

Establishment of agricultural research universities and their role in the innovative development in the Republic of Kazakhstan

Establecimiento de universidades de investigación agrícola y su papel en el desarrollo innovador en la República de Kazajstán

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ABSTRACT:

The problem with the establishment of research universities is determined by the need in involving the institutional scientific potential into the modernization of the national economy. The article defines research universities as a modern form of integration of education and science. The paper contains a comparative analysis of activities, structures and peculiarities of world-class universities. The analysis of the best practices enabled to determine the following peculiarities of the most advanced world research universities: high quality human resources; continuous cooperation with employers and consumers of research and development, consumer market; own modern research-and-development and experimental infrastructure, research facilities; independent management. The work includes recommendations on the establishment of agricultural research universities. The stages of establishing research universities in the

RESUMEN:

El problema con el establecimiento de universidades de investigación está determinado por la necesidad de involucrar el potencial científico institucional en la modernización de la economía nacional. El artículo define las universidades de investigación como una forma moderna de integración de la educación y la ciencia. El documento contiene un análisis comparativo de las actividades, estructuras y peculiaridades de las universidades de clase mundial. El análisis de las mejores prácticas permitió determinar las siguientes peculiaridades de las más avanzadas universidades mundiales de investigación: recursos humanos de alta calidad; Cooperación continua con empleadores y consumidores de investigación y desarrollo, mercado de consumo; Propio moderno de investigación y desarrollo y la infraestructura experimental, instalaciones de investigación; Gestión independiente. El trabajo incluye recomendaciones sobre el establecimiento de

Republic of Kazakhstan are determined herein. The key principles of the agricultural research university under formation are also considered.

Keywords: research university, education, innovative development

universidades de investigación agrícola. Las etapas de establecimiento de las universidades de investigación en la República de Kazajstán se determinan aquí. También se consideran los principios clave de la universidad en formación en investigación agrícola.

Palabras clave: universidad de investigación, educación, desarrollo innovador

1. Introduction

A new industrial policy in the Republic of Kazakhstan is focused on technical and technological re-equipment of operating enterprises, construction of new industrial units, and creation of the proper economy. This process shows commitment of the national economy to the dynamic diversification, expansion and strengthening of its stability basis (S. Seifullin Kazakh Agrotechnical University Development Program for 2015-2019, 2015).

A system that combines settlement of current problems, elaboration of the necessary technological advance to improve agricultural stability and competitiveness was substantiated to determine the priorities of agrarian research. The structure of the research priorities is relatively stable and includes the following issues: 1) product competitiveness; 2) environmental effect of agricultural production; 3) development of rural areas and rural standard of living. At the same time, it is necessary to cut down production and to reduce greenhouse gases emissions, water consumption and adverse environmental effects. Today, competences acquire a new social measurement, falling in a row with conventional factors that define development of public production – labor, land, capital, placing education among global factors of social development, mitigating imbalances in the world economy, forming political stability and stable development (Kazakh National Agrarian University Development Strategy 2020, 2015; Trainev, 2008).

Under growing globalization processes, modern and postgraduate education is to provide the Republic of Kazakhstan with internationally competitive human resources. That's why a new specialist, accustomed to requirements of the common economic area to the maximum extent possible, is to be trained according to world standards through further improvement of educational content, form and aids. The economic strength and success of the country depend on its capability to produce and introduce innovations into all spheres of societal life. The competitiveness of modern Kazakhstan is largely determined by the education level.

In 2010, the Republic of Kazakhstan entered into the European Higher Education Area and became the first Central Asian country participating in the Bologna Process. Implementations: a three-tier system of specialists training: bachelor – master – doctoral degree; a credit learning technology and modern information and communication technologies (Mukhametkaliyev, 2011).

Under continuous modernization of the local higher professional education, as well as establishment of national research universities and institutions, the development strategy enters into the foreground. The status of the research university is a high time-, efforts- and money-consuming aim (Seidakhmetova, 2014).

Nowadays, measures taken by the Ministry of Education of the Republic of Kazakhstan in terms of transforming the leading national institutions into research universities within the Bologna Process, based on the experience and the type of the same programs and foreign scientific and educational centers, comply with the content and the genius of national priorities.

2. Methodology

Classical universities and institutes are traditionally considered as a source of fundamental knowledge and skills. At present, in the period of education integration, lead nations experience shows that the key role in the innovative development of the country belongs to research universities. The research university is a scientific and educational complex with a well-

developed innovative infrastructure (training facility, laboratories, research institutes, design office, business incubators, technological parks, research and design organizations), realizing a full-cycle profit-making innovative activity, that is able to train specialists with innovative ventures skills (Sitenko, 2012).

The research university concept responded to new public needs: the public expects that the university will contribute to the social and economic development under the growing research intensity of production. The goal of the research university is to organize interaction and coexistence in the united physical space and interactive mode for the following processes: education, scientific activity and commercialization of results.

The research university model is built on three interactive components: education, research and innovation. The previous model included only two functions of the university – advancement of fundamental science and education. The modern model acquires the third function – information transmission “flow” or “knowledge transfer” (Strongin, & Grudzinskiy, 2008).

The research university can independently elaborate modular educational programs, establish business structures attracting young talented scientists and students, give momentum to design offices, open research and development commercialization offices.

It is well-known that now in the frames of education and science integration the research university acts as a modern form of integration of education, science and innovative production characterized by: knowledge generation and a wide range of research; effective system for training and retraining personnel for the hi tech economy sectors; high degree of science and education integration; international acknowledgement of the scientific and educational activity; effective system of commercialization of findings; available innovation area; interdisciplinary education and research (Kazbekov, & Kazbekova, 2012). Thus, Gnevasheva defines the research university as a modern form of education and science integration, well-reputed abroad. The key functions of the research university are as follows: production, accumulation, storage, transfer and dissemination of knowledge. The first Kazakhstani universities were based on these functions. The research university model is built on three interactive components: education, research and innovation. The modern model acquires the third function – information transmission “flow” or “knowledge transfer” (Gnevasheva, 2006).

The research university as a key source of the most valuable raw material – intellect – aims at effective functioning within the research-and-education organization, as a national center of education, science and culture, where highly-qualified personnel is trained in accord with modern scientific research in the frames of integrated education-innovative complexes, based on scientific and educational schools.

The goal of the research university is to organize interaction and coexistence in the united physical space and interactive mode for the following processes: education, scientific activity and commercialization of results.

3. Results

3.1. Comparative analysis of research universities in developed countries

Almost in all developed countries, agricultural research universities play an important role in supporting competitiveness of the agribusiness on the regional, national and international level. For example, a state support of the agricultural education and research works at the land-grant universities is one of the main factors of agricultural growth in the USA. Nowadays, in the USA the most public funds for agrarian research are channeled to the land-grant research universities, three of which are in the world top 10 agricultural research systems. In the Netherlands Wageningen University and Research (WUR) – the core of a famous Food Valley – is the founder of “economical miracle” in the agro-industry (Larionova, 2011).

The efficiency of research universities in the agribusiness economic development is stipulated by the ability to combine staff training, urgent research and development and outreach of scientific achievements. At that, universities that manage to maintain overall high quality and results are the world leaders (Ogarkov, 2005).

The analysis of the best practices enabled to determine the following peculiarities of the most advanced world research universities:

3.1.1. High quality human resources.

Sustainment and enhancement of academics at leading American, Canadian and Australian research universities is assured by their involvement into scientific research. For example, all teachers at the University of California, Davis, USA, implement their own research projects financed by government grants. At that, part of them is teaching in the frames of training programs, the other part is engaged in the knowledge dissemination system teaching the agribusiness employees. If academics have no own financed scientific projects for a long period, as a rule, they leave the University.

High requirements, set to teachers, define the excellence of academic and scientific activity at the University of California, Davis. Developing human capital is the key principle of the University. Thus, at employing new teachers to free vacancies, high intellectual abilities are the core criteria, while a current professional specialization of the candidate is not so important. The University ranks the first among world universities with regard to agricultural programs due to outstanding achievements of its academics.

It should be noted that the quality of the human capital is closely related to the teachers' wages. As a rule, each university has its own wage system ensuring competitive conditions compared with the other universities and scopes of activity. Only such conditions enable to attract the most gifted and promising young specialists into the agrarian education and science and to maintain the high level of prestige of the agrarian scientist's career.

2. Continuous cooperation with employers and consumers of research and development.

The importance of research and training programs of world leading research universities is stipulated by their cooperation with the agribusiness. Effective cooperation is achieved at all levels: by both involvement of agribusiness representatives into the university boards of regents and direct cooperation between the academics and farmers resulting in prompt response of the scientists to the problems arising in the industry.

As a rule, the most academics are involved into knowledge dissemination that enables to introduce advanced innovations to operating agricultural units and serves as an important "feedback" element. Consequently, if academics win agribusiness' trust, the agribusiness starts to co-finance the universities and the amount can reach up to 30% yearly budget.

3.1.2. Own modern research-and-development and experimental infrastructure.

An integral feature of all world leading universities is a well-developed infrastructure for practical classes, knowledge transfer, and research (Shevelev, 2010). For instance, the McGill University, Canada, has its own workshop with the most advanced equipment to process wood, metal and plastic; trial plant to process agriproduct; dairy breeding, pig breeding and poultry farm; greenhouse; arboretum; natural reserve; phytotron.

Plenty of such experimental platforms are the best in the world. For example, the Robert Mondavi Institute for Wine and Food Science at the University of California, Davis, is the best world platform to study wine production, and the plant growth promoter of the University of Adelaide, Australia, is one of the best technological platforms for grain crops phenotyping (Kartashova *et al.*, 2015).

Beside the educational and research function, such experimental platforms are an important element ensuring financial stability of research universities. For example, the Faculty of Veterinary Science at the University of Sydney, Australia, has two farms and an animal clinic

that are successfully used for commercial purposes. The Arthursleigh farm with area of 7.9 thous. ha is used for livestock production, and the Camden farm for 220 milk cows is used to produce high quality milk supplied to the Sydney market (Fusfeld, 1995).

The Holtsbaum Agricultural Research Station of the Faculty of Agriculture and Environment at the University of Sydney is used in the same way. All earnings from it are used to finance students' research projects and scholarships (Petrova *et al.*, 2015).

3.1.3. Independent management.

All leading research universities in the world operate as independent organizations. University independence is studied traditionally in the following aspects:

- academic independence as an ability to develop and to implement unique training programs, to conduct unique initiative scientific research independently;
- financial independence as an ability to control property and resources, including the ones coming from the state sources, independently;
- organizational independence as an ability to define the structure and the number of management bodies, assign their functions, establish or cancel units, subsidiaries independently;
- personnel policy independence as an ability to define employment, promotion and payment requirements for the academics independently.

Broadly speaking, independence means goal setting and achievement by each university independently. But universities have to cooperate while meeting the needs of some regions, countries and the global community as a whole. Independence involves accountability to the local university community – staff and students, and to the public in general.

3.2. Prospects of the agricultural research university in the Republic of Kazakhstan

With due account for the best practices and a model of Nazarbayev University, at the moment the work is aimed to establish the first international agricultural research university in the Republic of Kazakhstan. Establishment of the research university provides for a successive settlement of problems in the local agricultural education and science, as well as the above-mentioned ones.

The core principles of the international agricultural research university established on the basis of the Kazakh Agrotechnical University:

- independent management;
- continuous and effective cooperation with the agribusiness, state bodies, scientific community;
- active integration into the world system of agrarian science by means of partnership with world leading scientific centers and agricultural research universities;
- advanced equipment based on the model of shared technological platforms;
- continuous updating of unique training programs by reference to the advanced local and foreign scientific achievements;
- a wide range of scientific studies on key problems of the Kazakhstani agribusiness.

The analysis showed the current scientific potential at the Kazakh Agrotechnical University:

- patented innovations; physical, chemical and metallurgical, pharmaceutical and fine organic synthesis projects implemented and ready to be implemented;
- innovative infrastructure ensuring commercialization of research and development (innovation and technological center, technology commercialization office);
- academics participating in scientific studies and having international publications; implementation of PhD-level programs in physics, chemistry and their branches.
- Now the University includes 44 departments. More than 10 thousand students study at 8 faculties on

37 specialties of the Bachelor's programme, 31 specialties of the Master's programme and 14 specialties of the PhD programme. The University has started up training of multilingual personnel on 8 specialties of the Bachelor's programme, 31 specialties of the Master's programme and 9 specialties of the PhD programme. The academics consist of 889 teachers, 83 of which are Doctors and 376 are Candidates of Sciences, 18 are Doctors of Philosophy. Academic degree holders rate is 53%.

- The academics and the employers revised all training programmes, eliminated more than 100 outdated subjects, and made more than 200 amendments. Now, the duration of the practical training is 8 months instead of 3. They established a new experimental campus with the area of 1,159 ha in the territory of Tselinograd district, Akmola region. The dual training system was introduced with regard to 82 subjects starting from the current academic year. New educational programmes are being developed based on the UC Davis experience with participation of their professors. 4 new Master's programmes with 7 specialty fields have been already developed. 2 more programmes are under development now. Research institutes, scientific centers, laboratories, and a design office are established at the University to increase the research efficiency.

The agricultural research university strategy 2030: development of a high level university with academic, financial and institutional independence, having high educational standards, prominent scientific results and a net positive effect on innovative development of the Kazakhstani agribusiness. Development of the agrarian science and education is a national strategic goal. That's why the state support of universities is never disputed, because these investments will recover in future.

4. Discussion

The findings show that the research university principally differs from the traditional one in goals, approaches, technologies and resources of the scientific and educational activity. Traditional universities employ teachers to work as professors and research universities employ scientists. Traditional universities focus on training hours, and research ones – on the quality of research and relevant publications. At traditional universities, teachers tell students about somebody's inventions and 10-20-years old materials; at research universities, professors teach students based on their own inventions integrated into the innovative science. At traditional universities, professors can do compiled work and call it "science", and at research universities they are to conduct original research. As compared to traditional universities, where bachelors and masters go into general superficial education, at research universities each bachelor may be involved into the original research and be a co-author of peer-reviewed publications. Research universities, institutes, faculties and departments aim to ensure excellent training based on improved student body, qualitative teaching staff, implementation of new education methods and technologies, intensification of fundamental and practical training, deep integration of educational, scientific and innovative processes meeting the demands of research universities.

Thus, the main difference between research and traditional universities is that the research university is not a place to reproduce old knowledge, but to produce new one. Such organization of the scientific and educational process enables a teacher not only to reproduce current knowledge, but, first of all, to research enjoying a tolerable amount of freedom, time and financial-and-organizational infrastructure to produce new knowledge and then to teach this new knowledge.

It should be noted that one of the most peculiar features of foreign research universities is an academic community. Thus, taking into account staffing problems in research, technological and public spheres it is possible to optimize the system of training and replacement of academic staff by transition from the "closed" (European) to the "open" (American) model of planning a scientist's career. The American model has the other scientist advancement principles: scientists are employed for scientific positions based on scientific achievements and competition instead of the current "social line" and "professional practicability". These particular principles are turned into the idea and principles of the research university.

Extensive increase of new candidates of sciences (under 40 years old) and transfer of their training from agricultural research institutes to relevant higher education institutions are to be the core trends of the local agrarian sphere. It requires shifting the paradigm of education at the agrarian institute from teaching the results of the scientific research to teaching during the scientific research.

The scientific-educational sphere is very inertial in terms of reformation efforts. It is stipulated by a long period of forming its potential staff. That's why it is necessary to improve the scientific management; and renewal of flexible and mobile scientific personnel (at the agrarian enterprises) with adequate moral and material incentives for those, who can effectively use resources and successfully compete on the world market of ideas, is an appropriate measure to implement the state policy.

Close cooperation between the agricultural university and the science park promotes introduction to the labor market of highly qualified specialists, who are able to do innovative business, to develop and to implement new research and development products. At that, it is possible to teach students using the real projects. So, in future the students will be able to adapt to a modern economic environment, to get access to innovative sources and practical skills to create innovations in the agrarian sector inclusive. At the same time, scientists from the agricultural research university will be able to implement their know-how and to get royalties, to establish new small innovative companies by means of cooperation with the business incubator, to increase scientific volumes.

Cooperation of the agricultural research university with the science park, as its unit, establishes a more effective connection between the university science and local agricultural companies. At that, companies get research products to manufacture competitive goods and recruit new qualified specialists. Implementation of innovation projects and introduction of their results to agricultural enterprises – the partners of innovation environment of the science park – promotes an increase of their innovation level.

Achievement of declared goals and parameters directly depends on efficiency of local research universities, because they have wider goals than technology parks as their units. The research university produces both innovation technologies or scientific solutions and a new generation of scientists, combining educational and research activities.

The result is that the research university becomes a subject producing not only new industrial and scientific-applied, but also education-pedagogical technologies aimed at formation of research skills and abilities of all participants, subjects of the research-educational process (teaching scientists and teachers), to work in the frames of new paradigms and in the mode of scientific work (Dudin *et al.*, 2016).

5. Conclusion

In the nearest future, the earth population will increase from seven to eight billion by 2025 and nine billion by 2050 resulting in the double food demand growth. Population growth and expansion of its activities will have an additive environmental impact. This is a monumental challenge that requires a real breakthrough in knowledge and technologies. Nowadays, people take a critical look at intensive stock farming, biotechnological processes. There is also a tension in interdependence of economy and ecology (land use against nature and biodiversity). It needs innovative solutions and implementation of scientific projects focused on social research. The countries are to exist under the open global economy in order to develop competitiveness. Innovation investments and stability improvements are of critical importance to keep the lead and they answer the global challenges with regard to food security, poverty, energy, water, climate peace and stability. So, the interaction of knowledge, practice and policy is the key factor for successful innovations.

Low competitiveness of traditional institutes with insufficient integration of science and education required to establish fundamentally new research universities. Innovative education

provides for training in the process of producing new knowledge. At its best, it is focused less on transfer of knowledge, which continuously becomes outdated, than on acquiring basic competences that allow them to gain them independently, if necessary. In view of this, the educational system at the innovative higher education institute is to be open to modern scientific research and modern economy, and techniques of educational process are to comply with the advanced science. The main mission of the institutes of higher education is to train a new generation of specialists to work in new science-intensive areas.

The reformation of the higher school and establishment of research universities in Kazakhstan cannot be isolated from the other public sectors and the labor market. Thus, the key goals of the research university include a mission of forming a new scientist by means of innovative technologies, and this specifically refers to the staff and the student body of any research university. Namely this goal is the guarantee of future development of the science, the economy and the society as a whole.

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