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Education Excellence and Innovation Management through Vision 2020

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Integration of Science and Education in the Modern Kazakhstan

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Abstract

An article is analyzed the Kazakhstan legislation on science and other official documents. The purpose of the article is to show that integration of science and education represents process of interaction, cooperation of the scientific organizations and institutions of higher education in Kazakhstan. Authors were revealed the main reasons, which are caused a need of integration of science and education; they considered the structure of costs of scientific and technical works on financing sources. One of problems for the current education system is insufficient scientific training of the teaching staff (TS) of higher school owing to weak participation in research works. It is considered within the scope of article the problems challenging in integration process of the country; there are marked out their features; data on their influence on social and economic development are provided. The special attention is paid to a concrete example of the use of experience of Al-Farabi Kazakh National University.

Keywords: the higher education; science; students; competitiveness.

Introduction

Introduction of the innovative forms of integration of science and education, as foreign experience is shown, promotes to increasing of efficiency of the scientific research. Staffing of national innovative system and national economy in general has to become an ultimate goal of integration of science and education in Kazakhstan. The main directions of achievement of this purpose can be:

- improvement of quality of education and training of the scientific and technical staff, having modern knowledge at the level of the latest developments of science and technologies and the practical experience of participation in scientific researches, got in the process of training;
- involvement and fixing of talented youth in science and education;
- increase of efficiency of use of budgetary funds, personnel, information and material and technical resources of the scientific organizations and higher education institutions during the carrying out of the basic and applied researches and teaching of scientific staff;
- activation of interrelations with a business sector of economy and corporate science, processes of commercialization of results of scientific researches and developments and transferring of technologies in real sector of economy.

It is obvious that the essence of integration of science and education consists in formation of steady interrelations between scientific and educational activity, first of all on the basis of a project financing, management, stimulation and interaction. The science enriches the education with new knowledge; develops new, progressive methods of training; and together with it, education is the source providing the science for young staff.

The solution of many problems of development of scientific and educational activity depends on their effective interaction. The main objectives of the modern stage of integration of science and education in the Republic of Kazakhstan, in our opinion, have to become the personnel training for science and high technologies, stimulation of the scientific researches at leading universities, concentration of efforts of the academic and high school science on the priority directions, joint use of the expensive equipment. One of effective methods of the development of education is integration with science and industry. Such integration gives synergy effect and intensifies the development of all components of this triad. Unfortunately, in Kazakhstan the processes of integration of science, education and industry are still developed insufficiently. Today in the Republic it is actively going on the process of incorporating the scientific organizations with very uncertain purposes in the plan of requirements of development of science, commercialization of higher education institutions, which is promoted more to the competition, than to cooperation and integration.

Methods

Special sharpness at the modern stage is gained by insufficient orientation of the research and pedagogical personnel to innovative development of the country and their adaptation to the market realities of science and economy. The Kazakhstan education system generally realizes the traditional model of training, oriented on learning of the subject and disciplinary knowledge. Meanwhile today in the new conditions the specialist has to be oriented not on the necessary general basics, he must be oriented on the demand tomorrow.

Serious problem for the operating education system is the insufficient scientific training of teaching staff (TS) of the higher school owing to weak participation in research works. Now, the majority of higher education institutions in Kazakhstan were turned into the peculiar "Diploma factories" which were graduating of the specialists without taking into account the demand of some specialties in the labor market. It is aggravated the situation as a result with rather high unemployment rate among the persons, having the higher education or their employment not in the specialty received in higher education institution.

According to educational standards for four-year term the bachelor has to receive the fundamental training in the chosen area and the practical activities, to acquire the main technologies on the training direction, to get experience of practical activities and at the same time to be prepared for continuation his education for the master degree. Meanwhile the project of the State program of a development of education in the Republic of Kazakhstan for 2011 - 2020 provides creation of the research project institutes (RPI) and design bureaus. However at the operating qualification structure of university graduates of engineers will not be obviously enough and it will be required to increase the structure of engineering personnel considerably.

In the project of a State education program there is assigned the task: to provide with personnel with the higher and postgraduate education the projects of industrial innovative development of the country. For the solution of it there will be changed the structure of the state educational order according to requirements of the forced industrial and innovative development.

Results

Integration of science and education is one of the main objectives of the Concept of a development of education of the Republic of Kazakhstan. The President of Kazakhstan Nursultan Nazarbayev in the State of the Nation Address (November 30, 2015) "KAZAKHSTAN IN A NEW GLOBAL

REALITY: GROWTH. REFORMS. DEVELOPMENT” specified in the section "Foundations of a new investment policy" that it is necessary to increase the innovative potential of the Kazakhstan economy. It is important to lay the foundation for creation of economy of the future. It is necessary to develop competences of the sphere of smart technologies, artificial intelligence, integration of cyber-physical systems, power of the future, design and engineering. It can be done only through creation of effective scientific and innovative system. The powerful research universities and innovative clusters formed on base a high tech park "Astana business campus" of the Nazarbayev University and "Ala Tau" techno-park of in Almaty will be her basis.

The integrated scientific and educational structures are faced the solution of a number of problems. Institutional, organizational and administrative, legal and financial division of scientific and educational spheres was created their priority focus on the realization of especially branch tasks. So, the educational purposes which are especially brightly proved during formation of market economy when higher education institutions were commercialized and had been turned into service providers on educational space are priority in the higher education. Scientific researches were even more reduced or were gained purely formal character.

Unlike the academic or branch science, the workers of which have an opportunity completely to devote themselves to research work, high school teachers combine the last one with educational activity. Continuous changes in technology and the organization of educational process in higher education institutions have a tendency to involve a huge number of financial and human resources. For structure of teaching staff of higher education institution it is necessary optimum forms of the organization of work allowing to combine successfully educational and scientific types of activity. Besides an academic hours, growth of bureaucratization of educational process, transition to teaching in English at teachers more and more time is spent on development of educational and methodical documentation, preparation of different reports and references. (Aubakirova Zh.Ya., 2015).

Insufficiently inefficient state regulation has been led to an imbalance of structure of training of future specialists according to the directions of specialties, creating a slant on the preparation of the market specialties to the detriment of technical. As a result there is a great lack of process engineers and designers for a variety of modern high-tech areas of production. Most of employers aren't satisfied with quality of training of the specialists which were graduated by higher education institutions. Educational programs not always answer to the expectations of employers and don't correspond to requirements of economy.

The analysis of successful foreign experience was shown that one of the main conditions of effective system of generation of innovations is involvement in this process of higher educational institutions. In 2009 it was implemented 15 joint projects between the enterprises and universities of the Republic of Kazakhstan and it is shown very low level of cooperation. At the same time this situation is explained not so much by a lack of motivation of the enterprises to mass introduction of innovations as insufficient quality of research services that offer our higher education institutions. This problem, in turn, is caused by a lack of motivation of universities on development of own scientific competencies, as the main income they, unlike the western universities, receive from rendering educational services.

In Kazakhstan training of scientific and pedagogical personnel is carried out by Ph.D. program with graduation of degree of Doctor of philosophy (PhD) and Doctor on a profile. National, state universities and the scientific organizations conduct training of doctors of PhD together with foreign higher education institutions, as an indispensable condition of training of doctoral candidates is presence of the foreign consultant. Total number of doctoral candidates in 2014 was made 2063 persons, from them Doctor of philosophy (PhD) – 1 962, Doctor on a profile – 101. Graduation of doctoral candidates makes 314 persons, from them with the defense of a thesis – 125 persons or 40%. Specialties are most presented on the number of students: "Technical science and technologies" – 28%, "Social sciences, economy and business" – 13% and "Natural sciences" – 11%.

It should be noted also a problem of the international scientific communication and use of scientific information. In 2005 for the solution of this problem it was created the National center of scientific and technical information. In 2006 it was begun subsidizing of access to foreign databases for young scientists. Also this problem was connected with weak knowledge of foreign languages. The Ministry of Education and Science demands to increase scientific publications in English to 30, and then and to 50% on the scientific researches, financed from the republican budget.

Having signed the Bologna declaration, Kazakhstan was accepted the call of the European community, consisting in formation of united, global educational space and ensuring the academic recognition. For realization of the conceived plan there is introduced the system of three-level training of specialists – bachelor degree / master degree / doctoral degree; it is carried out the development of educational programs, syllabuses according to the Dublin descriptors; it was created the National Qualification Framework; it was introduced the program of the academic mobility of the students and teaching staff.

In 10 leading higher education institutions of the country there are introduced the principles of collegial management. Integration of education, science and innovations is carried out through active interaction of higher education institutions with business sector and production. One of key parameters of Bologna Process is the academic mobility of students and teachers. According to official data of the Center of Bologna Process and the academic mobility in 2014, 52 higher education institutions were invited 1726 foreign scientists (2013 – 1533 people, 2012 – 1 349 people, 2011 – 1717 people, 2010 – 418 people, 2009 – 389 people). Including, for the considered period from the countries of Europe there were invited – 785 scientists, East Asia – 85 scientists, Southeast Asia – 32 scientists, the USA – 140 scientists, the Russian Federation – 498 scientists, Republic of Belarus – 28 scientific, other countries – 158 scientists. The invitation of foreign teachers and consultants is carried out within the state order and at the expense of off-budget funds of higher education institutions.

Important problem was also the assessment of scientific researches, whereas of weak financing there were no the strict requirements of results. Today it is being introduced “the quote index” for an objective assessment of scientific researches. Introduction of “the quote index” promotes to the increasing of transparency of domestic science and on its basis there is carried out the system of an assessment of scientific researches.

In the recent years in the Republic of Kazakhstan there were made the certain steps in direction of the integration of science, education and production. However, the analysis of activity of the scientific organizations in the Republic of Kazakhstan shows that the majority of projects on development of innovative production are initiative developments, but not the regional or scientific-technical orders, i.e. developers invent any product, and subsequently, they are need to look for to it application and to find buyers of these inventions.

Meanwhile, the state order, in turn, isn't connected directly with requirements of business and it is determined by government bodies independently. It is shown the lack of relationships between science and the enterprises, figure 1(A state program of a development of education of the Republic of Kazakhstan for 2011-2020).

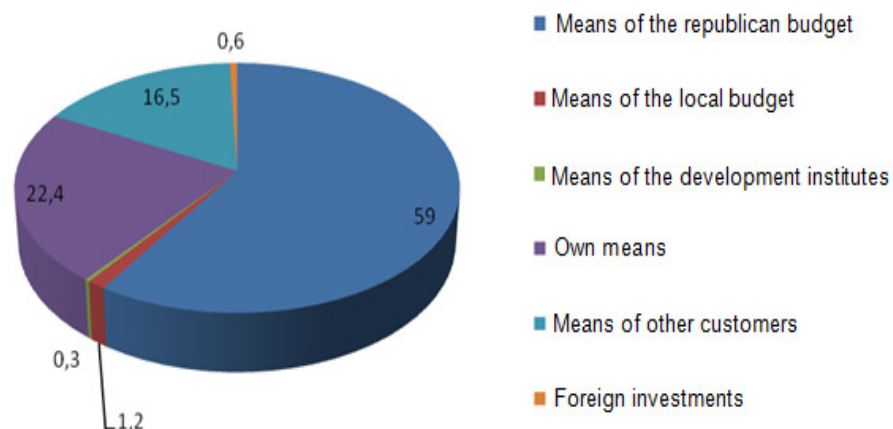


Figure 1: Cost structure of the scientific and technical work on the sources of funding

One of institutional gaps is absence of the formed base for creation and development of a network of offices of commercialization as a link between innovators and consumers of the innovations. Offices of commercialization are one of the components of support of commercialization and are created together with research institutes, higher educational institutions. The created offices carry out the following functions:

- determination of the inventions and technologies, having commercial potential – business ideas;
- management of process of commercialization of business ideas;
- assistance in determination of an optimal path of introduction into the market: the business project inside of the research organization, the spin-off company or sale of the license;
- determination and promotion of business ideas in the field of research services; technical consultation, analytical and expert services;
- search of appropriate partners at licensing – buyers of licenses and approval of license agreements;
- work with third-party experts in all spheres of commercialization;
- carrying out of the market researches and measures in support of potential projects;
- determination and establishing relationships with potential business partners.

In 2011 in the Republic of Kazakhstan there were created 9 offices of commercialization together with the following scientific research institutes and universities:

- “Institute of an Organic Catalysis and Electrochemistry named after D.V. Sokolsky” JSC;
- RSBSE (Republican state budget-supported enterprise) " Zhangir khan West Kazakhstan agrarian-technical university";
- RSBSE " Buketov Karaganda State University";
- Almaty Technological University JSC;
- RSBSE " M.Auezov South Kazakhstan State University";
- RSBSE " Institute of Biology and plant biotechnology";
- RSBSE "East-Kazakhstan State University named after S. Amanzholov";
- RSE on REM (Right of economic management) Al-Farabi Kazakh National University "Scientific and technology park";
- RSBSE "Karaganda State Technical University" (by Official site of Agency of the Republic of Kazakhstan on Statistics).

What is the current status of the integration process?

It is possible to note positive trends at the macrolevel, where the major factor is increase in financing: in 2011 there were appropriated 26,9 billion tenges, in 2012 – 46,6 billion tenges, in 2013 – 52,9 billion tenges (by National Innovative Fund). It was allowed to expand quantity and quality of fundamental researches. According to data of “National Center of Scientific and Technical Information” JSC, from 2010 to 2014 higher education institutions of Kazakhstan executed more than 60% of total number of the registered by research and development. It is connected with introduction of grant financing by results of the competitions, when higher education institutions received the greatest number of the supported applications on the submitted projects. At the same time 53,5% of all works are the fundamental researches, 46,2% are applied. Design and technological and experimental development works make only 3% so far. As the positive fact it is possible to note growth of number of the scientific researches which are carried out by higher education institutions at the expense of off-budget (own funds).

The number of publications in the international scientific journals, having an impact-factor, was grown during 2011-2014. The share of works of scientists of Al-Farabi Kazakh National University, L.N.Gumilyov Eurasian National University and Nazarbaev University in an array of the Kazakhstan documents makes about 40%.

Important point is involvement of researchers from the world academic market, the investment direction on development of the international cooperation in the scientific and technical sphere of higher education institutions, on the programs of teaching and student's scientific and educational exchanges. The state policy on support of high school science is realized also through creation of research universities. Nazarbaev University, opened in the capital of Kazakhstan in the summer of 2010, already had been become a national brand of the domestic higher education, combining advantages of the checked decades the national education system and the best world scientific and educational practice. But, except Nazarbayev University, there are a number of the universities which were passed process of institutional transformation. There were passed through a merge of the scientific potential the Kazakh National Technical University named after K.I. Satpaev and Research Institutes of the National Scientific and Technological Holding "Parasat", at the end of 2015 they were merged to the Kazakh-British Technical University, Al-Farabi Kazakh National University and Scientific Research Institute "Gylymordasy", the Kazakh National Agrarian University and “KazAgroInnovation” JSC, S. Seifullin Kazakh Agro Technical University and the National Center of Biotechnology. Within new form of cooperation there are updated programs, in addition, it was given 350 places for the master degree program and 100 places for the doctoral studies. It will be provided carrying out of joint fundamental and applied researches, creation of the conditions for functioning of modern scientific infrastructure and introduction of the scientific developments (by The resolution of the government of the Republic of Kazakhstan from March 26, 2014).

Multiplicity of financing sources is characteristic for research universities: federal and local budgets; grants; charity and trustee funds; business; income from educational, research, production and consulting activity. So, in the USA 13,3% of all financial resources is related to the federal government, to the government of states – 30,3%, to the local authorities – 2,7%, to the private sector – 4,9%, to the students – 33,1%. Another 15% of means in the budget of the higher school are related to the higher education institutions at the expense of the funds and the income (by Adil Ibraev).



Figure 2: Comparative analysis of the science in US and Kazakhstan

The following solution is submitted in synchronization of training of specialists with inquiries of regions. The system measure, which could be stimulated by interaction of higher education institutions and production in the scientific and technical sphere, can be a creation of tax conditions, which would give to business of benefit from cooperation with universities. And in the world such examples have already been had. In Japan the property tax concerning the equipment, acquired by the enterprise for implementation of the scientific project, placed at the university, decreases twice. Tax crediting practice for interaction of corporations and universities is also widespread in this country.

Conclusion

As for the level of universities, the following changes are necessary there. Scientists have to have real opportunities and incentives to be engaged in scientific researches, it is necessary to train in management of innovative projects, marketing of innovations and innovative production, a transfer of technologies, patenting and other forms of intellectual property protection, formation of innovative networks in scientific and industrial communities. It is felt the acute shortage of professional scientific personnel in higher education institutions. According to data of 2014, from 40,3 thousand teachers only 9,7 thousand people were involved in the science. And at an employment equivalent in 0,28 at recalculation for full time the number of scientists in higher education institutions didn't exceed 2,7 thousand people from whom only 1 075 people (39,5%) had the highest academic qualification. At the same time in the Kazakhstan scientific research institutes 5,7 thousand experts with the highest scientific preparation are involved in science. Secondly, there are necessary changes in the labor legislation, in particular, for the Labour code. Rigidly regulated requirements both to scientists, and to the workers, who are engaged in teaching activity, are limited the opportunities for involving to work of potential candidates. Thirdly, it is necessary to eliminate internal and external normative and legal barriers between science and education; to make system of financing of high school science more flexible (it means the provision of the sufficient amounts of financing), and also to provide a long term of the state guarantees on the financing. Fourthly, the system of formation of scientific and technical priorities, existing in the country, doesn't allow concentrating efforts on really important scientific directions. On the basis of officially fixed list of the priority directions of development of science and equipment it is difficult to make the reasonable decision on financing of these or those research projects. By the way for today, the concept of the priority directions of development of science is absent in the republican legislation. It is a serious problem, which is reflected in the process of reformatting of the Kazakhstan economy towards high technologies and innovations (by National Innovative Fund).

On the example of functioning of the domestic universities it is possible to describe results of integration of science and education in Al-Farabi Kazakh National University:

1. Application of modern technologies for the solution of practical tasks in the industry and economy of the region, focused on rational use of resources and energy saving. The university has the unique potential for Kazakhstan, allowing to conduct at the highest level the fundamental researches, to perform developmental works.
2. Commercialization of the science intensive production: the organization of stream-handling development of commercial web services, the solution of a problem of engineering design and the analysis with use of high-production services.
3. Development of infrastructure of scientific and innovative activity, including reequipment of scientific divisions of the university and its installation. There are integrated the design and developmental divisions of the engineering partner enterprises and it will be allowed to fill in the functions of the lost branch research institutes and to create conditions for development of again created laboratories to the level of full-fledged research institutes on research of the university.
4. The international scientific cooperation by involvement of the leading foreign scientists (including foreign research supervisors of doctoral candidates) for exchange of experience and increase of efficiency of research activity of the university.
5. Improvement available and creation of new educational resources and technologies taking into account requirements of employers, representatives of hi-tech business.
6. Integrative forms of interaction of education, science and business are tested. In particular, there are included into the structure of higher education institution: venture investment fund, techno-park, small innovative enterprises, etc.

Integration of science and education in Al-Farabi Kazakh National University is carried out by means of the following measures: 1) creation of the conditions and incentives of the international academic mobility, especially for young teachers and the best development by them foreign languages for ensuring such mobility; 3) ensuring access to electronic full text resources in the database of widely famous scientific publications in the world; 4) development of grant financing of the scientific researches at the expense of means of the higher education institution and strengthening of the material and technical resources of science; 5) creation in higher education institution of the joint scientific training centers on the basis of the scientific organizations and the enterprises, and in the scientific institutions — departments, the organization of their effective work; 6) increase in number of partner agreements between high school and scientific institutions on carrying out joint scientific researches, professional practice and internship of the students, masters and doctoral candidates, involvement of the representatives of the academic and branch science for teaching, especially for the level of postgraduate education. A new step in a solution of the problem of integration of science and education is become a creation as a part of the Republican state enterprise on the right of economic management "Gylymordasy" of the Committee of science of MES RK of the experimental educational programs on the master degree and doctoral studies. These programs are realized together with Al-Farabi Kazakh National University within signed (July 23, 2014) by heads of two organizations of the General framework agreement about integration of science and education (E.V. Neborskiy (2011). The adopted experimental educational programs allow to the university and scientific research institute to carry out joint training of 100 masters and 48 Doctors of PhD as experiment. In the process of the realization of these programs there is involved in training the university teaching staff and scientific potential of SRI. Such approach creates opportunities for inflow of youth to the scientific sphere, implementation of joint scientific projects of the scientific research institute and Al-Farabi Kazakh National University, involvement of the scientists to carrying out studies in higher education institution and together with it a real integration of science and education. For today this educational project is new to the republic. And, as far as such form of cooperation of the institutes of science and education is introduced in Kazakhstan for the first time, there will be appeared the problems during its implementation. First of all, it is about adaptation of scientists to the environment of the higher education, where there are a number of rules on the organization of educational process and preparation of educational methodical documentation (Aubakirova Zh. Ya., Medukhanova L.A., Aytbembetova A.B. (2015).

Thus, now the principle of integration of educational and research activity in the higher education takes new contents in Kazakhstan, generates a number of the actual problems, demanding the comprehensive analysis, discussion and the most important — developments of the effective and acceptable for all its participants ways and mechanisms of its realization. It is obviously impossible in a directive way to combine in higher education institutions and scientific institutions the processes of training and scientific activity without loss of quality of both kinds of activity.

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