

## NEWS

OF THE NATIONAL ACADEMY OF SCIENCES OF THE REPUBLIC OF KAZAKHSTAN  
SERIES OF SOCIAL AND HUMAN SCIENCES

ISSN 2224-5294

Volume 4, Number 320 (2018), 49 – 56

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## INTEGRATION OF EDUCATION, SCIENCE AND BUSINESS: FOREIGN AND DOMESTIC EXPERIENCE

**Abstract.** The system of higher education plays an important role for the innovation economy in the sense that it is this field of economic life that forms the frame of the new economy. Therefore, creation of an innovative environment causes significant changes in the education system aimed at improving the quality of the educational services provided, the formation of various forms of training and further training, as well as the development of both practical and research competencies of graduates capable of creating innovative products. In Kazakhstan, the foundation of an innovative environment is being created. In his Message to the people of Kazakhstan, N.A. Nazarbayev outlined the task of developing mechanisms for the transition of the country's universities to innovative activities. [3] To date, there is an urgent need to develop mutual integration of education with science and business, since it is cooperation through which knowledge, technology and innovative developments can be effectively exchanged, and ideas can be translated into real products. Today, the requirements for the results of the education system are changing; the demand for massiveness of creative competences and readiness for retraining is growing. These new requirements can be implemented, as the practice of foreign universities in research universities demonstrates. Research universities have proved their effectiveness not only as a successful model of training specialists, but also as a channel for introducing innovations into the economy, which contributes to the development of regions and various industries.

**Key words:** high education, business, innovative, university, research, integration.

### Introduction

Currently, the key resources for the development of the economy and society are: knowledge, information, education. It is their anticipatory movement that determines the quality and standard of living of the population, the positions of countries in the world technological markets. The future of Kazakhstan is connected with innovative development and the important role of formation of the economy based on knowledge belongs to higher education. Traditionally, universities are considered to have two functions: educational and research. Many research universities supplement these functions with a third one – transfer of knowledge, which is an integral part of the innovation system. The society is gradually developing a new approach to the perception of the role of the university – promoting economic development and transfer of technological innovation.

Improving the quality of education, training of highly qualified specialists is impossible without modernizing the system of higher education. At present, the process of modernization of the educational system continues in the Republic of Kazakhstan. Within the framework of this process, a new model of universities which actively integrates with business is being formed. As noted in the State Program for the Development of Education in the Republic of Kazakhstan for 2011-2020, it is the establishment of research universities in Kazakhstan that will serve to integrate education, science and production, provide conditions for the commercialization of intellectual property products and technologies and the training of highly qualified scientific and pedagogical personnel.[1] This process is successfully implemented in foreign countries and has proved its effectiveness not only as a successful model of training specialists, but also as a channel for introducing innovations into the economy, which contributes to the development of regions and various industries. In such universities, students within the university acquire not only

fundamental theoretical knowledge, but also practical skills and professional competencies, and the business receives qualified specialists ready to start work immediately after graduating from the university and apply innovative technology. This, in turn, actualizes the need to study relevant foreign experience, where the activities of research universities have been carried out for the last decades, with the goal of identifying the potential that can constructively contribute to the development of its own concept of designing ways for the development of higher education in the Republic of Kazakhstan.

**Analysis of recent research and publications.**

It is believed that universities traditionally perform two functions: educational and research. The original medieval universities were created as houses of knowledge, and their structure was the most effective at that time to provide education.[5]

Currently, the Humboldt model of the university dominant from the 21<sup>st</sup> century can't provide answers to the challenges of the modern society. It assumes that the activities of university scientists are financed by the state, that they produce fundamental knowledge in the conditions of academic freedom and that they deliver this knowledge to students in the volumes and forms optimal for the teacher. [2] But to date, knowledge and creativity are increasingly valued instead of awareness. We receive and provide information to others, and in most cases the success in technology, as well as the competitiveness of our country depend on the reality of the quality and speed of data transmission, on modern means of computer science and its innovation. Possession of information, its circulation, storage, proper use is a necessary, but already inadequate condition for achieving and maintaining a technological advantage and global competitiveness. [3] The main limiting factor is not land, as in the case of an agrarian society, not capital, as in an industrial society, but knowledge. As society develops, one can easily see the fact that knowledge, innovations and methods of their practical application are increasingly seen as a source of profit. [4] Graduates require developing knowledge, creativity and readiness for self-actualization instead of simple awareness. For competitiveness, propensity for innovation and the ability to steadily and continuously increase intellectual potential are absolutely necessary. I. Shumpeter, developing the idea of K. Marks about the excess profit received by innovators, showed that entrepreneurial income above the normal is achieved by those who know how to anticipate new trends in the development of supply and demand, find unoccupied niches of the market, introduce new products, technologies, management methods on the basis of "implicit knowledge" of their market segment. [5]. Instead of traditional meeting the demand for highly qualified personnel, universities also need to focus on the requirements of leading innovative enterprises, and not on their current needs, but on strategic plans for the future. Universities in their work face the need to adapt the internal culture, practices and organizational structure. Despite the relevancy of interaction between higher education institutions and the business community with a view to gaining a competitive advantage, recognizing that appropriate business interventions contribute to effective work, unfortunately many universities are not yet ready to interact with business [6].

In order to facilitate the development process, universities need to adopt a new strategy and create universities that will adhere to the strategy of integrating higher education institutions with business, which in turn will allow them to respond quickly to changes in the environment.[7]

At present, the concept of a market-oriented innovative university based on the "triangle of knowledge" is dominant in science and practice is. [8] "Triangle of Knowledge" is a system of interaction between education, research, science and innovation. This definition has become widespread in Europe and the world after the adoption of the Lisbon Strategy in 2000. At present, there is the OECD Project "Triangle of Knowledge".

According to the Bologna process, the higher school is at the intersection of the education system with the fields of research and innovation, and is also a key factor of competitiveness. Later, the European Institute of Innovation and Technology (EIT) adopted this term and transformed its structure, replacing the top of "innovation" with "business". According to EIT, innovations are born as a result of interaction of the vertices of the triangle of knowledge.

Underlining the importance of the "Triangle of Knowledge", it is necessary to understand that the transition to higher level integration can't do without an even more thorough adaptation of the institutes of

innovation development, research and education. It is no longer enough to supply future claimants upon global competitiveness with information, to give them the opportunity to learn the teaching material, and then to leave them alone. Acquiring and implementing the acquired knowledge requires joint efforts, integration of education, science and the real sector of the economy. Although all three components of the innovation process in the "Triangle of Knowledge" remain autonomous, they also complement each other in interactions. A distinctive feature of an economy based on knowledge is that not so much natural resources and cheap labor force define the competitiveness of modern society as its resource, that is, the mental power of the nation. The center for the reproduction of the intellectual potential of the society is university as the only organization where the intellectual elite reproduces, which then works in other branches of knowledge production.

The status of today's university in society and the state determines the new function of the university – the function of the integrator of knowledge. University becomes a leading participant and an organizational mediator of the integration of educational and scientific structures with production, cultural institutions and power structures. The purpose of this integration is solving interdisciplinary tasks of education and science, as well as implementable innovative activity. [2]

#### **Foreign experience of research universities.**

The integration of education, research activities and production in foreign universities evolved during the second half of the 19<sup>th</sup> century – the beginning of the 20<sup>th</sup> century. Approved integration models have proven their viability and, furthermore, promising outlook. For example, the American model of integration, being one of the most productive, is indicative in that aspect that the graduates of such universities become laureates of Nobel Prizes. It is their pilot developments that then grow up to a conveyor flow in technology companies, providing both scientific and technological development and multimillion profits. [3] For example: high-yield licenses for university technology such as energy drink Gatorade (University of Florida), human growth hormone (University of California, San Francisco), hepatitis B vaccine (California, San Francisco), Taxol chemotherapy medicine (University of Florida), as well as successful world-class companies with university roots, such as Cisco, Google, Yahoo (Stanford University) and Facebook (Harvard University) [9]. The activities of Silicone Valley companies (Stanford University) led to three world innovative breakthroughs. These are discoveries in semiconductor technology in the 70's, computer technology in the 80's and network technologies and the Internet in the 90's. For several decades, the Silicone Valley has turned into a profitable enterprise from a bold experiment: the total annual income of four thousand companies located in the valley amounted to two hundred billion dollars.

It is the research universities that have a special role in the creation and preservation of knowledge. Jonathan Cole: "they are capable of providing a significant part of the most important fundamental knowledge and practical research of discoveries that are created in the world". [4] The main principle of activities of the research university is "learning through research", generation of new knowledge and innovations.

The most important stages in the process of integrating education, science and production in the leading universities of the world are as follows:

a) From the end of the 19<sup>th</sup> century to the beginning of the 50's of the 20<sup>th</sup> century – the conceptual stage that designated fundamentally new approaches to determining the role and function of universities: from the accumulator of knowledge (the former European model) to the production of new knowledge.

b) 50's – 70's of the 20<sup>th</sup> century – the differential stage – creation and activities of research universities and technology parks. The development of scientific and technical achievements strengthened the role of small business as a direct platform for the introduction of scientific achievements.

c) 1980s – the beginning of the 21<sup>st</sup> century – the extrapolation stage – creation and operation of technopolises, large scientific and research areas, including universities, national research laboratories and institutions in which new knowledge is being regenerated.

The integration forms in each country, and partly in a single university, are carried out specifically, which necessitates research diversity of forms of integration by the example of universities of the American, Japanese and European models. A variety of forms of integration can be seen in the following table.

Table 1 - Types and forms of integration of research universities

Integration types	Countries	Key role	Integration forms	Development stages	Universities' rights
American	USA, Great Britain, Canada, Australia	University	Research parks, business incubators	from 1980-1984 (Bayh-Dole Act "On Patents, Licenses and Trademarks in Federal R&D Programs" from 1985 till present (Stevenson-Wylder Technology Innovation Act)	Universities have the right of ownership of inventions created at the expense of state funds; have the right to issue exclusive licenses to patents
Japanese	Japan, China, Hong Kong, South Korea, Brazil, India	State	Technopolis		
European type	Germany, France, Belgium, Netherlands, Finland	Technological parks structures	Technological and research parks		

Compiled by the author on the basis of sources: [3,6,5 ]

Based on existing world experience and research in the field of the development of world-class research universities [3] and the data indicated in the table, it can be argued that the research university is characterized by:

- close integration of teaching and research at all stages of the educational process;
- a high proportion of students enrolled in Master's and Doctoral PhD programs and a smaller proportion of first-stage students;
- a large number of special postgraduate programs;
- there is a smaller number of students per teacher and less training load than in ordinary higher education institutions;
- conducting major fundamental research financed mainly from the budget and various non-commercial funds;
- a close relationship with business and a well-established commercialization of the results of scientific research, carried out in the university space, mainly in research parks;
- close integration with the world's research centers;
- determining influence on regional scientific and technical, as well as socio-economic development.

Not all universities in the US are research universities. There is a certain amount that the country can afford. Out of 3,300 American universities, only 100 are research universities. It is they that account for the vast majority of federal appropriations for research carried out in universities, and the overwhelming number of doctoral degrees awarded. Creation of new businesses based on university research and technology accounts for only a small proportion of about 3% of the total number of new companies. [9] As for patent activity of the world leaders in scientific and innovative activity of universities, only 13 thousand out of 225 thousand registered patents were issued by universities.

#### **Development of research universities in the Republic of Kazakhstan.**

For Kazakhstan, the format of the research university is almost unknown and new. However, the idea of creating a research university is already implemented in practice by the example of the Nazarbaiev University. Along with leading Kazakh scientists, international professors from the USA, Canada, Great Britain, Italy, China, South Korea and other countries teach here. More than 3,000 students study under the programs of pre-university preparation, bachelor's, master's and doctoral studies. 2015 was marked by the first graduates of the University bachelors (380 people). 142 people graduated from the master's degree program. According to Nazarbaiev University, about 2/3 of them continued their studies at the Massachusetts Institute of Technology, Stanford University, University College of London, Duke University, the National University of Singapore, the University of California Berkeley, Columbia



University, the London School of Economics and Political Science. At the same time, 42% of graduates study under grant programs of foreign universities.

The partnership model at Nazarbaiev University, which provides for the establishment of a university that performs general coordinating and property management functions, with transfer of its academic units to joint management with leading foreign partner universities, is aimed at the following:

- the development of unique academic programs of the university in priority Kazakhstani areas and specialties together with a foreign academic partner university being for each of the schools (institutes);
- joint development of corporate governance systems of the university, quality control systems and evaluation of the educational process;
- selection and appointment of the deans of the university's schools and the main foreign teaching staff (TS);
- training of Kazakhstan professors and teachers on PhD programs, who will gradually replace foreign TS;
- joint research in laboratories and scientific centers of the university.

Creation of research universities and approval of their status is an important and necessary step towards the modernization of the national system of higher education. However, only a small number of republican universities have such prospects and real chances. The status of the research university assumes a number of conditions that are difficult for the majority of universities:

- strong financial support, including from the state;
- the prevalence of master's and doctoral programs over bachelor's programs;
- a sharp decline in the pedagogical load for teaching staff engaged in research sector.

Implementation of the principle of the triunity of education, science and production facilitated the beginning of the process of infrastructural transformation of the country's higher school. High requirements of the labor market for the training of qualified personnel presuppose the strengthening of the MTB high schools.

The innovation structures of 37 state universities of the country are represented by 541 research departments, 16 commercialization offices and 7 business incubators. Out of 10 technological parks of the country, three are located at the universities (Kazakh National University named after al-Farabi, Kazakh National Technical University named after K. Satpaiev and Eastern Kazakh State University named after D. Serikbaiev). This contributes to the creation of high technologies and the promotion of innovation culture, management of knowledge and technology flows between universities, research institutes and business structures (Table 2).

Table 2 - Information on business incubators located at higher education institutions of the Republic of Kazakhstan

University name	Services provided by the business incubator
Eurasian National University named after L.N. Gumilev	development of entrepreneurship and innovation among young people, improvement of the scientific, innovative and educational process in the direction of entrepreneurship at the university, improving the quality of training of young professionals through the introduction of systematic training in the study with practical participation of students in the development and commercialization of business projects
Western Kazakh State University named after M. Utemisov	promotion of scientific and creative projects of student groups in the real market and increase of competitiveness of graduates in professional activity
Kazakh Agro-Technical University named after S. Seifullin	development of students' business ideas with entrepreneurs
Kazakh National University named after al-Farabi	monitoring of innovative business ideas and research projects, identification of talented undergraduates and doctoral candidates who demonstrate the ability to innovate in project activities
Kokshetau University named after A. Myrzakhmetov	assistance in the implementation of innovative projects, consulting and training by professionals in various business areas
Taraz State University named after M.Kh. Dulati	development of small- and medium-sized businesses (preferably in the innovation field) through the creation of optimal (greenhouse) conditions for the incubation and establishment of new enterprises at all stages (from the origin of the idea to the realization of their product)
Miras University	support of student entrepreneurship

Source: Review of higher education policies of OECD. Final report for 2015.

Training of highly qualified specialists in priority sectors of the economy is carried out on the basis of 15 national scientific laboratories of engineering profile and open type at the leading universities of the country.

Since 2013, the MTB of universities has been strengthened by innovative laboratories for the implementation of research projects (“Study of the problems of the fuel and energy complex”, “Energy Monitoring and Expertise”, “Industrial Ecology”, “Energy”, “Nanoelectronics”, “Automatic Process Control Systems”, “Means of Cryptographic Protection of Information and Information Security” etc.).

Since 2011, Nazarbaiev University’s scientific projects have been carried out in cooperation with 350 international universities and institutes. This includes Princeton University, Cambridge University, Oxford University, Harvard University, Columbia University, University of Tokyo, University of Hong Kong, Max Planck Institute, the National University of Seoul etc.

In 2015, the National Laboratory of Astana of the Nazarbaiev University implemented more than 100 research projects with the involvement of financial resources of national and international organizations and companies (World Bank, European Commission, British Council). The work of the Center for Life Sciences and the Center for Energy and Science on new materials has been launched. Scientific research activity is transferred to Kazakhstan universities.

In 2014, the status of the leading research university was assigned to the Kazakh National Research Technical University named after K.I. Satpaiev. Activities of the university for cooperation with leading scientific centers and universities promotes integration into the European space. This allows us to train personnel and conduct research in the field of engineering and technology in accordance with international standards and needs of SPPID-2.

The successful implementation of the “Commercialization of Technology” project under the Loan Agreement with the International Bank for Reconstruction and Development (2008-2015) is marked. Assistance was provided to scientists and researchers in the conduct of scientific research and commercialization of their developments. 40 out of 65 supported projects reached the level of sales of finished products totaling more than 900 million tenge.

A successful scientific achievement was the creation of the International Materials Science Center at the Karaganda State Technical University. The Center is a modern model of the laboratory center, the activities of which are aimed at developing services in the scientific field.

In 2016, the “Stimulation of Productive Innovations” program was launched with the support of the World Bank. Within the framework of one of the stages of the project, it is planned to create an interconnected network of 5-6 effective commercialization offices of technologies at the universities of SPPID-2 and Nazarbaiev University. Another important step in the further development of the system of commercialization within the framework of the implementation of the Plan of Nations “100 specific steps” was the adoption of the Law of the Republic of Kazakhstan “On the Commercialization of Scientific and (or) Research and Technical Activities” (64 steps). At the legislative level, mechanisms for supporting the connection between science and business are envisaged. This is the provision of benefits to buyers of licenses for technology, providing funding for the activities of technology commercialization offices and the introduction of a new type of grant for the commercialization of technologies.

Activities of the public association “Alliance of Professionals in Technology Commercialization” is aimed at helping to increase the competencies of employees of technology commercialization offices, universities, technological parks, business incubators, technology enterprises and other interested parties. The Council of the association included representatives of commercialization offices of the country’s largest universities.

Despite the orientation of the country’s universities to the research activity of Kazakhstan’s position on the examinational indicator “Cooperation between Universities and Business” in the GCI-2016, it remains stably low occupying the 66<sup>th</sup> place, but compared to 2015, it rose to +22 points (2014 – 88<sup>th</sup> place, 2015 – 88<sup>th</sup> place, 2016 – 66<sup>th</sup> place), the indicator “Technology Introduction at the Enterprise Level” is at the 71<sup>st</sup> place and the indicator “Quality of Research Organizations” has improved by 18 positions [1]. This testifies to the large reserves of the university system of Kazakhstan. These improvements are the merit of state programs aimed at the development of education. Thus, the role of the development of research universities in our country in ensuring the competitiveness of the state is obvious.

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ӘОЖ: 33/2964

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### БІЛІМ, ҒЫЛЫМ ЖӘНЕ БИЗНЕСІНІҢ ИНТЕГРАЦИЯСЫ: ШЕТЕЛДІК ЖӘНЕ ОТАНДЫҚ ТӘЖІРИБЕ

**Аннотация.** Жоғары білім беру жүйесі инновациялық экономика үшін маңызды рөл атқарады, себебі экономикалық өмірдің осы саласы жаңа экономиканың кадрлық негізін қалыптастырады. Осыған байланысты білім беру жүйесіндегі интеграциялық үдерістер көрсетілетін білім беру қызметтерінің сапасын арттыруға, даярлау мен біліктілікті арттырудың түрлі нысандарын қалыптастыруға, сондай-ақ инновациялық өнімдерді жасауға қабілетті түлектердің кәсіби, сонымен бірге зерттеушілік құзыреттерін қалыптастыруға бағытталған ерекше өзгерістерге негіз болады. Бүгін білім беру жүйесінің нәтижелеріне қойылатын талаптар өзгеруде, өйткені креативті құзыреттердің көпшілікке ортақтығы және оның қажеттілігіне байланысты қайта оқытуға дайын болуына деген сұраныс артуда. Мақалада шет елдік университеттердің тәжірибесін зерделеу негізінде отандық тәжірибеде оның озық тұстарын қолданылу мүмкіншіліктеріне назар аударылған. Зерттеу университеттері мамандарды даярлаудың сәтті моделі болуымен қатар, сонымен бірге инновацияларды экономика саласына енгізу каналы ретінде де өздерінің тиімділігін дәлелдей отырып, зерттеу университеттер

өнірлердің және өндірістің түрлі салаларының дамуына ықпал ететіндігі айқын байқалатындығын дәлелдеп отыр. Мақалада отандық зерттеу университеттерінің алғашқы қадамдары мен жетістіктеріне тоқтала отырып зерттеу университеттерінің шетелдік тәжірибесін пайдалану маңыздылығы артып отырғандығы негізделеді.

Қазақстанда инновациялық ортаны құрудың негізі қалыптасуда. Н.Ә. Назарбаев өзінің Қазақстан халқына Жолдауында еліміздің жоғары оқу орындарының инновациялық қызметке көшу тетіктерін әзірлеу міндетін белгіледі. [3] Бүгінгі күні білімнің ғылыммен және бизнеспен өзара интеграциялануын дамыту мәселесіне ерекше көңіл аударылып отыр, себебі ынтымақтастық арқылы біліммен, технологиялармен және инновациялық зерттемелермен тиімді алмасуға, сонымен бірге идеяларды нақты өнімдерге айналдыруға болады.

**Түйін сөздер:** университет, бизнес, зерттеу, инновация, интеграция, жоғары оқу орны.

УДК: 33/2964

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### **ИНТЕГРАЦИЯ ОБРАЗОВАНИЯ, НАУКИ И БИЗНЕСА: ЗАРУБЕЖНЫЙ И ОТЕЧЕСТВЕННЫЙ ОПЫТ**

**Аннотация.** Система высшего образования играет важную роль для инновационной экономики в том смысле, что именно эта сфера экономической жизни формирует кадровый каркас новой экономики. В силу этого создание инновационной среды обуславливает значительные изменения в системе образования, направленные на повышение качества предоставляемых образовательных услуг, формирование различных форм подготовки и повышения квалификации, также выработку как практических, так и исследовательских компетенций выпускников, способных создавать инновационные продукты. В Казахстане создается основа инновационной среды. В своем Послании народу Казахстана Н.А. Назарбаев обозначил задачу выработки механизмов перехода вузов страны к инновационной деятельности.[3] На сегодняшний день остро стоит необходимость развития взаимной интеграции образования с наукой и бизнесом, поскольку именно через сотрудничество возможен эффективный обмен знаниями, технологиями и инновационными разработками, а также воплощение идей в реальные продукты. Сегодня изменяются требования к результатам системы образования, растет запрос на массовость креативных компетенции и готовность к переобучению. Эти новые требования возможно реализовать, как показывает практика зарубежных университетов в исследовательских университетах. Исследовательские университеты доказали свою эффективность не только как удачная модель подготовки специалистов, но и как канал внедрения инноваций в сферу экономики, что способствует развитию регионов и различных отраслей производства.

**Ключевые слова:** университет, бизнес, исследование, инновация, интеграция, высшее образование.