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EMPLOYERS AND THE SYSTEM OF TECHNICAL EDUCATION: IN SEARCH OF OPTIMAL INTERACTION

Poslodavci i sistem tehničkog obrazovanja: iznalaženje mogućnosti za optimalnu saradnju

ABSTRACT: *The article deals with the problem of changing the system of interaction between higher education institutions and employers with the aim of improving the quality of technical education. It is pointed out that in the face of rapidly changing technologies and equipment used in industrial enterprises, a transition is required from the existing system of training future engineers to a new system that would ensure the development of both the ability to quickly master innovations and willingness to actively participate in their creation. The solution of this problem requires the employer to act not only as a consumer of the professionals produced by higher education, but to actively cooperate with teachers during the whole period of university studies.*

The empirical sociological studies conducted by the authors in 2014–2016 in the Sverdlovsk region, a large industrial region of Russia, reveal the problems to be addressed during the transition to new forms of interaction between teachers, students, and employers in training highly skilled engineering personnel for the economy of innovation. The study identified the differences in employers' and students' understanding of the requirements for such professionals, as well as the employers' lack of willingness to actively participate in their training.

The final part of the article suggests possible solutions for establishing an effective system of cooperation between technical universities and employers in order to accelerate the modernisation of the Russian economy.

KEYWORDS: employers, teachers, technical and engineering education, university graduates, employers and universities interaction, young professionals education and training quality.

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APSTRAKT: *U članku se razmatraju problemi promene sistema zajedničkog delovanja organizacija visokog obrazovanja sa poslodavcima u cilju povećanja kvaliteta tehničkog obrazovanja. Zapaža se, da je u uslovima stalnog usavršavanja tehnologija, tehničkih uređaja, koji se primenjuju u industrijskim preduzećima, neophodan prelazak sa prethodnog sistema obuke inžinjerskih kadrova na novi, koji kod mladih stručnjaka omogućuje stvaranje navika, kako brzog samostalnoga usvajanja inovacionih programa, tako i spremnosti aktivnog učešća u njihovom stvaranju. Ispuniti taj zadatak moguće je, kada poslodavac nastupa ne samo u ulozi korisnika onih stručnjaka, koji završavaju školovanje na visokim školskim ustanovama, već aktivno sarađuje sa profesorima celim tokom njihovog obučavanja.*

Zapaža se, da je u uslovima stalnog usavršavanja tehnologija, tehničkih uređaja koji se primenjuju u industrijskim preduzećima, neophodan prelazak sa prethodnog sistema obuke inžinjerskih kadrova na novi, koji kod mladih stručnjaka za kratko vreme omogućuje stvaranje navika samostalnog savladavanja inovacionih projekata, tako i prednosti aktivnog učestvovanja u njihovom stvaranju. Ovaj zadatak moguće je realizovati kada poslodavac ne nastupa samo u ulozi korisnika usluga onih stručnjaka koji otvaraju visoke školske ustanove već aktivno sarađuje sa profesorima tokom čitavog perioda njihovog obučavanja.

U radovima empirijskih sociooloških istraživanja, sprovedenih od strane autora, u razdoblju od 2014 do 2016 god., u Sverdlovskoj oblasti – jednoj od krupnijih industrijskih oblasti Rusije, javljaju se problemi, koje je neophodno rešiti pri prelasku na nove oblike saradnje profesora, studenata, poslodavaca u procesu obuke visokokvalifikovanih inžinjerskih kadrova radi inovacione ekonomije. Ispoljene su razlike u shvatanju potreba za takvim diplomiranim stručnjacima kod poslodavaca i studenata, kao i mala spremnost poslodavaca za aktivno učešće u njihovoj obuci.

U zaključnom delu članka predlažu se moguće varijante stvaranja efikasnog sistema saradnje tehničkih fakulteta sa poslodavcima u cilju ubrzavanja tempa osavremenjivanja ruske ekonomije.

KLjUČNE REČI: *poslodavci, profesori, tehničko obrazovanje, diplomirani studenti visokoškolskih ustanova, zajedničko delovanje poslodavaca i organizacije visokog obrazovanja, kvalitet obuke mladih diplomiranih studenata.*

Introduction

The current changes in the world economy, caused by the increasing competition for the leading position in the market of new technologies and systems, emphasize the need to improve the nation's scientific and technological independence as a necessary condition for its sustainable economic development. The availability of highly-qualified professionals with technical expertise, able to independently adapt to constantly changing technologies, to the newest machines and mechanisms, allows the country to maintain its political and

cultural independence, to support its own engineers, production designers, technical specialists and technologists, creating conditions for their creative potential realisation. Therefore, the key objective for Russia is to change the system of training young professionals in its higher education institutions, so that they acquire the skills and abilities needed to actively engage in continuous self-development in their professional field on the basis of studying both global and national experience in the creation and implementation of new technologies and devices in all spheres of production.

The sociological study conducted revealed the problems arising during the transition to the new system of interaction between employers and the higher education system aimed at training professionals ready for continuous innovation.

The article focuses on the specifics of interaction between employers and technical education system in Russia at the present stage of production modernisation. The paper consists of three parts: the first part looks at the main factors that are currently causing changes in the employers' requirements for engineers' training and qualification. The problems of training young professionals required by the innovative economy both in Russia and other countries are explored. The second part presents the results of the sociological study conducted by the authors in 2014 –2016. The final part summarizes the work done and gives recommendations for improving the system of training specialists in technical fields through joining the employers' and the university teachers' efforts.

Theoretical Background

After the Industrial Revolution of the late eighteenth century (Tomory, 2016: 152) a certain scheme of interaction between the employers, involved in organising production of certain goods and services, and the education system was in place. Scientists discovered new ways of converting natural resources and materials, devised technologies for producing different devices. Production designers developed machines and mechanisms for the realization of scientific developments. A special system of training workers and engineers was created to prepare people for working with them. At the same time production enterprises were under construction, where these professionals could work and apply their knowledge and skills (Vallencourt, 2016). The pace of technological modernization was low: the same devices and equipment were used in production for decades. This allowed organising training of future engineers with approximately the same professional knowledge and skills, planning for many years ahead. University teachers were not required to constantly update their knowledge and modernize their teaching methods. There were textbooks that could retain their educational value for students for 20–30 years. The quality of young professionals' education was determined by their knowledge of technologies applied in most enterprises manufacturing certain products.

The extensive development of the economy through the construction of new plants and factories producing similar products did not require identifying employers' opinions on the quality of graduates' training. A simple calculation gave the approximate number of engineers, technologists, production designers and technical specialists that was necessary for a certain number of existing enterprises and those under construction, taking account of employees' ageing and the need to replace them with young professionals.

Thus, the number of qualified employees with a university degree in the USSR at the time of industrialization increased from 233 thousand in 1928 to 909 thousand in 1940. This growth was particularly noticeable for employees with degrees in engineering and technology in the metal processing and mechanical engineering enterprises: from 28 thousand in 1928 to 253 thousand in 1937 (Arefiev, Arefiev, 2012: 123). The total number of students in tertiary education in the country increased from 127 thousand people in 1915 to 2.1 million by 1957; the number of universities increased from 105 to 767 within the same period. The number of students in the institutions of secondary vocational education grew from 54 thousand to 2.12 million, and the number of institutions providing such education increased from 450 to 3642 (Movsovic, 1959: 6–7).

Planned economy, dominant in the Soviet Union, allowed distributing graduates between all the existing plants so that there were almost no people unable to find a job in their field. Employers, the industry ministries, gathered data from the subordinate enterprises on the number of professionals that they would need in 5 years or more, which helped to determine, with relative accuracy, the number of places for first-year students in state universities. Their number was stable since staff turnover rates were steady and new professional fields did not appear very often. In addition, production enterprises had a system of retraining, which, if necessary, helped teach those already working in the industry to master new equipment within a short time (Prokofiev, Chilikin, Tulpanov, 1961; Gokhberg, Sokolov, 2016: 3).

However, secondary vocational education was one of sources of new engineering staff. The graduates of these institutions could cope with more complex responsibilities if they had wide working experience, especially those involved in the organization of production, rather than the introduction of new technologies and equipment. At the time universities did not provide specialized management training for engineers at all; only those who had innate leadership qualities and inclinations became managers.

At that time, there were two main factors encouraging school leavers to obtain higher technical education. The first factor was the national demand for young professionals for the existing enterprises and for those under construction. The second was the high prestige of engineering education, which gave many university graduates an opportunity to follow their inclination to work with technology and a chance of career advancement. Under the influence of these factors, the number of school leavers aspiring to a university degree in technology and engineering increased every year. If the number of those willing to enter a technical university was almost in line with the availability of places, by 1960

there was a competition with 1.8 people applying for each place (Pietsch, 1983, 307–308).

As a result, in planned economy a stable and rather effective system of interaction between employers and higher education institutions was in place. The former periodically updated the number of the young specialists they needed, without suggesting any changes in the education content or teaching methods (Kosogova, Araslanova, 2015: 169–170). Yet, the problem of university graduates' knowledge and skills not complying with the demands of the production process was evident even then. They had deep theoretical knowledge, but did not have the competencies and skills needed to use the technologies and machinery used in specific enterprises (Pietsch, 1983: 308), therefore, they had to be retrained to adapt to the production requirements in the first months of their work. The 1–2 month work placement the students had at the enterprises during their studies was not sufficient to gain full understanding of all the details of the production process. There was no opportunity to study the specificities of technologies and equipment used at different enterprises in depth.

An attempt was made to solve this problem in the USSR in the early 60-s of the last century, when university students had to master the machinery in factories during the first half of the day, and to study theory at university in the afternoon (Matthews, 1982). However, this experiment showed that most students did not manage to acquire the necessary skills to work with the machines, nor to gain theoretical knowledge in university lectures. After two years of the experiment, the former system of training was reintroduced, whereby university graduates acquired theoretical knowledge, but had no practical skills of working with technology applied in industrial enterprises (Shumovsky, 1969: 4–5).

It should be noted that some Russian universities have a system of combining work and studies in operation, designed to develop the students' practical skills of applying theoretical knowledge. In Moscow Institute of Physics and Technology students are assigned to specific laboratories in their first year, where they familiarise themselves with the equipment used, carry out experiments together with the laboratory experts, and engage in creating innovations. Based on their work and research results, the students and their mentors obtain grants from enterprises for the most promising and relevant innovative products and also secure the support of the university technology park (Trunin, Lebedev, 2011: 76–77). After their graduation these young professionals only need a very short adaptation period to comply with the employers' requirements. Thus, employers have a real influence on their prospective employees' training and help them develop professional competencies they require.

Yet, the vast majority of Russian universities do not use such a system of organising studies. The main hindrance to introducing similar practices is a lack of continuous interaction between universities and specific enterprises whose experts participate in students' education and training throughout their studies, when they gain professional skills and knowledge.

These problems, related to employers' and university interaction in training industry personnel, that had existed for decades were greatly exacerbated when technological progress and equipment modernisation pace accelerated sharply.

Since the 80-s of the twentieth century, scientific and technological progress has lead to new methods of various goods and services production appearing every year, or every two-three years. New machines and mechanisms appear, significantly reducing not only the need for physical labour, but also changing the focus and content of creative mental activity that professionals who use new technologies and technical devices are to perform. This creates the need for their continuous professional development, the acquisition of the innovative content of professional knowledge and skills, taking into account the technological changes in the production process (Brewer, 2009: 9–10).

The high pace of production modernisation is changing the employers' requirements for university graduates. If they used to look for specialists with the knowledge and skills needed to work with the *existing* technologies and technical devices, their key requirement now is *the ability to independently master new technological developments in the industry within a short time*. These could include new software and hardware, an innovative method of creating products, or a new device, mechanism, etc. Someone who is ready for continuous change in the content and methods of work, able to make the right decision in the face of uncertainty, and can quickly adapt to new demands arising from new technologies, devices and equipment, becomes the most valuable and demanded prospective employee on the labour market (Gurban, Tarasyev, 2016: 189–190).

Therefore, university graduates are not only to be familiar with the technology and operating principles of the machines and mechanisms used in most production enterprises. A strong commitment is required to mastering all the developments that may appear during their studies and may be introduced in the production process by the time they graduate. A university graduate able to quickly master innovative solutions and aspiring to active participation in their creation is in high demand by employers (Vorontsov, Vorontsova, 2015: 1148).

The fast-changing world economy needs a new type of employee that universities did not use to train, which requires to considerably restructure the entire educational process (American institutes for research, 2013).

Therefore, a problem arises of universities' lack of readiness to implement this complex task. How well the existing higher education system is ready to shift to different, more effective methods of training young professionals, equipping them with knowledge and skills necessary to quickly master various innovations appearing in the industry and to design new equipment in response to scientific and technological developments is open to question. If universities are able to teach in a new way, then the country has a chance to actively participate in the technological and technical changes occurring in the world. Otherwise, there is a danger of falling behind other countries in terms of technological progress, which is exactly what international competitors are interested in.

Therefore, Russia's key objective is to create a new system of training engineers who are capable of mastering modern technologies, of working with new machinery, and are ready for creative work of designing new devices.

It should be noted that the problems related to training professionals required by the innovative economy originate at school, where students develop an interest in obtaining an engineering degree. Back in the early childhood some children are curious to learn how their interactive toys, cell phones, computers

and other machinery operate. However, education does not develop this interest as there are no courses at school that allow studying the operating principles of the most common household appliances and other equipment. Students do not have a „playground" for using various technical devices, for creating new ones, for identifying their inclination for engineering, or for preparing to enter technical universities (Belyaev, Livshitz, 2003: 363).

The absence of facilities for school students to acquire their first engineering experience, to express their creativity when designing new machines and mechanisms also has a negative effect (Chistyakova, 2015: 119–120). This impedes early detection of the students' aptitude for working with technical systems.

Such problems are not unique to Russia: in Canada, a significant number of school leavers face difficulty when trying to make informed career choices. Due to the lack of information about possible further education options and the specifics of certain professional activity, they make choices without being confident about them (Witkoetal, 2005). Therefore, their admission to engineering university departments is determined by the profession prestige and the opportunity not to pay for education, not by genuine interest (Belyaev, Livshitz, 2003). No attempts are currently being made to identify the potential students' inclinations and aptitudes for technical subjects, for designing new technologies, machines and mechanisms. In Serbia, as some researchers note, a decline in the value of higher education among students is observed, as a university degree is not equated with mastering professional knowledge and skills that are in demand, or with employability. Young people tend to choose a job first, and only after that they think of receiving higher education (Mojić, 2012: 308–309).

Consequently, the development of a career guidance system in schools, based on creating the necessary conditions for the development of children's aptitudes for working with different technical devices, as well as for creating new ones, has become a central issue. The need arises to develop a new system to prepare school leavers for making informed career choices, channeling the schools', industrial enterprises' and engineering organizations' concerted efforts into its design. This will allow for a more effective organisation of the educational process at universities aimed at developing young people's aptitudes for working with technology, identified while they are at school. It will also significantly improve the quality of training specialists for modern industrial enterprises (Krnjaja, 2014: 287).

School leavers who are ready for receiving a degree in engineering and technology are interested in supporting their theoretical knowledge by practical experience of mastering the newest machines and mechanisms which can only be gained through working in specific enterprises. This can be achieved through reorganizing the system of interaction between engineering universities and employers (Hasanefendic et al, 2015).

The practice of organising learning based on solving urgent problems of a particular company by means of joint efforts of students, teachers, and employers will help to train young professionals who immediately after graduation get involved in the organization's innovative activities (American institutes for research, 2013: 11; Krnjaja, 2014).

In the meantime, as researchers note, the lack of the skills that employers see as essential in young professionals is one of the main causes of unemployment, not only in Russia, but also in Bosnia and Herzegovina (Tomić, 2012: 299–300). In Slovenia, university graduates have difficulty with finding employment, because their training and qualification do not meet the employers' requirements (Ule, Živoder, 2012: 319–320). The consequence of this lack of coordination between the system of higher education and the labour market is the increasing unemployment rate and Serbian university graduates' low economic activity (Mojić, 2016: 248). In the US employers are faced with the issue of young professionals' insufficient technical knowledge and skills caused by unsolved problems related to the interaction between universities, colleges and industry (Sayers, 2015: 42–43). These problems manifest themselves, in particular, in reduced investment in facilities modernisation in many American universities. Prospective engineers are sometimes trained using obsolete technology and equipment (Lassiter, 2012: 4).

These issues generate the need to intensify the efforts aimed at changing the content of future engineers' education and training in accordance with employers' requirements. This requires identifying if the organisations of higher education and employers are willing to shift to a new system of interaction when teaching engineering students. Sociological studies on this issue allow determining the current state of such cooperation and the directions for its further improvement.

Data and Methods

The authors conducted a sociological study with the aim of identifying the similarities and differences in employers', teachers' and students' ideas about the requirements for young specialists. Their opinions about how well the existing system of higher education trains and educates young professionals in relation to what employers demand were also studied. The study also examined the universities' willingness to cooperate with employers to train personnel capable of mastering modern technologies, of working with new equipment, and ready to independently tackle arising difficulties.

The study was done in Ekaterinburg and Sverdlovsk region in 2014–2016. 832 people were interviewed in 2014: 150 employers, 187 teachers and 495 technical and engineering students of Ural Federal University named after the First President of Russia B.N. Yeltsin. In 2016, 1230 senior students of different universities receiving engineering and technical degrees were surveyed.

Among the respondents were such employers as directors and department heads of Ekaterinburg and Sverdlovsk Region industrial enterprises (77%), as well as heads of municipal institutions and research centers (23%). In addition, the opinions of the leading specialists of these organizations were identified: 67% of the respondents were directors, chief engineers, and heads of departments. 36% of the participants had a working experience of less than 5 years, 25% had 5 to 10 years of experience, and the rest had been working in management positions for over 10 years (39%). The remaining 33% of the respondents were leading specialists of the organizations (laboratory heads, engineers, etc.).

A formalised survey (questionnaire) was chosen as the main method of gathering data. In addition, in-depth interviews were used to obtain more detailed information about the factors that determine the quality of young specialists' training at university.

Results and Discussion

The study showed that 81% of the employers agree that the requirements for young professionals have become more demanding over the last 10 years. The reasons, according to them, are continuous technological improvement – 65%; the arising need for regular professional development, for improving professional knowledge and skills – 65%; the importance of the ability to quickly master new technologies – 55%; the introduction of new machinery – 41%; the need to intensify work-related efforts to adapt to constant changes – 37%; mastering foreign equipment – 20%.

Consequently, the development of skills that enable *mastering new work content* is the most important indicator of the high quality of graduates' professional training and qualification and their readiness for work. To achieve this, the educational process at universities needs to be restructured and focused on developing the competencies required by scientific and technological progress through joint efforts by employers and university teachers. One of the employers noted: *„If we give knowledge about equipment, we inform on what is used by companies now. If we talk about the current trends in organising production, we give information about how to build an efficient modern company"* (department head, 7 years' experience).

The study revealed the *similarities and differences* in the respondents' ideas about what modern engineers, production designers, and technologists need to know and what skills they need to possess in order to become valuable young professionals demanded by modern enterprises.

Table 1. Opinions on employers' requirements for university graduates (%)

Indicators	Students	Teachers	Employers
Knowledge of advanced technologies and equipment used abroad	39	40	65
Ability to get involved in innovation activities	69	70	72
Knowledge of technologies and equipment used in domestic enterprises	33	46	60
Ability to find new solutions to arising problems	60	60	61
Self-education and self-development abilities	48	60	63
Practical professional skills	76	68	51
Ability to communicate with foreign companies' and organizations' representatives	36	21	35
Ability to work with scientific and technical literature in foreign languages	26	28	41
Thorough theoretical knowledge	14	23	28
People management skills	30	33	27
Ability to entice customers	20	29	37

The comparison of the views of the three groups of respondents shows that teachers and students agree with employers only in understanding the role of *the ability to quickly engage in new, unfamiliar work; the ability to find new solutions to arising problems; the ability to manage people*. The teachers' and students' positions on other indicators ***only partially comply with*** the requirements of industrial enterprises managers. This indicates that the current practice of interaction between universities and employers does not encourage developing in future young professionals the commitment to acquiring knowledge and skills that will ensure their successful work at industrial enterprises, with constantly changing technologies and equipment.

One of the industrial managers elaborated on these opinions in an in-depth interview. He believes that young professionals need „*to be familiar with modern equipment to ensure high quality of the manufactured products, to be flexible, to aspire to career advancement, to think systemically, to be able to process large amounts of information and to identify the most important information*" (Chief engineer, 19 years of working experience).

Another employer added: „*University graduates need to have team working skills and commercial skills. If they are to be working with innovations, they should be able to calculate costs and evaluate cost-effectiveness*" (department head, 3 years' experience).

All the participants of the educational process, including employers who are the customers for highly-qualified specialists, understand the need to develop in students the ability *to quickly master innovative technologies and learn working with new equipment.*

The survey revealed the students' misunderstanding of the role of theoretical knowledge in training qualified professionals. Their personal experience of using household appliances, computers, mobile devices creates the illusion that it is possible to successfully work with modern equipment in production enterprises without understanding the principles and physical processes that determine its functioning.

One of the teachers described the problem as follows: „*They (students) can, for example, use the new data processing software. But they don't know the theory that underlies it*" (university teacher, 25 years' experience).

Another teacher pointed out: „*If only 8–10 years ago about 30% of the students could more or less successfully master the theoretical material presented, now not more than 10% of the first year students can do this*" (a university teacher with 35 years' experience).

Another myth in the students' minds related to the role of *practical skills* in training young specialists was revealed in the study. On the one hand, their importance is constantly emphasized by teachers and many employers. During the in-depth interview one employer said: „*It is good when students learn not only the theory, but also solve some business cases, do practical tasks connected with the real market*" (department head, 5 years' work experience). On the other hand, industrial managers understand that the relatively short work placement does not allow students to acquire all the skills necessary to work with particular

equipment. They believe, as it was 20–40 years ago, that the skills that ensure its correct use are what students need. These skills are developed in the first months of work after graduation. Therefore, only 51% of the employers surveyed noted the importance of this indicator of the quality of young specialists' training; with about 70% of the students and teachers agreeing with this position.

According to employers, only 4% of university graduates fully comply with their requirements, and 41% – almost fully match meet their demands. One of the company representatives added his comments on what skills and knowledge young specialists lack: *„Poor knowledge of scientific and technical documentation, of the conventions of business correspondence, of the structure of a modern industrial enterprise, the inability to articulate and present innovative suggestions"* (Chief engineer, 19 years; experience).

However, senior students are considerably more optimistic in their evaluation of their readiness to work in industrial enterprises and to comply with the employers' requirements after graduation. 32% believe that they *are able to fully cope* with their future work responsibilities, and 44% think they are almost able to do so. The lack of practical work experience leads to the students overestimating their future career opportunities immediately after graduation.

In the in-depth interview one teacher explained the situation with young professionals' readiness to carry out their professional duties, *„Many graduates need to acquire new knowledge and skills. The requirements in different organizations vary a lot. Few graduates work in the sphere connected with their university specialty"* (university teacher, 17 years' experience). Many respondents mentioned that university graduates have difficulty finding a job connected with their university specialty. The 2016 study showed that 47% of senior students in technical universities are oriented towards employment in the profession they are trained for at university. 27 % intend to look for a job in a related field, with the rest not thinking of connecting their future job with their degree.

There are several reasons for this: firstly, some of the students during their studies realise that the acquired profession does not match their inclinations. These inclinations were not identified at school due to the absence of an effective career guidance system. Secondly, 21% of the students believe that the knowledge gained at university is not sufficient to successfully work in a modern company, equipped with the latest technologies. Universities do not manage to shift to new methods of training, constantly interacting with employers. The transition is very slow from simply informing the students about scientific developments and designers' and engineers' creations to involving them *in independent learning to work with the newest equipment and the latest technologies applied by the best companies in the region and the country, in the search for solutions to the real problems that exist in present day production companies.*

When students start looking for optimal methods for innovative production transformation, they will find the information about already existing solutions developed in the past for a specific industry, as well as the information about the possible steps to follow to tackle new objectives. Thus, motivation will appear for creativity and discovery, which ensures successful studies. The students will seek

opportunities for self-assertion through finding original solutions to scientific, technological and technical problems.

Students have commented on some of the problems that prevent them from receiving quality technical education that employers require: „*We are not well-informed about possible work placement options or about the opportunities our profession can offer"* (a 1st year master degree student).

According to the employers surveyed, universities are slow to shift to new teaching methods. Only 6% of the employers agreed that universities started using modern techniques in training young specialists that help develop the skills required by production enterprises. More than half pointed out that this is not the case in many universities – 56%. The fact that only 11% of the interviewed representatives of industrial enterprises have sufficient information about what innovations the teachers bring into young specialists' training only contributes to exacerbating the problem; 37% only have some vague idea about this, and the remaining 52% of the respondents *do not have any information on this matter*.

Organising interaction between universities and employers in training young specialists, able to actively participate in continuous technical and technological production modernisation, is impossible through solely the university faculty members' efforts. New forms of cooperation are needed between potential employers and those responsible for running the educational process.

Table 2. Suggestions on forms of cooperation between employers and universities (%)

Indicators	%
Help in organising students' work placement	60
Professionals from the enterprise are willing to work with students	42
Willingness to participate in developing new programmes, curricula and courses	34
Willingness to commission training particular specialists	29
Willingness to invest in new courses development	5
Not ready for active cooperation	13

Currently, employers are willing to cooperate with universities mainly in traditional ways: work placement and counseling individual students in the preparation of their final research papers. Only a third of the respondents supported the idea of such form of cooperation as organising special target groups at universities to educate and train professionals commissioned by enterprises on the basis of a tripartite agreement „university – employer – student". Thus, the employers' lack of readiness for new, more effective ways to participate in training those who will become their employees in 1–2 years is an important issue.

Employers have suggested measures aimed at improving the quality of graduates' training. 42% of them believe that students should have their work placement in companies willing to employ young professionals right after graduation. 16% pointed out that universities should involve professionals from enterprises that are actively involved in the introduction of new technologies and systems in teaching students.

Some employers gave specific examples of successful cooperation of enterprises and universities: *„We cooperate closely on the issues of science and technology, research, on improving the quality of the organisation and are members of the university State Examination Commission. Our experts give classes at different university departments and are actively involved in the teaching process"* (department head, work experience – 25 years).

The results obtained show that, firstly, the creation of an effective system of interaction between universities and employers aimed at training young engineers, production designers and technical specialists is still hindered by some acute problems that need addressing. Secondly, at present neither universities, nor employers are fully ready for the transition to new forms of training students based on their inclusion, from their first year of study, in collaboration with specialists from enterprises and university teachers, aimed at solving urgent problems of a particular company related to the implementation of new technologies, introduction of new devices, and innovation. The system of organising collaboration between enterprises and higher education institutions that is currently in place enables training professionals ready for continuous production modernisation.

Conclusion

The analysis of the students', teachers' and employers' opinions about what qualities are demanded of a modern young professional, ready to actively participate in the creation and development of new technologies, equipment, and facilities, and the analysis of the representatives' of higher education institutions and industrial companies attitudes to new forms of cooperation, has shown that to improve the quality of engineering staff education and training the following steps are to be taken:

1. Giving students and teachers opportunities to participate in solving practical problems related to modernising the production process at particular enterprises. Employers in collaboration with university teachers and students are engaged in searching and implementing the most effective ways to develop and master new technologies and devices, in creating new methods that would ensure a steady increase in productivity. As a result, the employer receives draft solutions relevant to their production problems. The teachers obtain relevant information about national enterprises, get involved in creating innovations, and develop their creative abilities. The students acquire a body of knowledge and skills needed to actively participate in the development of new technologies, machines and mechanisms, as well as the experience of participating in innovation activities. This connection of theory and practice allows them to express their creativity in the independent search for solutions to the problems they may encounter in their work after graduation.

2. Building learning laboratories where students could design, create and develop new technical systems under the teachers' and employers' guidance starting from their first year of study. This will allow future professionals to demonstrate their innovation abilities and creative thinking. The most promising technical developments could be implemented in real enterprises. Higher education institutions will then become real drivers of technological progress.
3. Creating temporary creative teams of senior bachelor and master degree students who take on a responsibility to develop a new technology, an innovative technological device for specific industrial enterprises within a specified period of time. The enterprises provide their material base and facilities for experiments, for creating pre-production prototypes of new mechanisms.

Organising joint training of students by university faculty members and specialists from industrial enterprises will significantly change the content and methods of technical education. A new special practice will appear: students will be involved in research and project work while continuing to study. Theoretical knowledge will become really valuable, as it will be applied primarily to search for and justify various methods for improving the operation of a particular company. The student will become personally interested in finding the best options for its development in order to prove their value to future employers.

The students involved in solving problems in the company will develop a steady interest in their future profession; they will aspire to apply the acquired knowledge and skills when looking for employment in their field. There will be opportunities to demonstrate creative abilities while studying at university, which will significantly improve the university graduates' competitiveness in the labour market. Concerted efforts that university and employers put into future professionals' training will enable enterprises to accelerate the production modernisation and will ensure the development of the national economy.

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