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LABOR AND EMPLOYMENT

Forecasting Recruitment Needs of the Russian Economy: Qualitative Aspects

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Abstract—The article presents a new mechanism for translating labor market's needs to the vocational education system that promotes the provision of long-term personnel requirements within the framework of the implementation of competence-based educational programs.

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At the current stage of economic and technological development of the Russian Federation, there is a serious problem of the misalignment of interests and opportunities of business community, state, and educational facilities in a labor market. The existing gap between employers' needs in staff with certain knowledge, skills, and practical experience and the students' appropriate skills development among students is largely due to the systematic lag of state educational standards behind the market demand in prospective employees for industry technologies and business processes. This gap is particularly characteristic of high-tech industries where processes of change take place more rapidly. The situation is exacerbated by the absence of communication tools to identify and submit prospective requirements of business community to the vocational education system.

Under the circumstances, the issues of forecasting the graduates training quality for the labor market, as well as the need to search for an appropriate mechanism for translating the labor market's needs to the vocational education system, the practical implementation of which will promote the satisfaction of the economy's forecast needs for staff, become very topical.

Relevance of issues of qualitative forecasting for the labor market. One of the main tasks of the educational system improvement up to 2020 is bringing the volumes, structure, and quality of training of graduates in vocational education institutions in compliance with the labor market's needs. Providing a high quality education in Russia in accordance with the changing needs of the population and long-term tasks of development of Russian society and the economy is a goal of the State Program of the Russian Federation "Development of Education for 2013–2020" [1]. These issues are addressed in various documents of strategic planning at the state level at the annual Presidential Addresses to the Federal Assembly of the Russian Federation and long-term forecasts of social and economic development of the Russian Federation in general and its particular regions [2–6].

The further improvement of work related to the staff needs of economy forecasting and changing the professional and qualification structure of staff training, i.e., the so-called *quantitative component,*[1] is implied. The second (qualitative) component includes changes in the field of content of education and its adaptation to real employers' needs. Under circumstances when the creation and utilization of knowledge become a source of economic growth, determining the competitiveness of not only individual enterprises and regions but the country in general, increases the significance of this second component by several times.

Let us examine the qualitative aspect of the coordination of the forecast recruitment needs of the Russian economy and the labor supply on labor market, which is currently the most discussed but still insufficiently explored, in detail. Since the 2011–2012 academic year, the educational process in vocational education system of the Russian Federation is carried out through the programs developed based on federal state educational standards. A new approach to training staff incorporated into educational programs in accordance with educational standards of the third generation, known as federal state educational standards (FSES), assumes that the results of completing an educational program should be represented as general cultural and professional competencies, i.e., the complex of expertise, knowledge, skills, and personal experience that are necessary for the further effective activity of an employee who holds certain position (profession).

High-technology branches of industry, where the compensation of labor shortage by means of labor migration is impossible, apply special requirements to the quality of labor resources and staff training. The

[1] This theme was repeatedly reviewed in, e.g., *Studies on Russian Economic Development* [7–10].

necessary condition of their development is the substantial growth of the efficiency of human resources utilization along with the maintenance of a sufficient number of staff with a certain level of qualifications and knowledge [11].

The formation of innovative economy in which the requirements for the quality of training of graduates in the system of vocational education increase fundamentally, amid sufficient inertia of the system, forces one to look for new ways of identifying the need for skilled staff and determines the need to identify and forecast the skills demanded in a labor market in the short, medium, and long term.

Identification of required competence for various forecasting horizons. In 2012, in research works related to the Federal Research and Technology Target Program (FRTTP) "Study of Long-Term Demand for Staff with Competencies in the Field of Technological Innovations," seven priority areas of science, technologies, and technics, i.e., biotechnology, medicine and health care, environmental management, information and telecommunication systems, transport and space systems, nanotechnologies and new materials, and energy efficiency, were the subjects of foresight sessions,[2] as well as of a survey conducted among employers in the format of Job & Competence Description.[3] Furthermore, a study of international experience on this issue has shown that these particular research methods are important elements that enable labor-market requirements to be translated to the professional education system.

In the course of the foresight research for each of areas for development of science, technologies, and technics in the Russian Federation (PDDSTT RF) experts formed the groups of future challenges based on the key trends of development of industrial directions. These challenges not only encourage the changes in industrial structure of labor specialization but also are certain impetus for the development of package technologies leading to the emergence of families of innovative products, which even today determine the demand for new skills. Based on the revealed future challenges, the experts identified knowledge and skills that remain relevant for employers on the horizon of 2012–2030, as well as those that will not be in demand during this period. Each priority area was provided with a list of universal, professional, and narrow professional skills.

However, the results of the foresight research have shown that, as a rule, enterprises (organizations) show demand not even for the individual skills of employees but for competency clusters, i.e., sets of expertise, knowledge, and skills, which enable one to resolve a variety of new tasks related to the appearance of new market opportunities. Some time after their appearance, these skills clusters can be institutionalized by the labor market in the form of new occupations; for example, for the priority direction "Nanotechnologies and New Materials," the implementation of which in the coming decades can significantly affect the transition of Russian economy to the sixth technological level, four skills clusters were developed and detailed:

– designers of nanotechnologies' life cycle;

– integrators of modular solutions;

– nanobioengineers;

– architects of active substances (also known as *smart substances*).

In order to ascertain and formalize the data received during the foresight "Skills 2030," a selective survey was conducted among the representatives of employers; it enabled one to evaluate the real level of development of innovative skills among employees concerned with the implementation of technological innovations in entities of the real sector of economy. The general scheme of implementing the Job & Competence Description method, according to which the survey among employers has been conducted, is shown in Fig. 1. The survey involved over 100 enterprises with regard to each PDDSTT RF.

In the course of the survey conducted in the format of Job & Competence Description in relation to each priority area among employers (PDDSTT RF):

– data that enable one to identify *what kind* of task the employees solve within the framework of the direction of professional activity and *how* they do it have been collected;

– models of universal and professional skills along with the description of demanded directions of professional activity for three forecasting horizons have been developed;

– data of foresight studies have been verified and formalized (unified) [12].

Analysis of the results of questionnaire surveys among employers, i.e., entities of the real sector of economy, within the research direction "Nanotechnologies and New Materials" enabled one to give a detailed description of the following specializations of professional activity that in prospect can be transformed into new occpuations: design engineer of nanotechnologies, nanobioengineer, and design engineer of modular solutions in the field of nanotechnologies.

As an example of this, Table 1 shows a description of the professional activity of a design engineer of modular solutions in the field of nanotechnologies in the format of standard working tasks of a future employee, knowledge, skills, and personal characteristics that are necessary to solve them, and Table 2 shows a model of the skills for this direction of professional activity.

Since an employee's qualification is an outcome of completing a certain educational program and/or practical experience, the results of studying current and long-range demands of employers for skills enabled the development of new requirements for the vocational education system that take into account the

[2] Performers: Petrozavodsk State University and Moscow School of Management SKOLKOVO.

[3] Performers: Petrozavodsk State University and the Center for testing and development "Humane Technologies," Moscow State University.

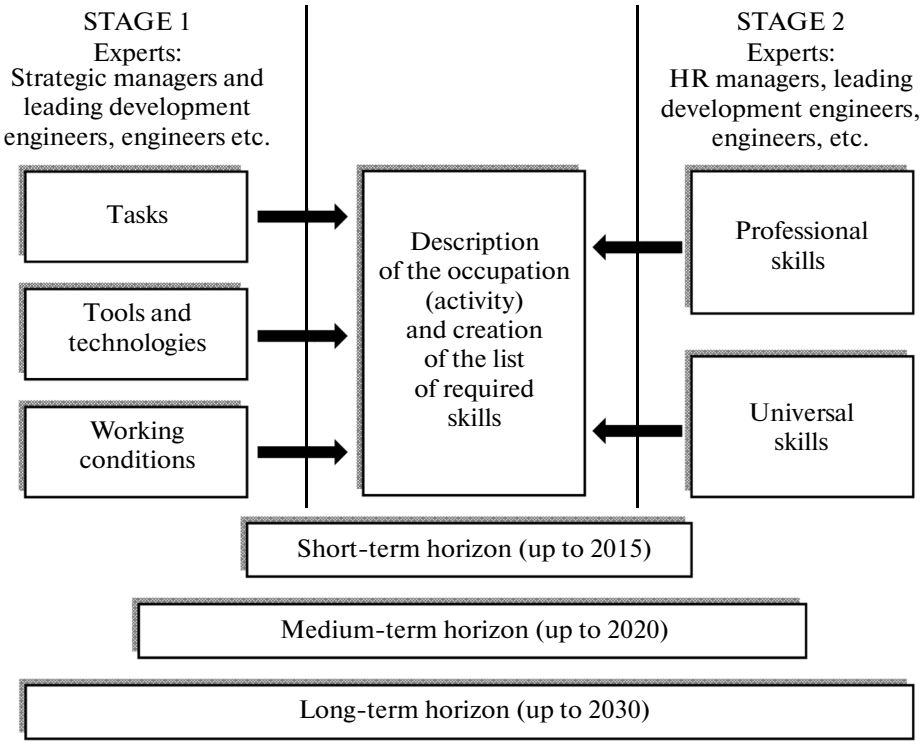

Fig. 1. Scheme of implementing Job & Competence Description method.

development prospects in the field of technological innovations based on priority areas for scientific and technical developments through 2020 and involve modifying state educational standards and educational programs.

Modification of educational standards and educational programs with due consideration of identified required competencies. This mechanism of translating the needs of the labor market to the skills education system involves a preliminary analysis of educational programs in vocational education facilities with relation to the compliance of skills developed in the process of training and the required skills identified in the course of the foresight research and the survey among employers. Since educational programs are developed based on FSES, this analysis also involves developing principal provisions of state educational standards based on the inherent competence-based approach.

The analysis of the third generation of existing state educational standards, based on which institutions of higher education have developed educational programs for training staff based on the priority area "Nanotechnologies and New Materials," has shown that the general list of skills that they approve sufficiently complies with the demands that employers in a labor market place on graduates of higher education. As a rule, these particular skills are included in educational programs of various Russian universities in relation to staff training for the field of nanoindustry.

However, according to the list of required general cultural and professional skills made with due consideration to the expert opinions based on the results of the foresight research and the survey among employers in the format of Job & Competence Description, it is recommended to insert an "Analytical Activities" block [13] into FSES, which includes three new professional skills that should be formed in the course of studying both basic and varying parts professional disciplines, especially, of profession-oriented disciplines chosen by students. This block includes the ability to do the following:

– apply the methods and techniques of analytics and data processing;

– participate in optimizing existing methods of creating and utilizing nanosystems and nanomaterials for successful competition on the market of ideas and technologies;

– draw scientifically based conclusions in view of the results of theoretical and experimental studies, provide recommendations on improving equipment and systems.

It is also reasonable to modify the description of individual general cultural skills approved by FSES and unify them in order to avoid the duplication of skills that have the same meaning. For example, "the ability to adapt to changing conditions, reevaluate accumulated experience, and analyze opportunities" and "the ability to self-adapt to changes in sociocultural and social conditions of activities"; or "the ability to introduce the results of the performed work in

Table 1. Professional activity of a design engineer of modular solutions in the field of nanotechnologies

Horizon period	Task	Tools and technologies	Working conditions
Short-term (up to 2015)	Adaptation of current research and process equipment to new products and technologies Information, marketing, and patent search Operation and maintenance of equipment Manufacturing, financial, and distribution management	Analytical instrumentation Computer technologies Body functions, including sight, hearing, speech, and intuition Theoretical knowledge and ways of thinking, i.e., theory of inventive problem solving, lean production, and six sigma	Office-laboratory Shared knowledge centers Remote work through the Internet
Medium-term (up to 2020)	+ Certification of nanoproducts Ensuring safety of environmental research and nànoproducts Development and engineering of new equipment and technologies		+ Virtual offices and systems of remote coworking
Long-term (up to 2030)	+ Targeted design of properties of new materials Providing the communication and interaction with allied disciplines (first of all, biotechnologies, energetics, informatics, and high-energy physics) Legal aspects of nano- and biotechnologies, bioethics		+ Augmented reality systems

The plus sign (+) in the Task column means additional types of activities.

the form of reports, symposium speeches, and scientific publications using modern opportunities of informatics and rhetoric" and "readiness for active communication with colleagues" (general cultural skills for the qualification (degree) of master). It is reasonable to extend general cultural skills, such as "the ability to have a positive impact on people in the context of the observance of rules and recommendations for healthy living" to all directions of training or to remove it from the general list of skills.

It should be mentioned that the number of professional skills, currently approved by FSES, significantly differs depending on the area of training. For example, the area 222900 "Nanotechnologies and Microsystem Equipment" includes 44 professional skills; and the direction 022200 "Nanosystems and Nanomaterials," 14. The reasonability of this differentiation is doubtful.

As for certain types of professional activity represented in FSES, they exist in varying combinations, including the following:

– design and engineering;

– design, engineering, and technology;

– manufacturing and technology;

– manufacturing, engineering, and technology;

– research and development;

– research, development, calculation, and analytics;

– research, development, and innovations;

– service and operation;

– maintenance and support.

In our opinion, the above-mentioned types of professional activity should be grouped by a generalized name of a type of professional activity.

It should be mentioned that the improvement of the staff-training system involves both the development of new educational programs and the timely correction of programs that are being implemented in the professional education system. The correction of higher education programs related to the priority direction for the development of science, technologies, and technics "Nanotechnologies and Nanomaterials," which, according to FSES, should be carried out annually, involves the following:

– optimizing the structure of general cultural and professional skills (from both quantitative and qualitative points of view) with special attention to the compliance of skills acquired during training, with current and future requirements of employers oriented toward professionally significant skills that will be in demand by the Russian innovative economy in the coming 5–10 years;

– correcting the structure of disciplines and the sequence of their completion;

– implementing new educational technologies and principles of educational process organization, with or without using modern information and communication technologies;

– evaluating the sufficiency of resource provision (personnel, material and technical, training and methodology, etc.) not only of an educational program in general but of courses of disciplines (modules);

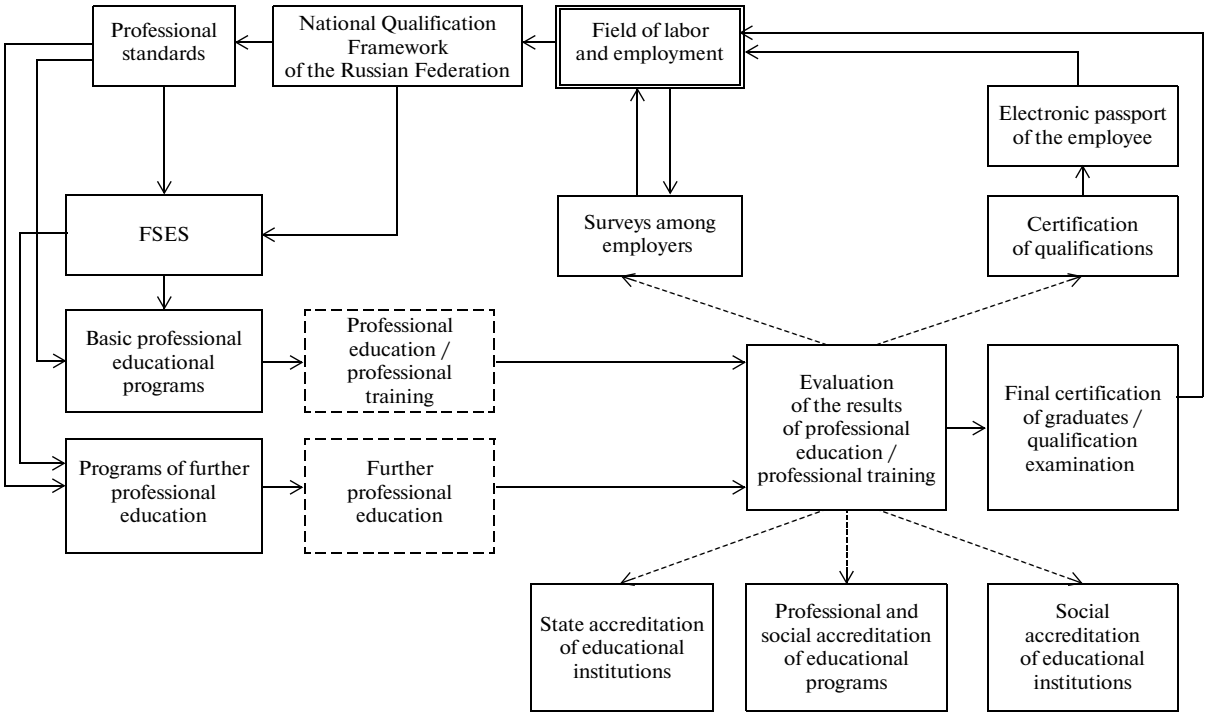

Fig. 2. General scheme of providing Russian economy with qualitative human capital.

– developing interuniversity educational programs that involve joint activities of various higher education institutions;

– altering the form of control and midterm assessments, including estimations of the level of completeness of competencies, not only at the stage of the state final certification, but also in the course of midterm assessments.

The advance character of training in educational organizations, conditioned by modified FSES and educational programs, will promote the training of employees demanded on the labor market. In turn, the usefulness will increase guarantees for graduates to find jobs based on their occupation and confirm the intended expenditures of budget funds.

Figure 2 shows a general scheme of provisions of the Russian economy with human capital.

The scheme includes quality management in the field of preparing individuals receiving secondary vocatioanal and higher education, as well as further education. We developed the scheme with regard to the changes in legislation that regulates issues of vocational education, building on the approach proposed by A.N. Leibovich [14].

This scheme involves updating the educational content with due account for the employers' requirements under the conditions of implementing competency-oriented programs. Practical Implementation of the proposed procedure for training and retraining personnel in order to provide for the Russian economy (in conjunction with relevant forecast figures of quantity and structure of students in vocational education institutions) will promote the alignment of qualitative characteristics of demand and supply in a labor force, consideration of long-term demand in a labor force, and enhance the efficiency of utilizing the labor potential. After all, in the event of implementing the constructive scenario of socioeconomic development, this procedure can become an efficient step toward solving the structural problems of Russian labor market.

National qualification framework of the russian federation. Currently, in Russia, the implementation of the Roadmap "Establishment of a National System of Competencies and Qualifications," developed within the national enterprise initiative "Improvement of the Investment Climate in the Russian Federation" is underway [15]. The roadmap is aimed at creating and improving a unified Russian system of developing professional potential and evaluating professional skills and knowledge, as well as overcoming the gap between the content of vocational education and training in educational institutions and the employers' demands for employee skills. According to the developers, it is a metamap for providing the post-industrial economy with high-quality human capital.

However, this document has at least two essential disadvantages. First, it does not contain the results of a detailed financial elaboration of the cost of planned activities that can become a stumbling block on the way towards their practical implementation. Second, it does not take into account provisions of the National Qualification Framework of the Russian Federation (NQF RF), which was previously developed based on a cooperation agreement between the Ministry of Education and

Table 2. Model of competencies "Design engineer of modular solutions in the field of nanotechnologies"

Universal competencies	Professional competencies
ANALYTICAL THINKING ability to think systematically and analytically identify cause-and- effect relations, problems, or situations; conduct systematic com parisons of various properties or aspects; and set priorities INITIATIVE ability to do more than necessary or expected, do things that no one asked you to do and that improve or increase the results of the work and help to avoid problems; look for or create new opportunities DUTY PERFORMANCE full compliance with instructions, observance of rules and technologies, exact and timely execution of orders SELF-DISCIPLINE ability to define aims unambiguously, set priorities and properly use available resources; plan actions with a glance to potential obstacles and complete them in a timely manner; use working time effectively and meet deadlines ORIENTATION OF RESULTS pursuit to achieve the goals, including activity control and prioritization to increase the efficiency of utilization of available resources INFORMATION SEARCH constantly striving to enhance knowledge of things, people, and issues; application of efforts to get more information without taking anything on trust CREATIVITY ability to doubt existing approaches; ability to come up with new and more effective decisions; utilization of intuition and new opportunities; ability to experiment; utilization of new and unconventional approaches to problem solving ORIENTATION TOWARD EDUCATION: orientation toward permanent training and development of knowledge and skills, as well as support and promotion of other people's desire for education and development	• Ability to use and apply basic professional knowledge • Ability to use methods of analytics and data processing • Ability to use and apply technological processes • Ability to work with computer technologies • Ability to use foreign languages in practice • Knowledge of the main types of inorganic and organic materials of various purpose, including nanomaterials, the main functional properties of materials, ways to select materials for a particular task, modern methods of synthesizing materials and nanomaterials of inorganic and organic natures • Knowledge of operating principles of modern synthetic and analytical equipment and apparatus, construction principles of technological cycles of producing various items that are related to the use of nanomaterials, micro– nanomodules (units), processes of nanotechnologies, and methods of nanodiagnostics. • Knowledge of regulatory and guidance materials in relation to preproduction engineering, quality, standardization, and certification of products and processes, taking into account economic analysis and the principles of construction and operation of the Product Quality Management System • Knowledge of production control system • Knowledge of typical methods of engineering calculations of technological parameters of biotechnological production • Knowledge of pilot adjustment for technologies and scaling the processes • Capacity for the professional utilization of modern synthetic and analytical equipment and apparatus, ability to use technological equipment • Knowledge of foundations of metrology, key principles of metrological support management, methods of analysis and control of nanostructured materials and nanosystems, etc.

Science of the Russian Federation and the Russian Union of Industrialists and Entrepreneurs of June 25, 2007 (we should mention that the block "National Qualification Framework of the Russian Federation" is one of the main blocks in the scheme represented in Fig. 2).

The development of professional skills is considered to be a component part of improvement of national qualification frameworks that are now elaborated and being tested in 116 countries. In international practice, national qualification frameworks are considered to be a system description of recognized qualifications structured by certain levels (as a rule, industrial, national, and international qualification frameworks). The evaluation and correlation of educational results are carried out using these frameworks, and the correspondence of diplomas (certificates) of education is established.

The implementation of national qualification frameworks in various countries has various level of efficiency. NQF RF takes into account the existing experience of development of European qualification framework [16], as well as national qualification frameworks of countries, including members of the Bologna and Copenhagen Processes. It represents generalized description of qualification levels and the main ways of their achievement in Russia [17] and it is aimed at providing a clearer understanding of qualifications (including academic degrees, certificates of education, and recognition of the results of practical proficiency and functional capabilities), as well as the information that they carry for an employer in relation to the potential employees' competence.

The NQF RF includes descriptors of general competencies, skills, and knowledge that emerge through appropriate criteria of professional activity, including breadth of powers and responsibility (general competency), complexity of activities (nature of skills), and research intensity of activities (nature of knowledge). It establishes relations between qualifications that enable one to provide the permanent professional

development of employees; it can help to plan the career and follow the selected educational path in accordance with the concept of lifelong learning [18].

The Order of the Ministry of Public Health and Social Development of Russia of December 22, 2011, approved Temporary methodical guidelines on the development of industrial qualification framework based on the NQF RF, where the industrial qualification framework is considered to be a component part of the national qualification framework of the Russian Federation and represents the description of certain criteria of qualification levels within the industry that is recognized by the core enterprises in the industry [19][4]. In our opinion, although the NQF RF still does not have legal confirmation, this document, elaborated with due regard to the European qualification framework, should be used in the course of works on establishment of national system of skills and qualifications. NQF RF should be considered as a functional tool for providing dynamic development of the vocational education system in accordance with the labor market's demands; it should be used during the development of both professional and educational standards.

General recommendations on the alignment of interests in the field of labor and employment. The main factor of the demanded skills formation is the alignment of interests and opportunities of business community, state, and educational facilities in the field of education and vocational training. Taking into account the peculiarities of the development of the system of the formation of skills development in Russia and the best international experience in this field, we have the following recommendations for specific groups.

Statistical Authorities and Organizations That Conduct Surveys among Employers and Employees

– Conduct surveys on figures of demand and supply for staff with vocational education on regional labor markets for various time horizons on a regular basis at least once per year.

– Include new criteria into the surveys, including level of development of skills; identification of expertise, knowledge, and skills; distribution of the working population by occupational groups and educational levels; distribution of employees with certain educational level by occupations, etc.

– Implement new data collection technologies, e.g., phone questionnaire surveys using computer-assisted telephone interviewing (CATI) technology, email questionnaire surveys, and online questionnaire surveys.

– Amend and update classifications of occupations and works (OKZ) and actively introduce the new Classification of Economic Activities (OKVED) and modernize the existing Russian National Classification of Occupations of Employees, Positions of Civil Servants and Wage Category (OKPDTR) in accordance with the needs of time and international standards, as well as control code compliance among these classifications.

– Consider the possibility of forming a new directory of occupations and qualifications that would enable one to integrate professional standards and existing classifications.

Educational System

– Annually reconsider basic vocational educational programs (BPEPs) for the purpose of meeting the requirements of federal state educational standards. BPEP modification should be accompanied by and follow behind their expert examination in relation to the compliance of training skills with current and long-term requirements of employers, as well as with regional specificity. This expert examination can be conducted In cooperation with the concerned representatives of employers, industries, educational system, and public administration. In turn, with the professional standards approved, the FSES should be modified.

– Increase the participation of employers' representatives in BPEP consideration and development in order to ensure harmony between staff training in the vocational education system and staff training and retraining in the education system where educational programs under specific order are implemented.

– Improve the motivation of vocational education institutions for annual BPEP modification in accordance with the changing demands of employers.

Employers

– Monitor the required skills in the enterprise and introduce the practice of medium- and long-term planning of the enterprise's development.

– Promote cooperation with the educational system through the creation of partnerships, joint ventures, and agreements for cooperative personnel development, internship, elaboration of educational programs, as well as other similar activities on a regular basis.

Employers and Representatives of the Educational System and the Ministry for Economic Development

– Elaborate the description of occupation profiles (qualifications) for the most critical professions in a labor market in high-technology economy sectors as a system of their quantitative and qualitative characteristics, including the lists of necessary skills.

– Create and maintain an interactive system containing detailed classification and description of occupation profiles that relate to qualifications, standards, and job duties, as well as structured lists of skills of employees demanded by employers in high-technology and other economy sectors.

– Approve common terminology and measuring tools and common language for all concerned parties in the process, including terms, methods of analysis and evaluation, and tools for assessing acquired skills.

[4] The document has been posted on the site of Legal Reference System Consultant Plus; however, it has not been officially published.

– Improve policy in the field of information distribution and occupational guidance, the development of appropriate systems, and the implementation of best practice at all levels of vocational and further education, primarily in relation to the access to education and vocational training and the recognition of skills and qualifications in order to support professional and territorial mobility of population.

Conclusions. The development of national labour-force capacity requires forecasting economy recruitment needs and timely changes in the professional and qualification structure of staff training. However, at present, issues of qualitative forecasting primarily connected with skills that developed in the process of education within the vocational and further education system are also very important in the field of labor and employment.

The proposed mechanism for translating labor-market requirements to the vocational education system enables one to identify the demanded skills of employees for various forecasting horizons. Under the conditions of the formation of an innovative economy, this facilitates the solution of the problem of the gap between the employers' needs and the staff-training system through the study of long-term prospects of economic, scientific, and technical development and forecasting the employers' demands for skills of future graduates.

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