

# **ENGINEERING PERSONNEL TRAINING THROUGH THE EXAMPLE OF VOLGA STATE UNIVERSITY OF TECHNOLOGY, MARI EL, RUSSIA**

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*The paper reveals priorities and problems of engineering personnel training through the example of Volga State University of Technology, Mari El, Russia. The article presents the following issues: dynamics of its innovative development, interaction between the university and employers, realization of strategic development programs, innovative infrastructure expansion, increase in activity of scientific students' societies, creation of interregional resource and unique centres of shared use. On the basis of monitoring, social research of graduates-engineers and employers interviewing, we summarized experience in the field of interaction between students' science and manufacture, elicited the reasons for imbalance of the regional labour market and the market of educational services. The paper determines new dimensions of cooperation between the university and enterprises, including the international level.*

*Key words: Engineer, Science, Manufacture, Student, Higher education institution, Innovative methods of training*

## **INTRODUCTION**

Engineering personnel in conditions of the market economy plays the key role in workforce productivity. Over the last years, in the context of world financial crisis and economic sanctions the Russian Federation has been facing serious problems in such leading economic sectors as industry, civil engineering and agriculture. Taking this into account, the president of the country V.V. Putin in his article "Formation of justice. Social policy for Russia" thoroughly revealed the role of specialists in the social: "An engineer, an agriculturist, an economist, a designer – each of these professionals must have a possibility not only to get occupational work, but built his professional career. It means the ability to upgrade skills constantly and learn new applied technologies." [02].

At all times regardless of geographical position and regime of any state, in all the time and era, regardless of geography and public, a citizen with engineering education has been always in demand at the labour market. Scientific papers of many foreign and Russian scientists were de-

voted to this problem. According to the famous German physicist A. Einstein: "Scientists study already existing things; engineers create things that have never existed before"[03]. A British public leader M. Thatcher believed that "An engineer is a person who can explain how this or that device works..." [04]. Labour Organization pays close attention to the issues of professional personnel training: "an expression "vocational and technical education" means theoretical and practical training that has take place at schools with the view of vocational education" [05].

## **RESEARCH RESULTS**

A retrospective analysis of the engineering personnel training in the Republic of Mari El shows that the source of manpower is Volga State Technical University. Its main mission: "An engineer lives in every person". According to the head of VSTU E.M. Romanov, "Connection of education with real manufacture is an important step for the economy strengthening"[06].

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The university has greatly evolved: if in the period of its creation (Volga Forestry Institute) it trained engineering personnel only for the timber processing complex, during 1960-1980th (Mari Polytechnic Institute named after A.M. Gorky) it expanded a number of professions: civil engineers, mechanics, radio engineers and others. Starting from 2012 (Volga State University of Technology), at the stage of transition to the innovative economy, engineering personnel training for industrial, building and agricultural complexes has become more profound. This points to the fact that not only the names of the university underwent changes, but the education system in a

part of engineering personnel training as well. In that regard we rally the opinion of мнение Tale Geramitcioski that “The education system is the key factor that should establish a solid structure and organization to enable its functional connection with the labour market” [07].

A monitoring survey showed that within the 3 last years the university saw an increase in graduates (bachelors and specialists) of engineering professions (figure1).

In view of majors, most of specialists are the engineers of forestry, construction and information technologies, who are much-in-demand at the regional labour market (Figure 2).

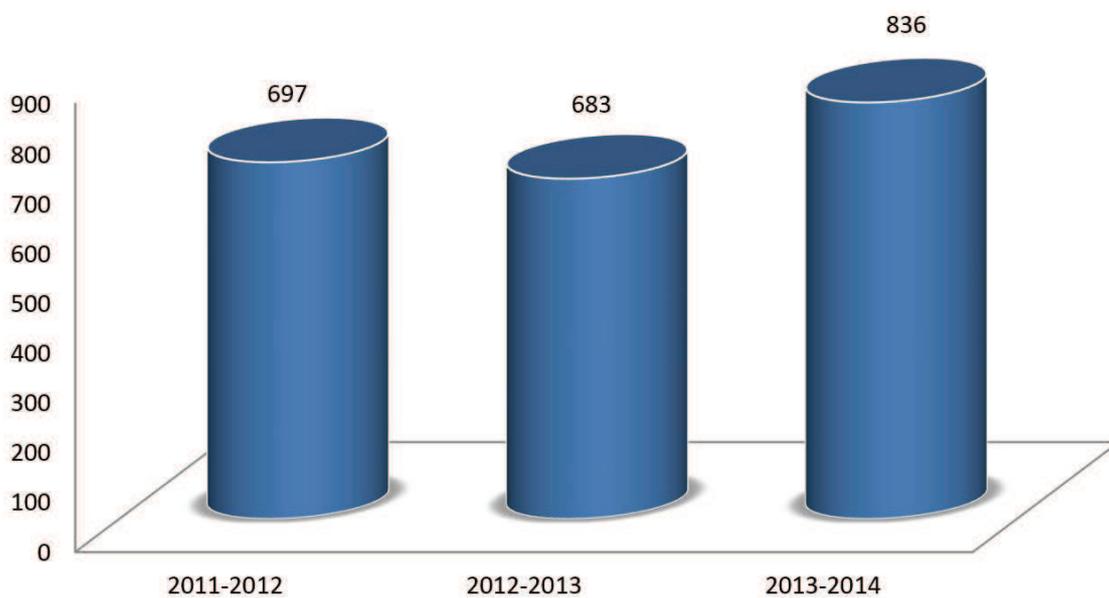


Figure 1: Dynamics of the training of engineers at VSTU (number of people).

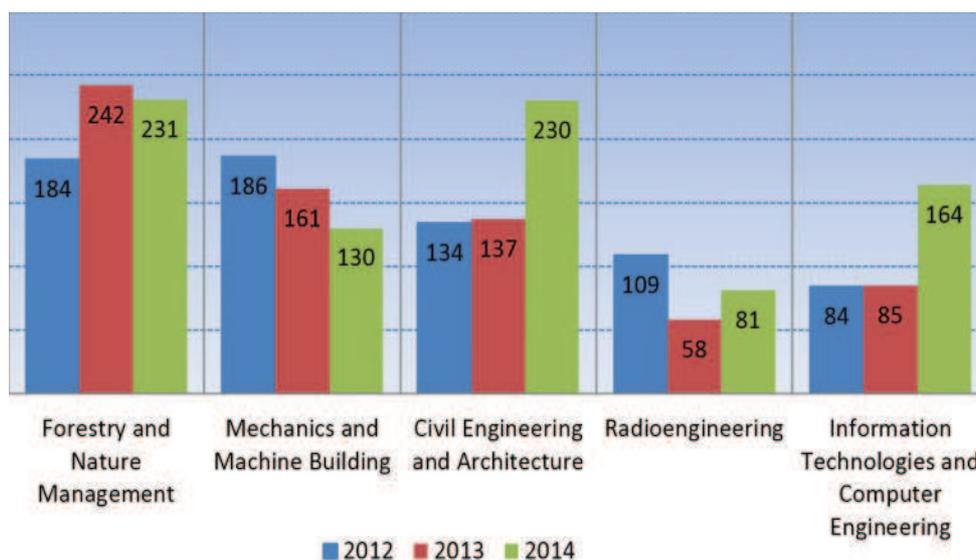


Figure 2: Grading of actual number of graduates-engineers according to majors (number of people)

However, according to the research, there still exist employment problems even in view of positive dynamics of personnel training. In addition, according to the author's sociological research and the students' opinion, the main reasons for this are: low wages (48,8%), remoteness of the work place from the place of residence (18,7%), inconformity with employers' demands (9,3%), lack of occupational work places (23,2%) (figure3).

According to employers (interviewing), the main problems in the training of engineering personnel are:

- lack of organizational mechanisms which allow educational institutions interacting with employers regarding to the prognosis of personnel demands;

- lack of the state order for specialists training in compliance with labour market demands;
- lagging of material- technical and practical training bases of educational institutions from demands of modern highly technological manufacture;
- lack of due motivation of young people to get engineering professions;
- unfavourable demographic situation in the period from 2001 till 2015 led to the reduction of the school leavers number for 30% (Figure 4)

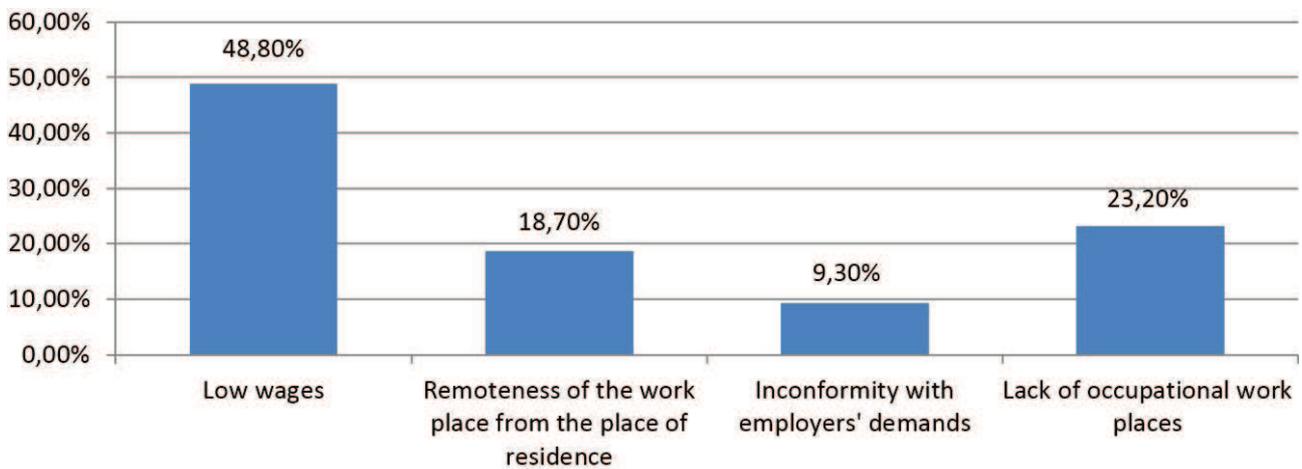


Figure 3: Grading of opinion of VSTU graduates-engineers about the problems of employment

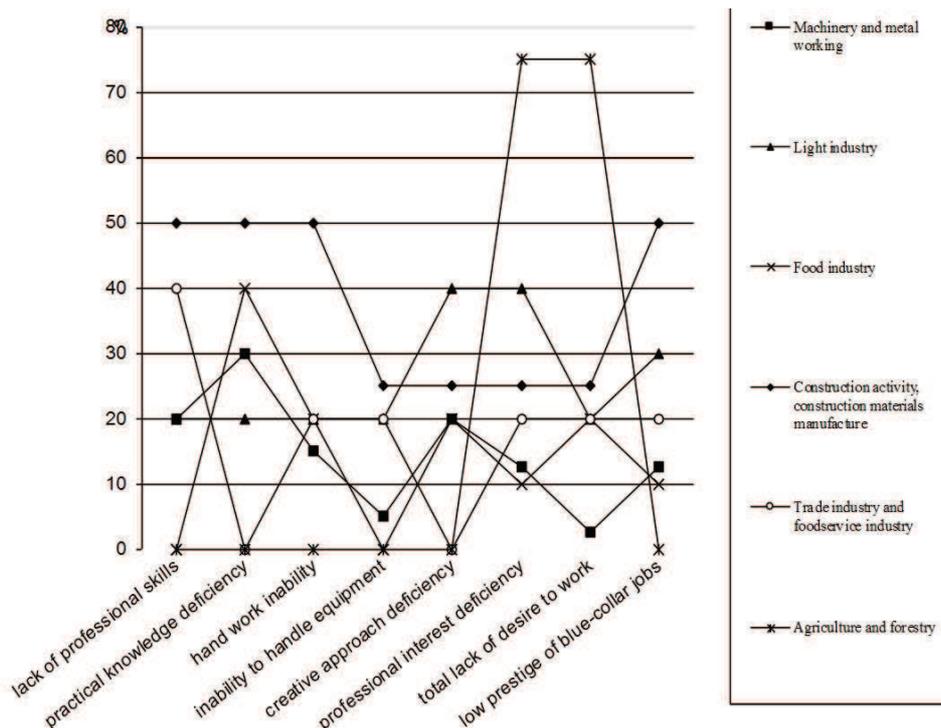


Figure 4: Grading of employers' opinion about the training of engineering personnel

Taking into account these facts, Volga State Technical University has taken a course toward high quality training of specialists and increase of labour motivation (and this is the most important thing) rather than toward positive dynamics of the students' number. For these purposes there appeared a lot of innovative methods of training:

**DEVELOPMENT OF SCIENTIFIC-RESEARCH WORK AMONG STUDENTS**

The university has powerful scientific potential that includes 9 research-educational centers on the base of scientific schools, technological park, business incubator, students' construction department, 7 laboratories open in consort with institutions of Russian Academy of Sciences and Russian academy of Agricultural Sciences, 25 small-scale innovative enterprises, botanic garden-institute, scientific-experimental forestry station. VSTU possesses 86% of all objects of intellectual property in the Republic of Mari El which takes the leading position in this sphere in Volga Federal District.

Small-scale innovative enterprises (SIE) are the prototypes of streamlined production works. Every second work place in SIE is occupied by students that is a good base for scientific activity and work practice. One of the examples of practical significance of SIE is that almost all protective coverings for metal dental prostheses in Mari El are laid at the enterprise "Examples of practical importance for the Republic of SIE consists in the fact that almost all of the protective coatings on metal dentures in Mari El are applied in the enterprise "Poisk-MarSTU". Besides, it manufactures vacuum installations for application of

extra fine film coatings for the clients not only from Yoshkar-Ola, but from Saint-Petersburg, Kazan, Perm and others as well. Another SIE, "Vozrozhdenie", produces drying chambers for wood material, more than 80 of which are installed at the wood processing plants of the country.

We can see development of innovative infrastructure of the university, a start-up of the business incubator, an organized work of 9 business offices for high technological economy sector, small and medium business. It should be also noted the development of scientific students' laboratories "Mechatronic systems", "Laboratory of non-destructive control", "Laboratory of off-road means of transport".

A great role in the development of the scientific-research work belongs to research and practice conferences at international, all-Russian and intramural levels. For example, in 2014 the university organized 28 scientific students' conferences, VSTU students made 2488 reports and published 1851 scientific papers, 9 of which were edited abroad. In order to involve school students into the scientific-research work, starting from 2012 the university annually organizes youth forum "My first step in science". Most works are devoted to the forestry and wood processing industry, economy and agriculture. The main scientific fields of publication activity are presented on the figure 5.

Scientific activity of students, postgraduates and young scientists of the university is increased through their participation in the grant program P.Y.S.I.C (participant of the youth scientific innovative contest). According to the total number of winners in 2014, VSTU joined the ranks of the best Russian universities.

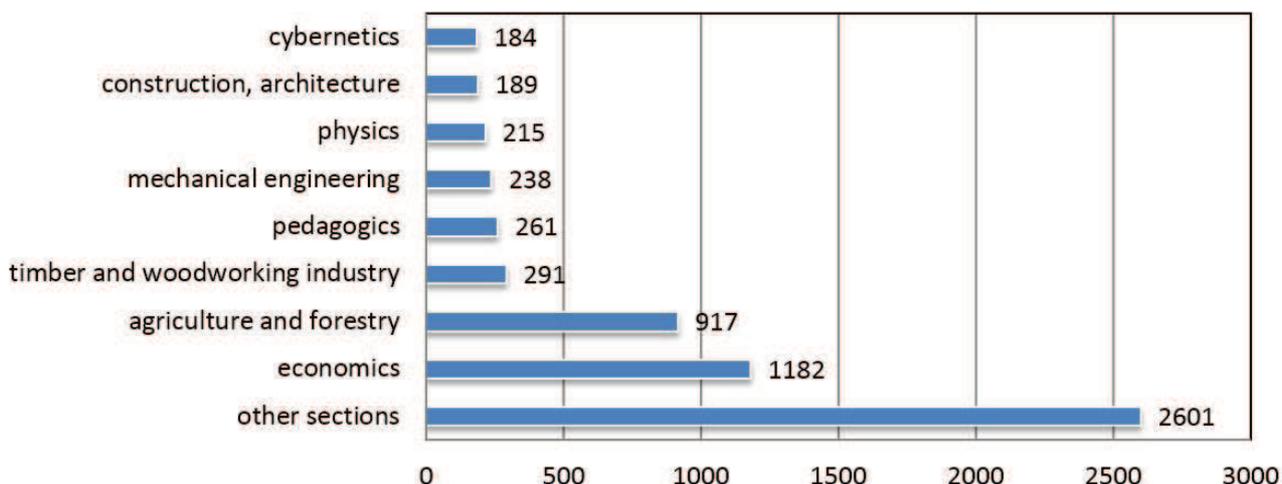


Figure 5: Fields of concern of students' scientific papers [08]

More than 200 projects became winners during the whole period of the program's existence.

The university pays close attention to the patent activity within the framework of a specially created structural subdivision "intellectual property and publication activity". In 2014 there were made 154 applications to the objects of intellectual property, including 104 patents, 65 of them are co-authored by students [08].

During the year of 2024 more than 230 projects were presented to the grant contests, every 5 of which (41 grants) won (figure 6).

All these factors contribute to the overall development of the innovation infrastructure of the university as an integral part of the engineering personnel training. Monitoring of the university performance showed that its scientific-research

activity is three times higher than the threshold value (154,81 vs 51,28), international activity - 3,7 times ( 3,68 vs 1,0). Moreover, the university exceeded the threshold value in educational activity (62,3 vs 60,0), financial and economic activity (1750,85 vs 1327,57) and employment (99,437 v 98,705) (Figure 7).

### CONNECTION WITH THE INDUSTRIAL SECTOR

This year the university will celebrate 10 years anniversary of the beginning of its strategic co-operation with the machine-building plant. This city-forming enterprise manufactures commercially viable products of the international level. At the plant there are affiliates of three university's departments (radio engineering and communication, information security of automated systems, machine-building and materials science).

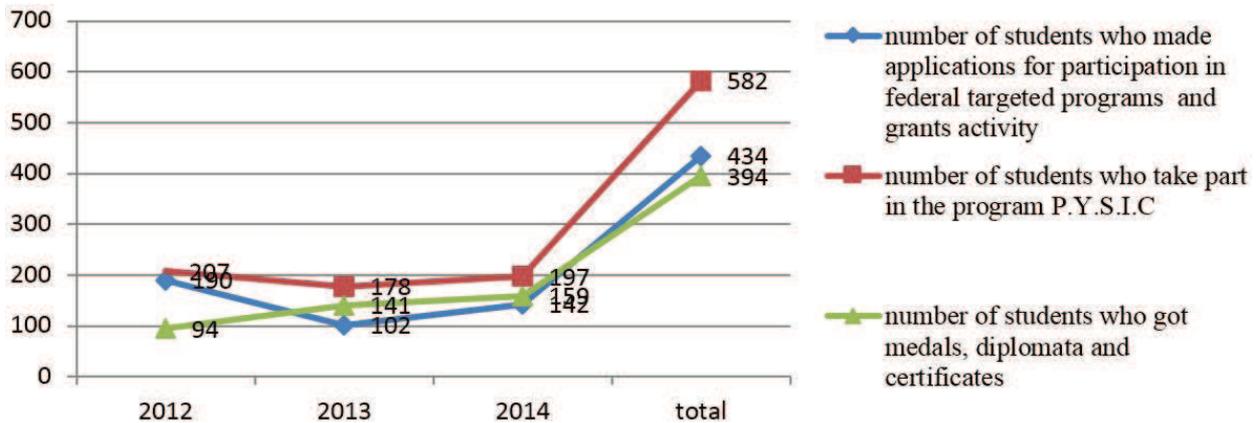


Figure 6: Dynamics of students' participation in research activity

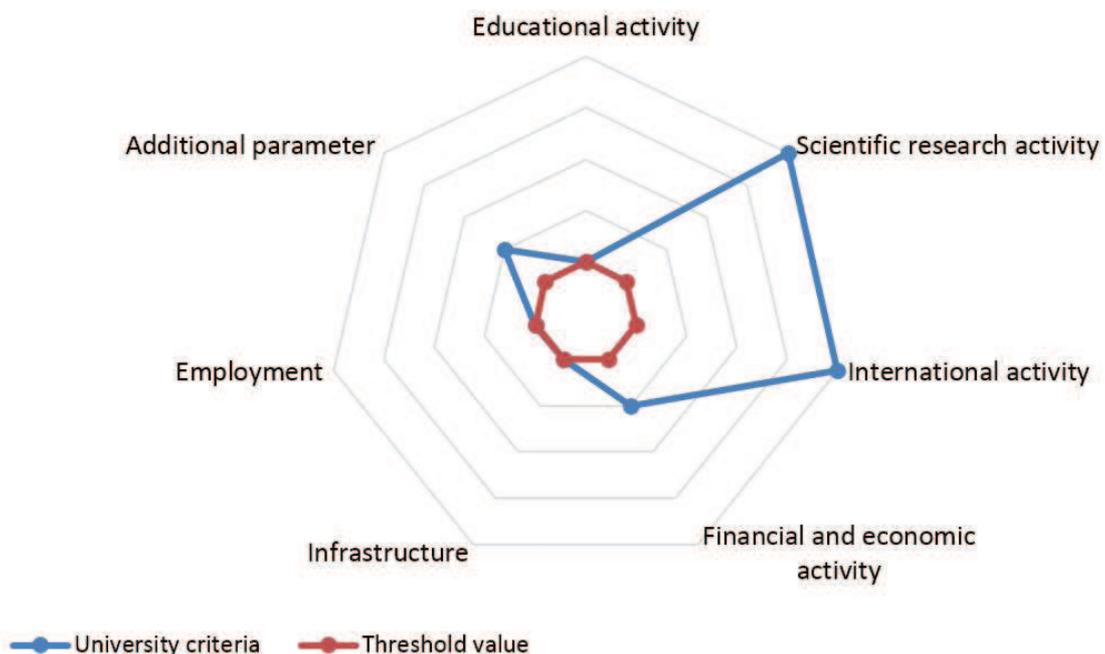


Figure 7: Results of monitoring of the university activity efficiency

There exists a practice of dual education: every year up to 80 undergraduates, combining work at the plant and studies, get practical experience and apply their knowledge in the process of real manufacture. As the result the plant created a unique Centre of radio-locating system and complexes which solves several tasks:

- A) Combination of scientific achievements and potential with manufacturing process makes it possible to integrate the activity of already existing and newly created structural subdivisions of the university on the base of the plant, that in its provides necessary infrastructure for the personnel training program. At the same time it is expected not only to apply unique educational programs for profound personnel training, but to train interdisciplinary multi-purpose teams for solving practical production problems. In total this centre creates possibilities for extensive use of laboratories and industrial base in the training process, conduction of mutual scientific-research and design and experimental activity under the conditions of real production.
- B) Training of highly qualified engineering personnel makes use of all the scientific-research potential of the university. Apart from three VSTU affiliates which operate on the plant there are such structures as the centre of automated mechanical engineering, the centre of engineering and industrial design "Bioenergy", students' construction department. There is also a college called "Politechnich" where more than 700 students are trained to get blue-collar jobs.
- C) Graduates of the university are employed at enterprises. Being taught by the centre program, students expand motivation for demonstration of their best qualities, application of their knowledge at production site. Even today students study in the first part of

the day at the plant, and in the afternoon they continue their studies at the university. The system of dual education is used with regard to the German experience. During university days students are involved into solving of up-to-date production tasks. At the same time an employer can reasonably evaluate students' knowledge and its application in practice. The main thing is that the prestige of engineering professions grows and outflows of talented young people decrease. More than 75% of engineering personnel of at the plant are VSTU graduates. Only for the last 5 year at the plant there were created 354 work places for these graduates. (figure 4).

A demonstrative example of fixing of graduates at enterprises is LLC "Technotech", which is the only enterprise in Russia where there is a unique engineering group consisting for 95% of "Volgatch" graduates.

### CONNECTION WITH THE REAL SECTOR OF ECONOMY

For these purposes in the university there were created three new large structures: Institute of mechanics and machine building, Institute of forestry and nature management, Institute of civil engineering and architecture. Formation of these institutes is a well-planned, balanced decision focused on maximal approaching of our education and science to the real manufacture. Every new institution is closely connected with a particular economic sector. Their aim is to become the main source of manpower. It will give an option to increase the contribution to the innovative development of the republic and the whole country [06].

In our opinion, creation of these institutes and resources concentration will encourage strengthening of relations between higher education and real manufacture.

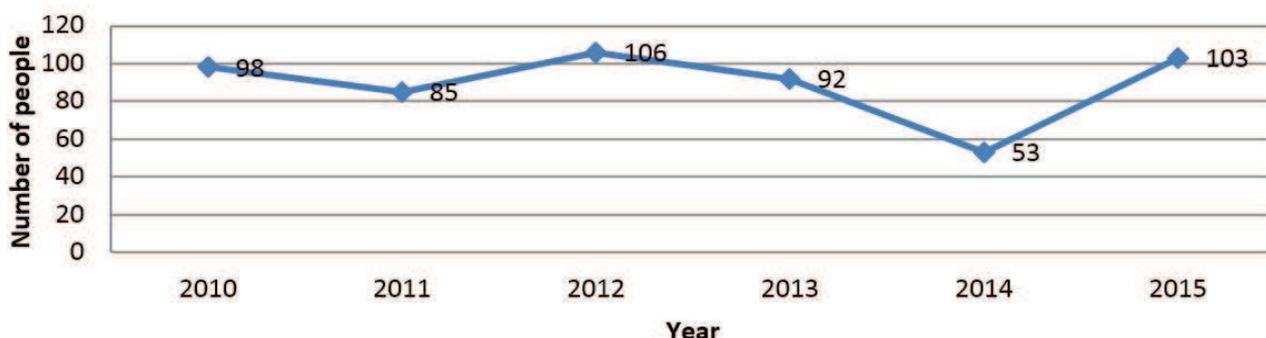


Figure 8: Dynamics of graduates-engineers employment at the factory

As a result there will be more possibilities for implementation of academic knowledge into practice according to the principle of a closed ring. Getting education and taking part in scientific-research work, students come to the enterprise and realize their ideas; that causes orders from enterprises to the university. Thus, the ring which includes education, science and manufacture is closed. According to the Head of the Republic of Mari El L.I. Markelov, "A lot of our enterprises literally stand in a queue for highly qualified specialists". The training of such personnel is a specific state order to universities. While for young people this is a start in life, a possibility to have good profit after getting a profession".

### **INTERNATIONAL COOPERATION IN TRAINING OF PROFESSIONAL PERSONNEL**

With the view of training of highly qualified engineering personnel, the university practices interaction with foreign universities and firms (figure 9).

Development of scientific-research and innovative activity at the university is annually proved by awards at all-Russian and international levels. For example, every year students take part in International festival of innovations, knowledge and inventions "Tesla Fest", Serbia; in Russian-Britain forum inventions and innovative technologies, London; in International showroom of inventions

"INOVA", Croatia; in International forum of innovative development "Open Innovations" and exhibition "Open Innovations Expo" and others.

### **CONCLUSION**

To summarize all mentioned above it should be emphasized that the main trends of engineering personnel training are:

- participation in programs of innovative development of state corporations;
- creation of the centre of engineering and industrial design on the base of the university;
- development of the system of small-scale innovative enterprises as the main form of interaction between the real sector of economy and the innovation infrastructure of the university;
- employers' involvement into the educational process;
- formation of structural subdivisions at the university and at factories within the framework of governmental-private partnership;
- strengthening of relations with international scientific society in terms of internship and work practice.

All these made it possible for VSTU to join the ranks of 95 leading Russian universities which train highly qualified engineering personnel and participants of the real economy market.

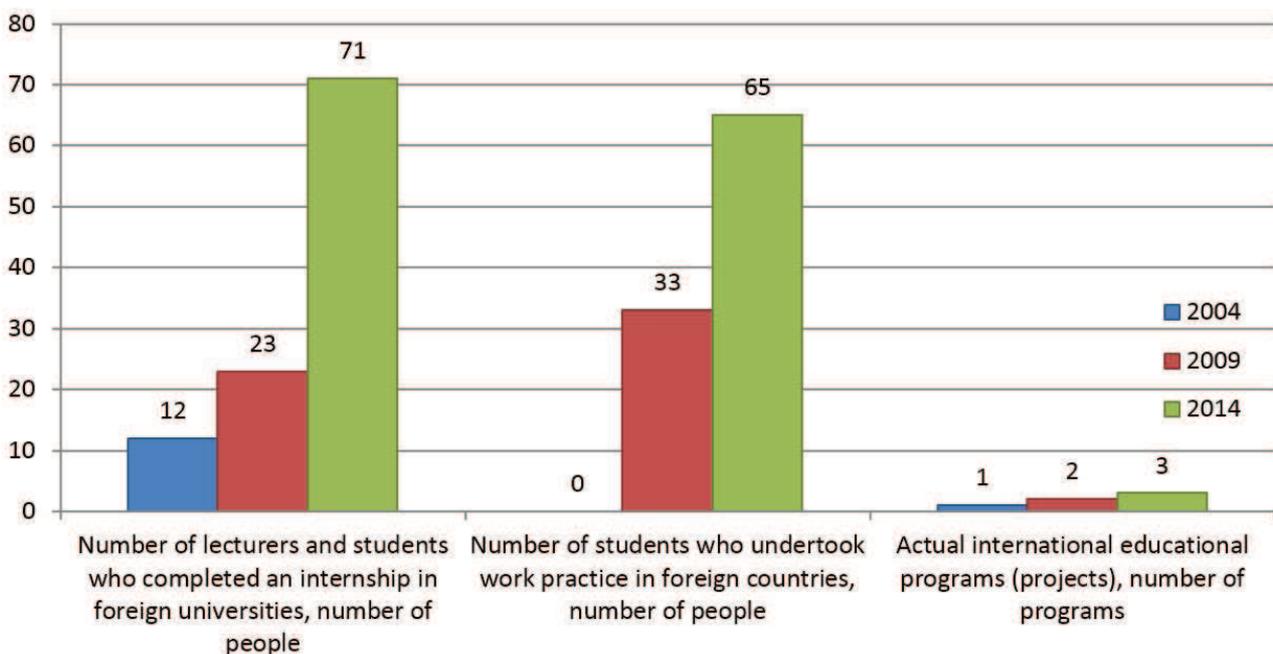


Figure 9: Dynamics of internships and work practice abroad [09]

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