

The Current State of Engineering Education. A View from the Region

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The article deals with the key problems of higher engineering education system at the regional level. The ways of their solution are discussed.

Key words: *engineering education, education modernization.*

The North-East of the Russian Federation (the Republic Sakha (Yakutia), Kamchatka Krai, Sakhalin Oblast, Chukot Autonomous Area) is referred to rapidly developing regions of Russia. Strategic significance of this region for Russia grows repeatedly due to the economical, demographic, and political processes taking place intensively in the world and in the adjacent areas in particular.

According to the complex scheme of production force, transport and engineering development and distribution of Republic Sakha (Yakutia) the economic development is aimed at its diversification, formation and development of recycling production, development of regional fuel engineering complex up to national scale in the Far East of Russia and international scale in the whole North-East of Asia till 2020 [1].

One of the ways, currently accepted as a perspective one, is intensification in integration of higher educational institutions into the region activity on the territory of which they are located. In other words, training students is to become advanced to implement modernization and engineering development of the real regional economics. Therefore, the role and significance of engineering education system increase in particular as a power of innovation economic national system in Russia.

The head university training specialists for North-East region of Russia

is the North-Eastern Federal University named after M.K. Ammosov (NEFU), where more than 22 thousand students are trained. The part of engineering specialties amounts 30%, there is a growth of students' number in engineering profiles, new specialties and profiles were opened within the last 3 years: petroleum engineering, chemical engineering, land management and register. Realization of 11 consolidated profile groups (CPG) in engineering training shows the regional peculiarities, namely, demand for engineers of construction and mining-geological industries (Fig. 1).

The NEFU development program of 2010-2019 with financial plan adoption for 5 years (1 billion per year) has provided the new conditions and perspectives for the university itself. Much has been done by now: there appeared new departments, Arctic innovation center (AIC) was established, 12 small innovative enterprises were set up, and the research-training infrastructure is being sufficiently modernized.

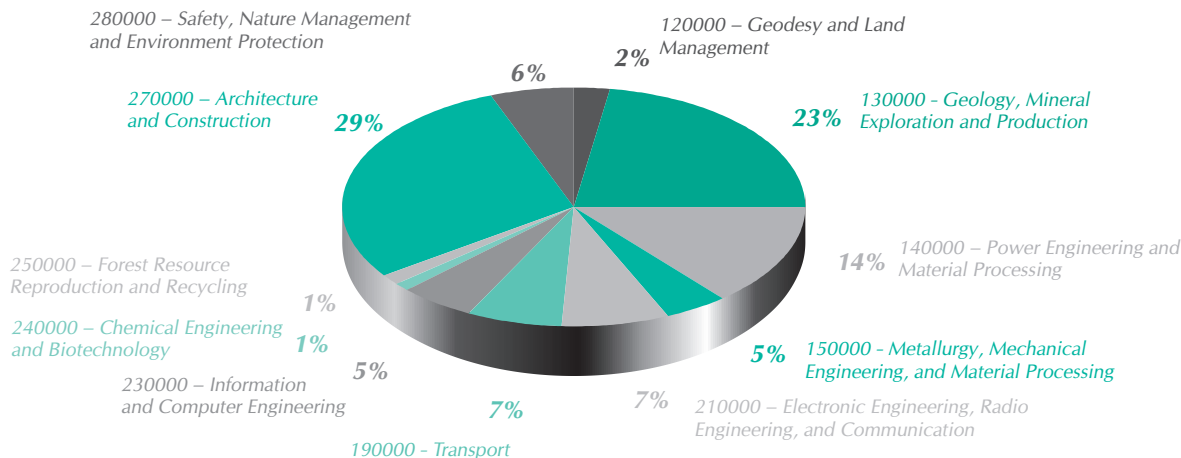
In the course of strategic tasks the direction «Modernization in Content and Organization of Training Process with Regard to International Tendencies in Development of Education Techniques and Technologies» is defined as a condition for providing education quality, allowing the graduates to be competitive



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Fig. 1. The relationship of the Students' Share in CPG as of 31.12. 2011


in the modern labour market in social sphere.

Solution of the given problem is directly connected with the adoption of two-level training by the university. Much has been done, transformations were introduced into university management, material-technical, and financial systems. However one cannot be satisfied with the achievements. The transition into two-level education system is connected with the necessity of taking into account some important factors.

Firstly, management and teaching staff readiness for development of conditions for transition of training departments to level education.

Changes in organization of educational process is revealed in the fact that the main thing becomes students' choice – the choice of curriculum, sequence in studying subjects, selective courses, lecturers, development of individual syllabus. Hence, the task of university is to provide such a choice. Such an approach allows student to choose the level of proficiency that corresponds at the moment to his (her) wish, possibilities and skills.

In fact, the tasks of reorganization are complicated and strongly influenced by external factors, archaic principles and the future is too vague to make global programs too efficient. Today engineering education is developing in the condition of out-of-date methodical and

academic base, educational structure and content insufficient for its stage-by-stage integration into the international education space.

When developing basic curricula on the basis of FSES, it is necessary to use the principle of «passing through modules» consisting of choosing a number of modules for every curriculum (profiles included in CPG) determined as constituents for achieving one of the generalized goals of training in education program as a whole and providing the formation of both general and professional competencies. Curricula are necessary to be developed on the principle of credit-module system; in this case a module can include subjects from different courses of natural sciences, general professional disciplines the content of which is to correspond to the goals and tasks of the module. Such an approach is aimed at establishment of correct logic sequence in studying disciplines, interdisciplinary links and opportunity to respond quickly to the changes forming more specific and rigorous requirements to engineering university graduate.

Secondly, scientific researches are to form the bases for generation of new ideas and their transfer to educational process and economics of the region via innovative activity. Nowadays, researches are often aimed at formal increase in university academic and accreditation

indexes, first of all, the number of dissertation defenses and publications.

Primarily, only in case of arranging profound scientific training through Master course one could train elite engineers, highly-qualified technicians and managers, encouraging and motivating the training of scientific-pedagogical human resource through post-graduate and doctoral courses. Research activity in university is to have clear structure and distinct system of management. It is necessary to abandon the fragmentation of scientific research, reduction to department-scale in favor of integration of research trends and scales, one should enable the development of interdisciplinary and multidiscipline researches. Of particular importance is also team use of unique and expensive equipment in training masters and post-graduates.

Of great use is to develop basic research laboratories that will become an effective link in the technological chain of receiving the newest scientific knowledge by the students in combination with involvement in real research, on the one hand, and a true foundation for efficient innovation activity, on the other hand.

The reference point in the sphere of scientific research is to become Priority trends in modernization and engineering development of Russia; Priority trends of science, technology and engineering in the Russian Federation approved by RF President on 21, May 2006, № Пп-843; Critical technologies of RF, the list of which was approved by RF President on 21, May 2006, № Пп-842 [2].

In this case one needs to create efficient mechanisms of interaction with academic science and real economic sector of the region. We realize that contemporary research should form opportunities for additional fund raising in university.

Under the condition of absence of legislative and financial mechanisms for encouragement of universities' innovative activity, stimulation and preference system for attraction of private investments to establish small innovative enterprises, to introduce new technolo-

gies into current production, commercialization of research results a regional university has to be a centre of business, society, state communication in questions of forecasting scientific development, investigation of world technological market, solution of global problems. To perform the innovation activity special groups should be formed (for example, as a part of NEFU Arctic Innovation Center) that are directly engaged in research of engineering development, scientific-technological forecasting, are the resource centers for enterprises and companies of the given region performing consulting and informative-analytical activity etc.

Thirdly, a distinctive feature of regional universities has been a practice-oriented direction in students' training. Today engineering training is performed at insufficient participation of employers without efficient practical training at base regional plants, legislative and financial problems of regional university and plant interaction are not solved. Current curricula are not sufficiently adapted to the conditions of market relation and not always make possible for students to have efficient practical training. According to employers' estimation, if the level of students' theoretical training is estimated comparably higher, then poor graduates' practice orientation cannot satisfy them.

It is necessary to bring into accordance the content and structure of professional education and labour market demands. In particular, one should improve sufficiently the practice arrangement and content, enhance the practical orientation, involve leading specialists and managers into classes, organize and conduct practical classes at the enterprises of different property forms.

It its turn, the sphere of professional training has always additionally required academic, laboratory and supplemental facilities. It is necessary to involve industrial plants, research institutions, experimental workshops into educational activity on the basis of private-state partnership, to establish design bureaus, special technology development economic zones, training-experimental plots, remote

laboratories etc, introduce the network of educational program performance.

Along with increasing requirements for graduates' competencies a number of principle problems are posed the essence of which consists in contradiction between the necessity in sufficient growth of graduates' knowledge, skill and competence level and ambiguity in methods and means for reaching this level [3]. For example, lecturers' qualification upgrade or students' practical training by means of their internship at construction enterprises allows them to find their positions in terms of employers' requirements and opportunity to learn new equipment and tools which they are going to work with. But nearly entire material-technical base of construction industry is in stagnation and requires sufficient modernization and adaptation to modern economic market and new tendencies itself. In this case the speech is about modernization, perspectives, advanced training of personnel. Today this issue needs to be specially considered as modern engineer cannot be trained without appropriate facilities.

There is no governmental regulation obliging employers of enterprises, companies, institutions, private firms to take students for internship, to provide them with work places and rights equal to members of work team, to perform mentorship. At present, not all employers are interested in arrangement of internship at their companies since this responsibility requires additional resources, time for management and mentorship, resources which are limited for enterprise. There is no purpose governmental funding for this sphere of employers' activity.

Hence, assessment of internship results can allow for evaluation of students' competence development, but only in case if the internship itself is performed at the appropriate level: correctly selected practice base, qualifies specialists work as consultants from university and enterprise, students themselves work at up-to-date equipment and are involved in true projects.

One of the serious problems connected with changes in the labour market

is a threat of graduates' unemployment or work not within their specialty. Graduates like young specialists appear to be one of the most vulnerable population group in social aspect, apparently without relative governmental support, legislative mechanisms of social support for a young specialist, the problem cannot be solved by only one university. Nevertheless, the problem of employers' involvement into graduates employment activity and their adaptation at production has become one of the highest priorities for universities. For example, to assist in graduates' employment, encourage career planning and development; arrange students' temporary employments the Career Center of NEFU was established, the vacancy fairs are held. Nevertheless, enterprises and companies are poorly involved in this sphere as economic conditions for their participation are absent. It is necessary to organize perspective cooperation of university with enterprises and plants interested in graduates. Under these conditions one should create special structures within the universities that are to be purposely engaged in employment, under the condition of market relation the new approaches and economical means for solution of problem in their stimulation (funding) are required in this case. Today the responsibility in employment assistance is an extra-job for the workers of graduate departments, not included in the load and because of this performed without necessary planning and not efficiently.

In the course of this activity it is useful for universities to learn to forecast the demand for specialists of this or that profile at both short-term and long-term scale and to respond to it by changes in curricula and syllabuses.

Fourthly, extended education in universities is often centrally managed resulting in isolation from production and consumption demands, becoming less attractive from the point of view of business investments. It is mostly expressed in professional engineering education. It is typical for it the absence of efficient stable direct and reversed feedbacks with production enterprises, absence of

industrial units' interest in the system of extended education. At present extended education being an important part of continuous education is intended to respond to new requirements of regional economics, growing demands of society for qualification and professional training rapidly and efficiently. First of all, development of extended professional education system would promote the creation and operation of engineers' certification system. The mass training and re-training of qualified engineers and technicians is necessary via the system of extended education, first of all, via synergetic partnership with industrial companies [4]. One needs to increase the attractiveness of extended education for labour market, correspondence of content and quality of educational services to the industrial requirements. Besides, it is essential to involve leading regional industrial plants into training process using their production and innovation potential and in cooperation to establish industrial centers, engineering certification systems.

Fifthly, a serious problem remains in absence of developed systematic task-oriented work with gifted children and talented youth to prepare them for entering engineering departments. A rather heterogeneous cover of schoolchildren with extended curricula should be noted. In rural areas its complete absence is observed. In this situation it is necessary to use advantages of regional university in closeness to entrants, efficient mechanisms of bright school-leavers' selection as well as opportunities of research and specialized educational institutions such as physical-mathematical forum «Lenskiy Krai», Small Engineering Academy. In NEFU the system of network communication with educational institutions of Far-Eastern Federal District is being formed. One of the forms of network cooperation is association «North-Eastern University Educational District» that incorporates 56 training institutions of different types in the Republic Sakha (Yakutia), Magadan Oblast, Sakhalin Oblast, Chukot Autonomous Area. A union of university, schools, professional education institutions permits, on the

one hand, openness, accessibility and variability of education both in republic and in the whole region, succession of secondary and higher education.

Finally, in terms of new economical relations, humanity and flexibility of education system it is required to introduce some corrections into conceptual principles of education system, lecturer's attitude to a student. To develop conceptual principles it is necessary to take into account the economic approach, to involve students and their parents, employers into educational process as consumers, clients. Now a student is transformed from «raw material» into «consumer», from an object into subject of training, becomes a participator of training process formation.

Administrative approach to the education quality in the course of which the quality was defined by examination session results as a level of student's standard proficiency, but those who did not pass exams were sent down without mercy from university has become outdated. Following the real economic sector we must realize that new economical approaches towards education, quality management meeting the demand are required in this condition.

The created situation in the sphere of engineering education has shown the necessity in system to surmount the negative phenomena, principal organizational transformations in the structure of engineering education, enhancement in specialists' training quality in accordance with contemporary social-economical conditions of RF North-East development, requirements of the integrated world educational community and advanced experience of highly-developed countries.

The current problems of engineering education require integrated solution. We see the solution of the problem just in conceptual program development of regional engineering education system. In its development and performance, defining its general strategy, key directions, priorities and tasks universities, authorities, and businesses of the region are to participate.

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