

Adaptive Model of Advanced Training of Engineering Specialists for Residential Companies of Monotowns (TASED): Theory and Practices

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Abstract — The adaptive model of the advanced training of engineering specialists based on industry-university collaboration has increased attention in production or business practice and research due to the need of innovations, especially when we deal with the issues of monotowns. However, although authors have devoted considerable efforts to finding experimental studies on the issues of vocational and engineering schools located in single company towns, not many have been found. This article presents the results of the experimental research which prove that integration of education and industry into clusters intensifies the development of both industry and vocational schools. The experimental part of the research was carried out in the conditions of a Siberian monotown Yurga, which was included into the Russian Federal list of Territories of Advanced Social and Economic Development.

Keywords — *monotown, territories of advanced social and economic development, engineering specialists, advanced training, industry and education clusters*

I. INTRODUCTION

A *monotown* is a calque from Russian and means an urban settlement with economic basis dominated by a single industry or a group of integrated companies [1]. Within the periods of economic stagnation, when the factory or the plant (the so called town-forming enterprises) cannot grow or develop, different objective reasons turn monotowns into areas of social and economic tension.

The problem of single industry towns is not Russia-unique, as many industrial countries faced the problem of declining industrial regions back in 1970-s when many town-forming enterprises had been liquidated, restructured or transferred their production sites to other regions with more beneficial economic conditions, e.g. Detroit and Pittsburgh in the USA, or Glasgow in the UK [10, 2]. Some countries faced massive losses of population in some parts due to economic or political changes, like East German cities in 1990-s. Different countries started implementing different strategies and approaches aimed at diversifying and restructuring the economy of those areas [4, 10].

To deal with the monotowns problem, the Russian federal government created a Federal Law to support the so

called Territories of Advanced Social and Economic Development (TASED – authors initialism) [5] and an Intergovernmental Committee on Monotowns, which invited monotowns local authorities to submit plans with urgent and specific measures for current problems and road-maps for diversification aimed at sustainable development of the areas. The Government approved 27 monotowns to receive financial support from the federal budget and gave tax benefits for enterprises and companies that become the residents of these territories. This approach is aimed to provide an inflow of investment, and, thus, enhance the rapid development of monotowns economies and create descend living conditions for the residents.

For many decades the system of vocational training and education in monotowns was being formed as a social and economic ground for both, city economy in terms of staff training and social secure of residents in terms of available vocational training and education, guaranteed work placement as a part of a course of study, and further employment. Vocational schools, colleges and institutes located in monotowns had always been the rings of the so called technological chain, and had been focused on training specialists for residential industries or companies, which in its turn, in combination with a planned economy approach, had always factored in low unemployment and low human capital flow.

Nowadays many educators argue that this approach in building an educational system is safe in terms of long and sustainable development and pinpoint lack of staff and qualification diversification as a key feature which prevents people from finding another residential job or position when an enterprise is restructured or, which is worse, liquidated, which makes people search for job in different areas with different industries or different qualification requirements [14], [15].

With this regard, the development of business environment as well as industry diversification and new long-term investments are high priorities for federal government and local TASED authorities as they can give a good start for new education and training programs. Due to specific peculiarities of modern production and business relations, characterized by their ability to act in the

conditions of changeable market economy, TASED located vocational schools, colleges and institutes should provide an advanced education and training to support residential enterprises of their territories with personnel, staff and research investigations [13].

II. MATERIALS AND METHODS (MODEL)

There are many possible approaches to the effort to change critical situation in educating and training personnel and staff for company towns. The most advantageous ones at the stage of building new relations between schools and enterprises are comparative, systematic and analytical research studies of the best Russian and overseas practices, which is a great challenge because there have been a small number of studies investigating the ways of monotowns vocational schools modernization. None of the studies has been large-scale, but they suggest some interesting approaches in patterns of industry-university collaboration [3, 8, 12].

With this regard the research is loosely based on long-term experience of Yurga Institute of Technologies (National Research Tomsk Polytechnic University, Russia), which was founded in 1957 as a learning engineering centre to provide the main industrial plant of Yurga (a single industry town) with engineering specialists, has grown into Institute of Technologies, and for the last decade has been going through a range of modernization from mission and structure of the Institute to teaching strategies and industrial-university collaboration as a kernel of an integrated approach in teaching engineers.

Since the aim of the research is to find methods and forms of an advanced course technology based on collaboration between vocational schools, industries and business companies, the analysis of observation data concerning new enterprises established within the boundaries of company towns, i.e. residential companies, have been examined. The research aimed at identifying the needs of both residential industries and vocational schools which might factor in long-term collaboration, and at demonstrating the effects of such collaboration on area economy and residents' living standards, which is very relevant for any vocational school of any monotown.

Investigations into the issues of educating and training engineering schools alumni have been carried out in cooperation with top managers of recently started residential plants and their main investors. The research work resulted in a wholesome list of competencies a potential engineering employee of the plant must obtain to get a good job position with possibility of further professional development.

An adaptive model of an advanced training of engineering staff for residential companies of TASED was launched and tested at Yurga Institute of Technologies, and the findings obtained within the experimental phase of work are presented.

The Department of Economic Development of *Yurga-TASED* reported that more than ten industrial enterprises have applied to obtain the status of a residential company of the territory and suggested long-term business and engineering projects. Six of them are priority for Yurga

Institute of Technologies as they claim need in engineering staff:

- Construction of a Rainbow Trout Growing Plant;
- Construction of a Paper Recycling Factory;
- Engineering modernization of mining equipment and machinery;
- Construction of a greenhouse complex for a vegetable growing company;
- Construction of a Van and Mining Machinery Tires Plant;
- Construction of a gas boiler house;
- Clothing manufacture.

III. RESULTS AND DISCUSSION

Despite of all the advantages TASED gives to its resident companies, many of them face the problem of recruiting engineering staff of necessary qualification.

Recent investigations carried out in cooperation with top managers of the Rainbow Trout Growing Plant and its main investor OOO Siberian Investment Group Ltd made it possible to identify key competencies of the plant staff, presented in Table 1.

TABLE I. KEY COMPETENCIES OF THE RAINBOW TROUT GROWING PLANT STAFF

Department	Key competencies
1. Production management	<ul style="list-style-type: none"> • percept, analyze and communicate information; think critically, competently and reasonably, set goals and choose ways to achieve them; • work in a team, use management methods effectively, conduct business communication to present decisions and ideas in a more efficient way, understand the consequences of management actions and take responsibility; • evaluate market conditions and make organizational and managerial decisions, develop methods of managing a team, implement innovative management approaches; • carry out production and feasibility calculations, analyze and evaluate production and non-production costs, solve problems with the creation and reorganization of production sites, plan the work of staff and payroll fund; • calculate social, economic and financial indicators which are typical of economic entities of the enterprise [9].
2. Fish farming	<ul style="list-style-type: none"> • know the basics of Economics and Law; • use foreign languages to solve the tasks of interpersonal and intercultural cooperation; • apply modern methods and techniques of fish farming, including breeding, raising and feeding; • collect, analyze and interpret materials in the field of fish farming; • support technological decisions with theoretical knowledge of fish biology; • choose appropriate growing conditions and food, predict results of any changes concerning breeding, feeding and rising; • ensure the rational reproduction of fish;

	<ul style="list-style-type: none"> • apply modern research methods in fish farming.
3. Community, Packaging and Maintenance	<ul style="list-style-type: none"> • organize own activities, choose standard methods and ways of performing professional tasks, evaluate their effectiveness and quality; • develop personal qualities and professional skills through both formal education programs and self-education, take advanced training programs, manage inventory and production items flows, draw up supply and sale documentation; • organize and conduct quality assessment procedures, make accounting and production reports; • perform locksmith works, fit and solder parts and assemblies of various complexity during the assembly process; make tools to assemble and repair machinery parts; check, identify and repair machinery and equipment defects; • take into operation electrical equipment after repair and put it into operation, test machinery with the supervision of engineers and technical personnel [6].

Yurga-TASED has got three vocational schools and the Institute of technologies to support residential industries and companies with engineering specialists. These engineering schools provide education and training on more than twenty different programs and courses including on-the-job-training. Although, the study convincingly demonstrated the need for a new approach to the problem of advanced training of engineering staff to work at enterprises which have come or are intended to come to the territory.

The questionnaire on how education programs and training courses satisfy needs of residential industries and companies revealed that most of the programs and courses provided did not meet requirements, and employers often had to spend their own resources to further educate or train young specialist they had recruited.

New adaptive model of advanced training engineering specialists based on the integration of education and industry into clusters has demonstrated its ability to help tackle the lack of required specialists.

The unique characteristics of the suggested adaptive model, which was tested on the basis of the Rainbow Trout Growing Plant, are as follows:

- all the participants of integrated programs use the resources of education and industry clusters;
- all the relationships within the cluster, concerning specialist’s education and training are based on the methodology of social partnership;
- the model has the ability to change to suit any age groups of participants;
- educational programs and training courses are module-based and allow inviting lectures and trainers from different universities and companies;
- one of the modules of the program includes on-the-job-training at one of the residential enterprises.

The plant top managers’ survey showed that by the end of the experiment 90 per cent of new employees (all of them were the participants of the experimental program) met qualification requirements of the enterprise.

IV. CONCLUSION

Industry-university collaboration has increased attention in production or business practice and research due to the need of innovations, especially when we deal with the issues of monotowns. Many theoretical and experimental studies, as well as case studies, show that this type of collaboration results in the development of the “third mission” in addition to the two missions of research and teaching, and commercializes academic knowledge through continuing education, patenting, science parks and incubators, and intensifies the development of both industry and vocational schools [11], [16], which is of burning importance when looking for ways to restart monotowns economy.

The adaptive model of advanced training engineering specialists launched at Yurga Institute of Technologies allows training specialists of qualifications highly needed by residential industries and companies, and helps employees stay competitive and highly demanded all their professional life long with possibility to change their work placement and job positions without being attached to the only industry or enterprise.

The model allows education and training programs and vocational qualification diversification, which factors in economic and social sustainable development of monotowns.

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