country existing were spots of the territorial growth. In the crisis 90s, the single-industry of the most of region towns worsened the unstable dynamics of the manufactory development and the shortage of the vacancies [15] (Table 1).

Table 1. The Primorsky region towns specialization

Town	Specialization	Dominant local employer	Population (thousand)			Correlation 2014 and 1991, %
			1991	2005	2014	
Arseniev	Machine building enterprise	JSC «Askold» JSC Arseniev Aviation Company «Progress»	71	61	54	- 31,5
Bolshoi Kamen	Shipbuilding, ship repair	JSC Far Eastern plant «Zvezda»	68	39	39	-74,3
Dalnegorsk	Mining and chemical	JSC «Gornohimicheskaya kompaniya Bor»	50	49	36	-38,8
Spassk-Dalniy	Building material enterprise	JSC «Spasskcement»	61	48	43	-41,9
Dalnerechensk	Woodworking industry	JSC «LesEcsport» JSC «Primorskiy derevoobrabatyvauschiy kombinat»	40	34	27	-48,1
Lesozavodsk	Lumbering industry	JSC «Ussuriyskiyderevoobrabatyvauschiy kombinat»	45	32	37	-21,6
Nahodka	Ports	Port Nahodka, Port Vostichniy	192	175	156	-23,1

There was no opportunity to find a job at the labor market because of the towns narrow specialization, that caused high unemployment, and, as a result, an intense migration from the region. The Primorie population has decreased by several times.

To stabilize the economy situation and decrease the population outflow branches of the institutions of higher education were founded almost in every town of the Primorskiy region since mid-90s (Table 2), which help to keep young people on the south of the Far East.

Table 2. The branches role in the system of the personnel training in the Primorskiy region, 2014

Town	University	Number of students on a particular specialization of the total number of students, %	Number of students 2014
Arseniev	The branch of FEFU in Arseniev	Aircraft and rocket-space technology 42,19	1 033
Ussuriisk	The branch of FEFU in Ussuriisk	Education and pedagogy 85,82 Social science 9,34	3499
Dalnegorsk	The branch of FEFU in Dalnegorsk	Geology, prospecting and extraction of minerals 1,85	139
Nahodka	The branch of FEFU in Nahodka	Health, wellness and safety, environmental engineering and environment protection. Economics and management 2,42	889
	The branch of VSUES in Nahodka	Service sector 4,24 Culture and fine arts 4,2	740
Artem	The branch of VSUES in Artem	Computer science and IT 3,73 Culture and fine arts, 42	636

The institution of higher education branches has been working more than 15 years, training specialists for towns and region needs. Last years some branches were closed because of the raise of requirements to the institutions of higher education. While some of them, which were based on dominant local employer, having accumulated great material and technique base and science potential, became a basic training platform of higher qualified specialists for region needs. The branch of Far East Federal University in Arseniev (which was founded as branch of the Far East Federal Technical University) is one of them.

The population of Arseniev city is small-about 60 thousand people, and on this basis it is socially positioned as a small town in Russia. However, its strategic importance goes far beyond the Far East region. It all depends, first of all, by the presence of the two fastest growing economic entities specializing in engineering JSC Arseniev Aviation Company "Progress" and JSC "Askold". Products of these companies are highly valued in our country and abroad. In this regard, the city is in favorable demographic situation (which, in general, is not typical for small towns in Russia), and, as a consequence, the presence of their own personal capacities for core enterprises-about 20% of the population-young people aged up to 20 years.

By the early 90's of the 20th century, the Arsenyev city was among the most successfully developing small towns of the Far Eastern region. However, the sharp economic downturn, which was observed in the post-Soviet space, affected the city especially hard. The conversion of defense enterprises, due to a decrease in government contracts, launched a huge outflow of highly qualified specialists into the neighboring and western regions of Russia, where the plants of a certain profile were functioning. The situation worsened because of the outflow of young people from the neighboring large cities Khabarovsk and Vladivostok, and as a result in the demographic decline. The City appeared to be on the brink of survival. At this time, a very risky decision was made (but, as it turned out later, a very wise decision) that is to set up a branch of the Far Eastern State Technical University in Arseniev, where it was planned to train its own highly qualified specialists on economic and engineering faculties.

Currently it is an educational institution-a branch of the Far Eastern Federal University (FEFU). The occurrence of an institution of higher education, as well as gradually improving

economic situation of business units of the city, is due to the growing industrial orders with an identified need for full coordination of action to launch a multilevel system of training. Moreover, it was quite obvious that acting as members of such cooperation educational structures of different levels of training should be involved, strategically joint among one another.

The study of domestic [16, 17, 18] and foreign experience [19, 20, 21] of strategic partnership between employers and educational institutions in small territorial units, conducted by the authors sociological and job analysis determined the shape of the following partnership-the organization of academic and manufacturing cluster. It is commonly known that, each cluster member can function separately, but the effective interaction takes place in the conditions of educational and productive partnership. Thus, the educational environment of cluster type in a one-company town-is an effective tool to ensure the preparation of highly skilled professionals focused primarily on the customer and the needs of the labor market of the city.

The main subjects of educational environment of the city cluster are employers, educational institutions and bodies of the state and municipal administration, that provide legal framework of education, personnel and industrial policies in the city. For a clear definition of the status and authority of all stakeholders, and also the mechanisms of their interaction the projected cluster was nominally divided into three domains: the domain "the buyer of education services" – employers, domain "the provider of education services" - the educational institutions of the city, and domain-compiler - the educational process that provides a high-quality training for required qualifications.

The first domain was formed as a training and production center based on JSC "Progress", which consists of three sections - forecasting, expert, production and training. The center includes representatives of the two major economic entities of the city - only 15 people. The main activities of the center:

- determination of the size and structure of the required human resource capacity based on an analysis of current and future production volumes;
- delegation of authorities to participate in the formation of the second domain of educational cluster;
- development of category and the structure of professional competencies for adequately trained specialists;
- organization of the industrial areas to conduct career guidance, training and production activities with all potential members of the educational environment.

The second domain of the cluster is the main supplier of labor resources required by the employers. The core of this domain is a branch of Far Eastern Federal University in Arsenyev city, which trains specialists of the highest category in three educational areas that meet the customer's requirements: aircraft and helicopter construction, design-engineering software engineering industries, the economy. At the same time, predictive examination conducted by representatives of the customer, allowed to establish the need in the labor market in the city for highly skilled workers of such specialities as riveters of fourth category, turners and millers of fifth - seventh categories, operators on CNC machines. Training of such specialists is traditionally carried out in vocational school № 32 and in college of FEFU branch and these two educational institutions were also included in the educational-industrial cluster.

Solving the problem of labor market saturation with specialists is impossible without systematically organized career guidance identifying preferences in the future professional life. It is obvious that in order to begin this work with human resources, the process has to be started from school times, beginning from an average level of general education. Therefore, a competition

among the 9 municipal educational institutions for the right to conduct joint educational and career-oriented activities with the customers of educational services and educational institutions of higher level of training was held in the city. The contest was organized by the bodies of state and municipal government. As a result, four schools were selected which "closed" all possible levels of interaction between suppliers and customers of educational services.

It is clear that the educational process in all the structural elements of this domain was carried out under the relevant state standards. At the same time, for their effective interaction in a clustered environment in the traditional practice a number of organizational, structural, scientific-methodical and professional activities has been introduced which ensured compliance by all parties of strategic partnership continuity pre-service, secondary, tertiary, and post professional training. The content of these innovations is presented in the third domain of educational environment cluster.

For students in grades 10-11 of general education schools in order to gain deeper knowledge in physics (in particular for some of the mechanics) and chemistry, as well as in vocational guidance purposes at the training center of the JSC Arsenyev Aircraft Company "Progress" practical exercise are held. In the laboratory, a branch of materials science FEFU for the same students who study in applied programs series of master classes for metallographic analysis is conducted, as one of the methods to improve the quality and reliability of the production of helicopter parts.

The University conducts systematic work with students through the system of pre-university training in core subjects: mathematics, physics, and Russian language. Undergraduates majoring in Engineering Technology give optional lessons in schools on plotting. Companies provide a working platform for practical and laboratory classes, internships, field trips for the students of college, university and vocational school.

Teachers of branches, colleges and high schools are in close cooperation with enterprises and if required they do an internship there. School teachers have the opportunity to undergo through training courses at the university. In turn, representatives of the plants are teachers of special subjects, and they are also parts of the certification and examination committees for state protection of final qualified student works. Training division of the cluster production center is responsible for the quality of students' preparation enrolled in the target direction of the company. The proximity of the training center and the University College allows you to track the success of student learning. With students having satisfactory marks at the end of the session the contract can be terminated unilaterally.

In the educational institutions of the city that are included in cluster, 86% of students in 10<sup>th</sup> -11<sup>th</sup> forms receive specialized education, with more than half of the students prefer technical direction that meets the needs of the labor market of urban district. For a responsible choice of an individual trajectory of development and the expansion of social partnership based on school component, hours for elective courses are allocated, 15 elective courses have already been sold. 100% of students in the ninth form have gone through pre-profile training. As part of the additional education on the basis of the JSC "Progress" a technical class that joined 129 students from 9th to 11th grade was set up. Training is conducted in three areas: turnery; turner; miller. At the end of grade 11, 83 (64%) high school students received a certificate of their first profession. In addition, specialized practices were organized and conducted with the social partners: JSC "Progress", Department of Automated Control Systems - Lyceum number 9; JSC "Askold" lab – school number 4.

In recent years, schools of the city host the annual conference "Steps to Success", which presents the research of students on a variety of science branches. The winners of the conference are invited to a higher scientific level - student conference "Youth of the XXI century", which takes place at the base of the enterprise JSC "Progress". At this point, scientific and professional partnership has involved college students, from a branch of Far Eastern Federal University, as well as the young company's employees and teachers. Organizers and direct participants are the two main bodies of the student government: Student Scientific Society, Student Design and Technology Bureau. As independent experts, there are heads of the departments of machine-building enterprises and faculty. Many students and teachers are members of the Engineering Union; perform the results of scientific and technological work on the exhibition of the helicopter industry.

Thus, all the mechanisms of interaction between actors in the cluster work not only for professional development of teaching staff, but also for the efficiency of the educational training of future specialists. Operative networking, coordination of all parts within the cluster is fulfilled through the forth domain – the local authorities.

### 3. Results

Practical results of one of possible ways of interaction within industrial-educational cluster is the possibility to identify the structure of the future specialists' vocationally important qualities, and working out principles of its formation in the education process for specialization "Economics and management of the enterprise (in the machinery construction)". Particularly:

1. The analysis of the economists and managers' sphere of professional activity allows to form interrelated system of their vocationally important qualities (VIQ), which characterize features of behavior, thinking and socialization [22]. Based on developed methodology of assessment there was defined integral assessment of each quality (five-point scale). Job specification analysis was made by 35 experts: employees of banks, Machine building enterprises JSC «Askold», JSC Arseniev Aviation Company «Progress», Tax services (20 people of them from state one (57%) and 15 people from private one (43%)). Among these experts there are economists – 40%, managers – 25%, accountants – 20%, chief accountants – 9%, chiefs of the economic departments – 6%. The ranking of the defined VIQ was a result of the expert five-point scale assessment, which let to get integral assessment for each characteristics. The ranking results of the expert assessment are shown in the table 3.

Table 3. Vocationally important qualities of the economist-managers

The VIQ group	The VIQ of each group	Expert assessment in scores
<i>Motivational-emotional</i>	initiative	4,8
	high activity and energy	4,5
	ability to control oneself	4,6
	emotional stability	4,7
	level of motivation development	4,9
	ability to work out and realize one's ideas in the management and economy sphere	4,9
	ability to business-project activity on the machine-building enterprises	4,7

	ability to solve administrative-economic problems	4,5
	logical and analytical abilities (ability to analyze problems of enterprise)	4,8
	creativity	4,6
<i>Social- perceptive</i>	inclination to leadership	4,8
	sociability	4,7
	ability to stand on one's point of view and ability to convince the others	4,6
	ability to resolve the conflicts	4,5
	ability to manage a manufacturing team	4,9
<i>Cognitive- creative</i>	ability to work out and realize one's ideas in the management and economy sphere	4,9
	ability to business-project activity on the machine-building enterprises	4,7
	ability to solve administrative-economic problems	4,5
	logical and analytical abilities (ability to analyze problems of enterprise)	4,8

2. It should be noticed, that experts took into consideration specificity of the economist-managers future professional activity – the machine-building sphere. Machine-building factories in Russia are large enterprises, which realize its activity not only for Russian market, but also for foreign ones, and its products must be competitive. That is why experts chosen analytical, professional and strategic thinking, initiative and ability to control oneself, organization-administrative qualities as a priority.

3. The search of optimal approaches to organization of the process of formation and development of the economist-manager's VIQ let to prove the organization possibility of this process in the system of the independent students' work [24].

There were several stages of the development of structure-organizational, methodical and didactic provision, means of psychological-pedagogical support of the VIQ formation and development: software designing; construction of the disciplinary field of an independent students work\$ developing of the educational programs, which realize the process of the VIQ formation and developing . The base principle of the education programs developing is principle of the system variability, which provide subjective, technological, substantial and active variability of the educational environment.

4. The formation of the process monitoring system is realized in two directions. In social and job specification aspect there are four levels of the studied qualities formation, reflecting structure-functional correlation of the staff membership of the corresponding vocational sphere, such as executive (initial), tactical, administrative and strategical (Figure 1).

**Executive (initiative) level of the VIQ maturity**

- abilities of search, selection, processing and using of the necessary vocational information are developing;
- abilities to detect connections and relations between separate elements of the economic knowledge are developing;
- abilities to overview questions of the vocational activity, to analyze economic processes and phenomena, taking place in society and world economy are developing.

**Tactical level of the VIQ maturity**

- skills of the vocational argumentation while analyzing standard situations in the sphere of the forthcoming activity are developing;
- abilities to set and argue patterns of the social-economic processes, skills to explain existent economic conceptions are developing;
- features of the collective vocational activity are mastering;
- ability to assess analytically the economic effectiveness of the enterprise is developing.

**Administrative level of the VIQ maturity**

- abilities to work out recommendations of the discovered problems elimination, to assert one's own viewpoints;
- skills of the manufacturing processes management, abilities to work out several ways of solving tasks to eliminate administrative-manufactural problems;
- abilities to establish business and vocational contacts, to make individual and collective decisions are developing;
- creative activity in the administrative-economic sphere is developing.

**Strategical level of the VIQ maturity**

- ability to set goals, plan steps of its achieving, organize process and provide control;
- abilities to work out and bring the ideas in the sphere of economy to life;
- ability to make an expert examination of the economic projects;
- abilities to the business-project activity in machinery-building;
- abilities to control the collective.

Both for personnel deficit covering in the region, and for the academic staff professional development, for the future specialists' educational training effectiveness.

#### **4. Discussion**

This article describes the experience of social partnership between employers and educational institutions on the example of industrial-educational cluster that operates in Arsenyev Far Eastern Federal District. At the heart of the development of learning environment of the cluster type, first of all, there is a principle of proximity, which determines the efficiency of the interaction. The proximity of participants allows creating a single information space for professional communication, dissemination of knowledge, the exchange of new technologies and innovative products. The usage of this principle, logically leads to the functioning of mutually beneficial

cooperation in the implementation of joint projects that strengthen the position of each unit of the cluster, not only for the labor market but also for the market of products.

According to the proposed scheme, in the organization of social partnership between employers and educational institutions all participants control the multi-level system of specialist training. The employer determines what to teach, and educational institution determines where to teach and how to teach, but vocational education is considered as a process, which is based on its integration with the production. Thereby, the time spent on specialist's training of high quality, and the duration of his professional adaptation is reduced.

The uniqueness of the cluster approach is that the future specialist immerses into the "professional environment" from an early age, gradually acquiring common practice-and professional knowledge, which makes it possible to get to know the production process better and that significantly shortens the period of entry into the profession. Trained professionals not only cover the needs of the labor personnel in enterprises of the city, but also experience a fast promotion and become business leaders. The average age of employees has decreased from 55 years to 45 years. The number of pensioners in the structure of the staff has decreased significantly, and the number of young professionals in the age group up to 30 years has increased.

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