PROBLEMS AND SOLUTIONS IN ENGINEERING EDUCATION

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Abstract: There is a good basis for the development of engineering education in Russia. First of all, Russia has a large number of engineering institutions with competent teaching staff and sufficient equipment, enabling future engineers in training to obtain the necessary knowledge. But to date, Russia has a number of problems in engineering education. This paper presents possible solutions to these problems.

The past twentieth century can rightly be called a "time engineering" and "the age of engineers." The progress of science and technology has led to the flourishing of the engineering profession, has mobilized unprecedented creative forces, and at the same time, the engineers laid much of the blame for the fate of human civilization. Before obtain a present value and scope, engineer, engineering itself was difficult, historically long path of development. The price of the efforts of many generations of humanity bit by bit acquire knowledge, accumulating technical skills, preparing the ground for the germs of engineering.

Without participation of engineering shots it is impossible to submit today the operational solution of any of the complex problems, put-forward new scientific and technical and economic reality. After all the science directly connects to equipment and is embodied in projects of the difficult units, the automated lines, powerful industrial complexes, first of all, thanks to creative efforts big and various on the structure of group of engineers. Engineering activity is today a key link in a known chain "science-equipment-production", and at the same time it turned into the most mass type of highly skilled brainwork. The new equipment demands, on the one hand, qualitatively other engineering thinking directed first of all on search of optimum decisions in the field of human-machine interactions, and with another - a moral maturity of the engineering worker, ability to solve complex technical problems "humanly".

Roots of engineering activity are lost in the depth of last millennia as it is known that the human civilization is based on transformation of the natural world by means of instruments of labor, and creation of various technical means, history of their creation and emergence - at the same time is also history of engineering activity.

Each engineer of an antiquity can be called safely the scientist, the philosopher, the writer; he was "obliged" to be a leader. Though it is necessary to notice that this occupation was frequent destiny of commoners, not prestigious occupation.

Having passed a long way of formation of engineering, it is possible to allocate in this process such period, as before engineering, which chronological framework is quite wide (from the I-II millennium BC, till XVII-XVIII century of new time) where handicraftsmen were the main founders of technical innovations.
still.

Rough science and equipment development (the second half of the XIX-XX centuries) leads to that engineering activity changes literally in the eyes. Relations of engineering work, the engineer with various elements of productive forces are strengthened, the structure of an engineering profession considerably becomes complicated, the scope of engineering methods extends. Appear new and functions traditional for the engineer are filled with new sense. Today the engineer is the representative of one of the most mass professions.

Now Russia has a large number of engineering educational institutions with competent teaching personnel and the sufficient equipment that gives the chance to future engineers to receive necessary knowledge in the course of training.

In Russia for development of engineering education there is a good reserve:

1. There is a successful experience of the elite defensive technical colleges working with the defensive enterprises to order and the subsequent presentation to production to the end user (to MAI, MFTI, MVTU of Bauman, etc., in total about 70 higher education institutions). In spite of the fact that they more were guided by linear model of the innovative cycle "from science to a product", the resource of transition to other options of an innovative cycle potentially at them is high and can be strengthened thanks to the traditions of development of new knowledge developed in these higher education institutions.

2. There is a various experience of many schools of sciences which have reached world level.

3. Traditions of engineering creativity, invention, substantially, not demanded by the country as a result of a separation of several generations of the Russian engineering case from the main supplier of engineering tasks - the market are very deep. In the early eighties the USSR made to a half of opening and world inventions, overwhelming number of which had no demand at the country industry. The sense of the Soviet equivalent of concept of an innovation popular in those years "introduction" tells for itself. On many factors of the USSR in the 80th years could become an independent, self-sufficient innovative pole of the world, but for this purpose there was no understanding of opportunities of innovative economy various elite groups of the country, first of all the imperious.

4. The number of the people having various experience of research works, in Russia is still great and exceeds number of research workers in the USA: at us 4.35 thousand people on 1 million inhabitants, in the USA - 3.73 thousand. At success of innovative economy in Russia they can play an important role in deployment of innovative programs, creation of the positive innovative environment.

5. And, at last, in Russia objectively there is a demand for new engineering shots. They are necessary already operating while in limited quantity to innovative sector of the Russian economy, they are necessary for staffing of federal programs of the innovative development for the first time approved by the government of the Russian Federation in 2002.

The academic and scientific activity has no in our country of that prestige that in Europe, and the best young talents usually don't choose for themselves scientific career. Probably, this situation can be corrected by development of the strengthened preparation on mathematics and natural sciences at high school and an
intensification of fundamental preparation at universities. There is no doubt that the future of engineering becomes inevitable is connected with development of "pure" science more and more closely.

The Russian highest technical educational institutions pay much attention to design, and by means of implementation of the degree project they try to prepare the students for real practical work. The American highest technical educational institutions give to very few students in this area. In the field of designing of cars they understand very little. Many of them considered that the engineer has to prepare only sketches, and the draftsman who will choose the demanded sizes on the basis of last experience and by means of the directory has to design. The situation for the last 30 years considerably improved, but with our weak preparation at high school we won't be able to reach, apparently, that higher educational institutions in Russia have today.

The most important achievement of Russia in engineering education is the organization of preparation of engineers of new type whom we will call research engineers. This preparation is based on broad studying of such fundamental sciences, as mathematics, mechanics, and physics, for the purpose of gap elimination between "pure" and applied sciences.

The list of problems demanding solution is impressive. The first part of problems is connected with creation in Russia for the first time in its stories of the steady and successful innovative environment, overcoming within a short period of time three important psychological barriers in society and in scientific and educational communities.

1. In Russia there are no traditions to unite innovative creativity of scientists and engineers with market mechanisms, with commercial success. Still there is no effective mechanism of the personified encouragement of technical creativity, protection of intellectual property rights on results of engineering work. From all types of creative activity the engineering least status, engineers from all layers of the creative intellectuals are in the distress. The beginning of preparation of the innovative managers, new type of engineers occurs in a minimum of prestige of an engineering profession and a lot of work on a basic change of the relation of society to engineering work is required.

2. There are no traditions to work with various customers except the state which in Soviet period was guided, first of all, by political reasons. As result, in the country the whole directions of engineering creativity have no development; there are no systems of the feedback, allowing bringing corrections in created products according to requirements of end users (except for only military development). All education systems within decades worked in the conditions of 100% a state order. Transition to the market relations in preparation of the new engineering case demands development of unusual active space, will and ability. Actually higher education institutions, beginning the innovative way in education, have to change at the same time itself, i.e. will be compelled to apply art of updating, an innovation for the creative, organizational and financial development.

3. There are no traditions of lobbying of the interests in new conditions, carrying out in authorities of necessary bills, programs, decisions. First of all, there is no joint installation of scientific and educational engineering community on promotion of the idea of innovative economy, society and economy of
knowledge. All three main problems complicating innovative activity: absence of adequate legal base, the preferential taxation, effective system of the state support can be resolved in the conditions of democratic system of decision-making only through formation of the corresponding public opinion. And all interested participants have to find the place in this essentially important process of "innovative economy", including institutes of engineering education.

The second, the main, part of problems concerns actually changes in engineering education. The system of preparation of engineers as a whole in the country remained traditional, branch. Conservatism of an education system on the one hand played the positive stabilizing role last decade of reforms, having kept everything is positive that was saved up for many years, but on the other hand it didn't allow to develop internal incentives of modernization of education.

Communication with practice, with the industry and science remains weak. The remaining branch gap between education, science and production still doesn't allow using effectively the modern scientific equipment, both for researches, and for training. Long existence of engineering education under trying conditions a survival and considerable isolation brought, naturally, to inevitable processes of formation of the "education for the sake of education" installation, to emergence specific, adjusted on the internal purposes (maintenance of qualification system of reproduction and training, etc.) the high school science existing more in the information space.

Practicing of new engineering education can't be often realized because of insufficient informatization of higher education institutions, absence powerful the Internet of the centers, the electronic libraries, stable relations with foreign universities, an exchange of students, graduate students and teachers, work opportunities with the foreign innovative centers.

There are problems of teaching personnel: age, average age of teachers in higher education institutions often exceeds 50 years, and professional. The range of disciplines and training methodology in many cases should be defined still. Development of new courses and technologies of training demands new motivations, knowledge, skills of the teaching case.

The list of problems can be continued, but the most important from them, in our opinion, are: exit of higher education institutions to direct contact with the market, with production, with innovative activity, every possible development of scientific researches, and change of a paradigm of education. Entry of higher education institutions into various economic, educational, research and innovative network structures will allow solving these problems most successfully. The engineering educational community should realize usefulness of changes for the new future, to turn together with the state and different industries and business from military industrial complex and natural monopolies to banks and the small innovative enterprises a present crisis state of Russia into its innovative resource of development.

Uses of a known method of parallel planning and design, active exit in world information and innovative space can become mechanisms of achievement of the new purposes of engineering education of Russia, first of all, concentration of resources on the priority direction of preparation of innovative managers. Technical universities for achievement of the new purposes have to begin changes in two
directions with the point of view of management. On the one hand they have to become the effective organizations, i.e. community of experts in the field of educated the look, united by the uniform purpose of transformation to higher education institutions of new type. On the other hand they inevitably have to become subjects of economic activity, control with which is exercised already as the business enterprises. Thus, in higher education institutions there is a need of creation of team of "changes" operating in common from "founders" of new educational space and the "organizers" providing economic efficiency of activity of higher education institution. The state in this scheme acts not only and not so much as one of customers of shots, but, first of all, in the form of the partner, the coordinator, the inspirer and the creator of the innovative environment.

Transformation of technical colleges into active, creating "organizations" sets for them new tasks of application in the practice of the basic principles of creation new, realization of policy of changes:

1. Planned systematic improvement of all of that becomes. Changes accumulated gradually turn after a while into new quality, in this case, engineering education.

2. Use of successes in the interests for new appendices and achievement of the new purposes. This principle is especially important, in our opinion, in Russia as only visible successes in a condition to convince many of prospects of innovative economy in our country and need of changes for engineering education.

3. Initiation of changes as continuous process of training of creation of innovations and elaboration of installation that innovations can and have to be organized as systematic process.

Knowledge, production, business, education become interconnected. Universities become one of the main places of their meetings. What model of further development of Russia wouldn't be chosen: development of the national market, export of ready decisions and products on a foreign market, development of offshore programming and innovative activity, a core of any of them can be only coordinated actions of education, science, the industry and business for the sake of economic success.

For engineering education there came time of changes. The time of concentration of efforts of the state, business and society came to creation of effective prestigious engineering education. The time of address financial, moral and legal aid for education of future generations of engineering shots of arising innovative economy of Russia came. It will be that new "carpet" of competition on which Russia has chances to win victories. Creative victories, personal and command.

To turn knowledge into a source of successful development of the country becomes the main objective of new engineering education of Russia.

5. Morozov V.V., Nikolayenko V.I. HISTORY of ENGINEERING ACTIVITY.