



NEW TRENDS IN TRAINING ENGINEERS IN RUSSIA

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Industry has always been the leading and the determining area of the state's economic concerns; it is the industrial sector that is aimed at covering various social and individual needs for the relevant products. This is why the state must also focus on engineering education that supplies the manufacturing sector with professional staff. In Russia, it is the state that is acknowledged as the duty-bearer for social and economic reforms and economic independence, as well as for the realization of its citizens' rights and freedoms, including the education-related ones.

In Russia, educational sector is a manageable subsystem legally controlled by the state. It has always been built up and developed directly involving various governmental managing authorities and government bodies on the basis of necessary laws and regulations.

Today, higher educational establishments are not purely state institutions anymore. If the public funding of higher educational establishments made 72% of the budgets they declared in 1997, then educational institutions had been publicly funded by 25-40% of the rated requirements by early 2000s. For all this, the state was still the largest owner of the system of education with 62.9% of the total number of higher educational establishments.

This is why, in 1990s, the sectoral institutions-based managers' and professionals' career development system was practically destroyed – the former owners of such institutions and the state itself stopped funding and managing the system, and the new owners did not feel like going in for personnel development.

Over recent years, the state has almost stopped regulating the area of continuing education, being of the opinion that enterprises' personnel development should be the employer's commitment. There are no state standards for such educational programs and they are not subject to accreditation anymore. Without any regulatory requirements or norms, due to such approach, many employers did their best to minimize their expenditures related to educating or retraining their personnel. However, the problem of interaction with the labor market that has not been solved by now to the necessary extent or with the necessary effect becomes more and more critical. [1]

The system of continuing professional education (hereinafter – “CPE”) was formed within the institutions of engineering education due to their own initiatives only: Late in 1990s – early in 2000s educating economists and managers was considered to be of highest priority and most demanded in Russia. There were certain objective preconditions for that; however, it is quite obvious now that it would be reasonable to pay necessary attention to educating engineers, as well.

Higher educational establishments came to be on unequal terms with non-state CPE structures, since the former ones had not been focused on working in market conditions and their activities had been controlled more strictly. The only opportunity to capture a market share could be the

high quality of programs offered, due to highly-experienced teachers and experts involved in them, good methodological support, and the high-level responsibility for their implementation.

It is the active, honest and fair position of higher educational establishments that has ensured building up the new mechanisms of the private-public partnership, initiated the state's attention to the CPE area, and ensured its support in totally new forms.

Political and economic stabilization and strengthening the administrative constituent of management have also taken the desired effect. A number of important legislative instruments have been adopted to support and develop higher engineering education. Such measures have been taken within the frames of federal target programs, and some Decrees of the Russian Government have also been issued with significant financial support. Strengthening the interaction was supported by even forcible, to some extent, involving higher educational establishments into implementing technological platforms, the programs of companies' innovative development, into creating local and regional innovation complexes.

In 2012, the Presidential Program of Engineering Personnel Development for Years 2012-2014 (hereinafter – the “Program”) was adopted. It became the key document indicative of the inevitability, necessity and efficiency of the parallel participation of the state, education and business in building up the professional engineering elite. The Program's implementation was by 2/3 funded by federal budget. The enterprise funded 30% of the Program costs, or 50% of budget costs, including covering the expenditures related to sending attendees to the training location. The Program structure included teaching in form of lectures and workshops (72 hours and more), end-of-course assessment, and practical training in Russia (up to 50% of attendees) and abroad (up to 30% of attendees).

Using Kazan National Research Technological University (“KNRTU”) as an example, we can talk of the fact that participation in implementing engineering personnel development programs in accordance with concentration programs has contributed to the development of the teaching staff, as well; it allowed exploring best practices at the globally leading research and education centers and industry-leading enterprises, and improving educational technology. The university teachers developed their lectures and prepared practical studies for the attendees within the Program on the basis of updated teaching methods, using various remote-teaching techniques. The Program implementation experience has demonstrated that many professors lack advanced training or retraining themselves to ensure their meeting the modern requirements of education, science, and production. This is why the university went to additional expenses and included its professors into the groups sent to practical training at Russian and foreign enterprises within the framework of the Program.

All programs – and there were 7 of them within the period of the Program implementation at KNRTU – were developed and refined in accordance with the wishes of the organizations, taking into account the requirements of the potential and actual participants of the programs, i.e. managers and engineering personnel in the real economy. At the preparatory stage, the remote interaction with manufacturers, especially with their staff training departments was organized correctly in terms of tactic.

Due to continuous communications to enterprises, we managed to achieve a system-based preparation of professionals to their basic studies; they have accumulated good practical materials for their final assessments and formulated a number of technical innovations. The customer representatives actively participated in managing teaching and learning activities, as well as in their content formation.

Teaching staff developed new resource materials that were actively used within the basic teaching and learning activities and within the system of teaching staff career development. New educational techniques approbated within the Program realization are successfully implemented in the basic teaching and learning activities, such as lectures being given by foreign project partners, including video lectures, presentations supported by audios; usage of databases provided by corporate customers and program partners; professional consulting at each stage of the program implementation, with due regard to its specialization, etc. Suggestions regarding new academic disciplines and modules have been prepared. We are working on the development of new programs to participate in similar tenders in future. A successful team of professors and organizing realizers has been built up.

During the Program implementation, enterprises appraised the university's educational, staffing and organizational potential higher, new orders for programs were created; the growth in numbers of professionals to be sent to training within the program is expected. All programs have been highly appraised for their compliance with the participating enterprises' needs for development. The programs have ensured to a significant extent the achievement of long-term agreements between the university and enterprises and other program participants, such as consulting organizations, information service providers, and practical training venues. [2]

In Russia, the KNRTU attendees had their practical training at large enterprises, such as the All-Russian Scientific Research Institute of Aviation Materials (VIAM), Federal Research & Production Center ALTAI, etc. Practical training outside Russia was organized in the well-known educational research and engineering companies in the USA, Germany and Czech Republic, such as Perdue University (West Lafayette, IN, USA), Envidatec GmbH (Hamburg, Germany), the Research Institute of Industrial Chemistry, Explosiaa.s. of the University of Pardubice (Pardubice, Czech Republic), etc.

Approaches and practices developed by the leading higher educational establishments of Russia in the course of the program implementation appear to be worth of being included into the best practices of developing new approaches in engineering education. [3] It may be no accident that the success in the Program implementation, the excellence of staff qualifications improvement, revitalizing direct partnership links among higher educational establishments and enterprises specializing in the same industries gave rise to developing by the Ministry of Education and Science of Russia a draft of the new institutional program aimed at developing engineering personnel in 2015 and beyond.

In 2010-2015, a variety of other legal regulations was adopted that are important for strengthening the continuing professional education system and for enhancing its role. Thus, early in 2015, the Russian Government approved the Conception of the Federal Target Education Development Program for Years 2016-2020. It is specially focused on the necessity of

developing the continuing adult education, as well as on the continuing professional education of professionals and managers.

The Federal Law “On Education in the Russian Federation” dated December 29, 2012 legalized the new forms of the co-operation of enterprises and higher educational establishments in CPE starting from September 1, 2013. This particularly applies to the web-based implementation of educational programs and to using e-learning and online education technology.

Developing engineering and natural science education is a visible trend of higher education in Russia. At the same time, higher educational establishments put high hopes on the measures of the State support for the co-operation of enterprises and educational organizations, secured in the Federal Law “On Industrial Policy” to become effective in June, 2015. This law formalizes in legislation the principle of integrating research, education and industry as one of the industrial policy principles. The law provides for the full financial, informational and consulting support by the state for the development of the human resources at enterprises and at organizations performing educational activities under continuing professional education programs. The development of human resources at defense industry complex organizations becomes one of the priority areas of building up and implementing the industrial policy.

The enterprises were offered the prospects of providing them with academic and scientific materials, as well as with of funding them, provided that they let establish at their premises organizations rendering educational services under continuing professional education programs in order to bring theoretical knowledge into line with practical skills and know-hows.

Lastly, Russian educational establishments are more and more active in their penetration into regional cluster models as a new form of solving the problem of training and retraining engineers. Thus, KNRTU is a founder of the Kama Regional Innovation Production Cluster specialized in oil and gas processing, petrochemistry, and automobile manufacturing. It includes dozens of the Tatarstan Republic’s enterprises. A State Program aimed at supporting the cluster for years 2013-2016 was approved by Resolution No. 624 of the Cabinet of Ministers of the Republic of Tatarstan dated September 3, 2013. The cluster represents an integral mechanism of developing the territory, in which educational establishments and research centers play a key role. [4] Due to interaction between educational centers and industrial enterprises, it becomes possible to create in enterprises a long-term demand for and an interest in innovations, and to secure both domestic and external markets.

Today, the KNRTU is a modern, powerful educational, research and production complex. It is a perfect example of a positive result obtained from combining the efforts of the state, businesses, and research and educational community aimed at improving engineering education. Among the other Russian higher educational establishment specialized in chemistry and technology, the KNRTU is the leader in training highly-competent professionals. The university infrastructure includes 32 small innovation businesses and 33 research and education centers with leading research and educational agencies of our country. The university collaborates with 111 organizations in 33 countries. An important part of its activities is continuing professional education. It is KNRTU with its CPE system that has become an outstanding example of the efficiency of public and private partnership in innovative forms.

The KNRTU experience of participating in the Presidential Program of Engineering Personnel Development allowed applying a three-tier scheme in organizing the cluster enterprises' employees development. In this case, the implementation of a professional development program includes stages, such as:

- Studying the innovation development plans of the enterprises within the cluster to develop an innovative model of the cluster enterprises' personnel professional development;
- Developing an educational program;
- Purchasing the modern training and research equipment that allows simulating technology, expected products, etc.;
- Organizing the training processes for the enterprises' employees;
- Selecting the leading educational, research or engineering center for practical training;
- Selecting the heads of practical training among teaching, scientific or engineering staff of the host company;
- Developing practical training plans and guidance materials, including writing tutorials or organizing the additional modules of lectures in practical training areas;
- Implementing practical training plans, teaching the trainees at the leading educational, research or engineering center.

Summarizing the above and mapping out the prospects of the Russian higher and continuing engineering education, we can say that today, we are faced with a difficult, but interesting period of solving the problem of assuring its high international level, using our own resources. At the same time, the system of education is faced with the new industrialization and building up the post-industrial culture in economy and in society. This will require a new level of interaction with businesses, as well as their pronounced interest in personnel and scientific developments. Russia's involvement into the post-industrial global world, in its turn, would require openness for innovations and collaboration. Solving these problems will also need the involvement of the state and various measures to support the system of education.

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