

The role of leading classical universities in engineering education development

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The paper is focused on the role of leading classical universities, sponsored by the government, in the development of engineering education in Russia. The possibility of successful engineering training in a classical university is justified by fundamental and interdisciplinary nature of education provided, appropriate training facilities which have been renovated due to the state aid. The universities can establish innovative business associations in cooperation with industrial enterprises. Such business associations could provide students with internship and future work places, as well as they could contribute to the increase of new industrial capacity.

Key words: *engineering education, innovation activity, educational cluster.*



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The last 20 years were full of problems for engineering education of Russia. Production decline, reducing number of businesses and low wages at still operating enterprises, declining prestige of engineering profession, uneven development of industry in different areas and region, dramatic decline of relative teachers' wages, obsolescence of facilities at universities – all this factors predetermined decrease in the quality of training of engineers in our country. Today, the list of the problems has been added by challenges associated with the transition to a two-tiered education system and changes in universities admission procedures based on the results of the unified state exam. All above mentioned and other problems of engineering education are well known and have been repeatedly discussed at meetings, conferences and seminars with participation of Association for Engineering Education of Russia

[1]. From my point of view it becomes more important to search for ways how to improve the quality of engineers under the given circumstances. It should be noted that recently there have been positive developments and changes in the attitude of government towards engineering education.

According to the Order dated 18.05.2011, № 1657 on a large number of training areas in the field of engineering and technology graduates will be awarded degree diplomas with the degree of «bachelor-engineer» or «master-engineer». Governmental Decree № 1944-r approved a list of training areas that meet the priorities of modernization and technological development of the Russian economy. In 2012 students of educational programs in these areas could be appointed on a competitive for a special scholarship of President of the Russian Federation. Lately several presidential, governmental and corpo-

rate contests for universities (that implement innovative educational programs for the status of «national research university» or are engaged in innovation and commercialization process) were held according to the regulations of the Government № 218-220, ROSNANO corporation and Skolkovo Innovation Centre regulations. Implementation of innovative projects, commercialization of intellectual property rights is impossible without an engineering component. Thus, the state creates an opportunity for leading universities to modernize the methodology, content and facilities for engineering education. And what role should classical universities play in this situation? For decades, engineers were trained at technical and technological universities, although many classical university graduates were successful in engineering. There was a fixed system of training, with its own methodology and established links with industry.

Today it is required to develop new competencies to train advanced professional engineers. We live in a time of great change, when a new dominant technological system of the world economy as a base for nanotechnology is emerging. According to a universally shared definition for nanotechnology it is a broad and interdisciplinary field. In addition, development of Nano systems, Nano materials, and solution of Nano engineering problems requires fundamental knowledge in physics and chemistry of atomic structures, quantum-mechanics description of phenomena at the atomic level. It is easier to provide training of such specialists at classical universities, where there is a long tradition of fundamental training in physics and chemistry, there are academic schools, and subdivisions of related disciplines: mathematics, biology, computer science. Availability of humanities schools would assure high quality of students' social skills. There should not be any difficulty to create interdisciplinary teams and structures within a multidisciplinary university to solve educational, research and innovative problems. For example, one of the

first Russian educational and research institutes of nanostructures and biological systems was established in Saratov University [2]. This institute brought together physicists, nanotechnologists, mathematicians, chemists, biologists, physicians, programmers. Students of Electronics and Nano electronics department, Materials Science department, Chemical Engineering department, Bio-medical Engineering department had an opportunity to undergo practical training in interdisciplinary laboratories, take part in solving real tasks of the Institute.

Another area, where classical universities could contribute to the development of engineering education is connected with the capacity of federal and research universities to invest in modern equipment and start up business entities together with industry. Training of engineers is impossible without collaboration with industry. But unfortunately today industry is uneven resented in our regions. There is almost any shipbuilding, aircraft building, mechanical engineering, engineering tools industry in Saratov region. And electronics industry enterprises have reduced 10 times the number of employees and their equipment has become obsolete. What way out of the situation could be suggested? The solution could be found in cooperation of university and industry in creating business entities. Companies have enough area, energy resources, engineering services and qualified personnel. National research universities have scientific and innovative potential and moreover funds to purchase modern equipment. Thus, a unique environment is developing: together with existing businesses new «industrial shoots» are developed. Two problems can be solved at once: industry is developed and a base for training professional who will develop it further is created.

Special features of this partnership between leading universities and industry are as follows. Through joint establishment of new businesses or otherwise enterprise get access to high-tech equipment. Availability of such equipment opens up opportunities for enterprises

to develop and produce world level products (goods), and therefore, apply for funding from state corporations. Receipt of government defense contracts, sale of high technology products provides enterprises with an opportunity to renew and universities with additional funds for research and development and improvement of new technologies and products. Thus, within 4-6 years after the process was started a company could update its range of products, material and technical resources, reach a new level of profitability, and a university could receive funds to cover the cost of purchased equipment and ensure further development.

One of the examples of such cooperation is the establishment of new small business company Ltd Conversiya by joint efforts of Saratov University and JSC NPP Contact.

The company's main field of activity is connected with development and production acoustoelectric microwave devices: radio-frequency identification tags, filters, resonators, delay lines and sensors of physical quantities on the

surface and bulk acoustic waves. The company uses under lease equipment purchased by the university (coating equipment, electron lithography, clean room) to the tune of 150 million rubles. The company has provided a platform and services. The company became a base for creating department of micro- and Nano electronics, which provides students trained in the field of electronics and Nano electronics an opportunity for hand-on labs and project learning. Use of equipment (coating equipment) has allowed the company to sign in 2011 contracts worth around 40 million rubles. In 2012 when the company will work at its full capacity it is supposed to reach the contracting level at about 80 million rubles.

Thus, the leading classical universities on the one hand may become a germ of new businesses and provide cooperation with industry for development of engineering education and on the other hand due to the fundamental and interdisciplinary education to train engineers for the new modern fields such as nanotechnology.

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