The Evolution of University-Industry Interactions: Case of Kazakhstan

Yelena V. Smirnova

***Abstract*—**The paper aims to analyze a historical evolution of university-industry linkages in Kazakhstan since its annexing to the USSR till present days. The discussion in the paper is based on existent literature, statistical data, and author's observations. The findings reveal three basic periods of university-industry linkages development in Kazakhstan: a rise of science-industry interactions in the era of the USSR, scientific stagnation after Kazakhstan's independence, and a hard gradual recovery after 2000s. Despite numerous attempts of policymakers to revitalize science and foster innovative development of Kazakhstan clear mechanisms for the integration of science and industry were not yet developed.

***Keywords*—**Innovative development, Kazakhstan, knowledge-based economy, university-industry interactions, USSR.

I. Introduction

It has become obvious today that innovative development of an economy is crucial for achieving competitive advantage. But it is important to note that innovative development is impossible without creation of new knowledge. Traditionally, higher education institutions are being perceived as the source of knowledge and technology. However, in order to bring a greater benefit to an economy, knowledge and technology should not only be created but should also be disseminated and applied to a specific industry or an economy as a whole [1]. It has been proved that effective university-industry relationships strengthen a country's economic development and foster innovation growth [2].

Kazakhstan earlier than other post-Soviet Union countries recognized a need for creating an innovative economy. After dissolution of the USSR in 1991, Kazakhstan experienced severe difficulties such as plummeting of industrial production and widespread corruption. The economic recession and stagnation induced the government of Kazakhstan to realize a need for moving towards a knowledge-based society and innovative economy [3].

A release of the Program for the Formation and Development of the National Innovation System of the Republic of Kazakhstan for 2005–2015 can be marked as the beginning of creation of a new economy in Kazakhstan in which universities are assigned a key role to create, store, and disseminate knowledge.

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To foster transition to the innovative knowledge-based economy, the government of Kazakhstan initiated a new wave of novel programs and strategies. It created a national innovation system and innovation infrastructure to facilitate the transfer of knowledge between the agents. The main elements established during the last decade include: the National Innovation Fund, eight regional technology parks, special economic zone "Park of Innovative Technologies", scientific and technological holding "Parasat", "KazAgro Innovatsiya" company, four design offices, seven industrial innovation centers, nine commercialization offices, and four domestic venture capital funds (The Concept of Innovative Development of Kazakhstan till 2020). All these elements are aimed to enable the creation of new knowledge and its dissemination in the economy which is further translated into innovation.

This paper addresses the challenges that Kazakhstan experiences being in transition to the innovative knowledge-based economy in which innovation is the result of interactions between several agents. Thus, the second section of the paper starts from a historical perspective by evaluating science and industry linkages in Kazakhstan when it was a part of the USSR. It continues with the discussion of current state of science and innovative development of Kazakhstan since its independence. The last section concludes making inferences about the evolution of university-industry linkages in Kazakhstan.

II. Retrospective Analysis of Science-Industry Linkages in the Era of the USSR

The history of Kazakhstan as a part of the USSR had started from 1920 when its lands were annexed to the Russian Soviet Federative Socialist Republic (RSFSR). In subsequent years, Moscow had a strong influence over Kazakh SSR and other Soviet Socialist Republics by pervading all aspects of these countries' lives: economic, legal, political, social, educational, and technological. Thus, the emergence of university-industry interactions in Kazakh SSR was closely related to the development of science-industry linkages in the RSFSR.

In the RSFSR, the necessity of creating ties between higher education institutions and enterprises was realized in the late 1920s. This understanding was followed by immediate actions of the Soviet government which resulted in a number of universities and technical colleges established under the authority of economic commissariats, also called branch

ministries. Later in the mid-1930s, the government developed a scheme under which students were assigned to particular companies six months prior graduation and had to work there at least for three years [4]. During the World War II, the importance of university-industry linkages had grown as never before which induced the Soviet government to carry out a number of reforms to strengthen these ties.

The development of science-industry linkages in the USSR achieved its peak in a post-war period. Specifically, the impact of university science on the acceleration of scientific and technological progress in a post-war Soviet Union was described by Nikiforak (1983). The author claims that the primary goal of interactions between higher education institutions and enterprises was to improve training level of students who would further be directed to work on factories. To achieve that goal, educational facilities of universities and production base of industrial enterprises were integrated. Such integration allowed enterprises to contribute to the activities of higher education institutions by helping them to improve the content of the curricula, methods of teaching and by recruiting students as trainees for internship programs [5].

As Nikiforak (1983) notes, the main forms of interactions between higher education institutions and industrial enterprises in the USSR were:

1) contracts for assistance of enterprises in strengthening the material and technical basis of higher education institutions;
2) equity participation of branch ministries and their departments in major construction of universities/ institutes;
3) contracts assigning to study in universities;
4) joint development of qualifications needed for professionals;
5) involvement of highly qualified industry employees in education process; and
6) establishment of university departments on enterprises.

The effectiveness of each of these forms directly depended on the quality of cooperating universities and industrial organizations, as well as the extent of their mutual interest in collaboration. The primary end product of interactions between the agents was high quality training received at higher education institutions which conformed to the requirements of a specific industry.

Scientific and technical cooperation between universities and enterprises was a matter of great importance in the USSR. Above all, such cooperation was designed to enhance knowledge-intensity of the training process and mastery of teaching staff. In addition, cooperation implied active involvement of students in the research process which allowed them to develop creative thinking and find practical application to theoretical knowledge [5].

The Soviet government directed all its efforts to the integration of the research process which implied the move from narrow and small-scale studies to large-scale and systemic. The main feature of large systemic studies was a close connection between all phases of fundamental and applied research to be further implemented in practice. To accomplish that, the government introduced a program-target method of the research organization which clearly regulated the responsibilities of all the parties involved. As a result, the effectiveness of university-industry interactions increased significantly evidenced by the creation of applied research laboratories, agreements in scientific and technical cooperation, and integrated creative teams.

In the mid-1970s, interactions between higher education institutions and enterprises in the Soviet Union entered a new stage of its development. The process became more complex; the integration of science and industry took place within single organizational structures. Those structures were called educational, scientific and production associations (ESPAs) [5].

Although this may sound odd but the Soviet Union allowed democratic freedom in science, the researchers could choose the area and the direction they liked. USSR science managed to attract the best minds. Progressive youth lined up to enter postgraduate programs the competition for which was very tough. Being a scientist was “fashionable” in the Soviet Union. The salary of a Candidate of sciences was higher than the one of the Regional Secretary of the communist party. Doctors of science had the highest salary and academics of science received more than secretaries of the Central Committee of the Central Party of the Soviet Union (CPSU) [6].

The critics of the Soviet Union system [7] argue that science had been artificially separated from higher education system. There was only a limited number of universities that actively contributed to the development of science by producing new knowledge and attracting students to it: Moscow State University, Moscow Higher Technical School, Moscow Engineering Physics Institute, Moscow Physical and Technical Institute, and Novosibirsk State University. Additional albeit very weak mechanism for attracting students to scientific research involved economic contracts of universities with enterprises. After collapse of the USSR, these mechanisms were eliminated which created a situation in which science, universities, and business exist on their own [7]. Simply, the Soviet system of education was closed, so it was doomed to fail one day [8].

The proponents of the USSR system [9] claim that in the field of knowledge Kazakhstan owes to the Soviet Union. The golden age of Kazakhstani science as well as the USSR science was in 1960-1980s. At that time, the Kazakh Academy of Sciences was one of the leading Academies in the Soviet Union [6].

The Soviet system worked successfully until it collapsed due to political reasons in 1991. Just in several years Kazakhstani science was ruined. In the Soviet Union, science was divided into three categories [10]: academic (fundamental research represented by the Academy of Science and funded by the government), agency-level (scientific and practical specialized institutions under the ministries), and university-

level research. It so happened that university science in Kazakhstan was not well developed but academic and agency-level sciences were strong. In 1990s, the first hit was taken by the agency-level science, followed by the academic. Additionally, after the integration of the National Academy of Science of RK with the Ministry of Education, and termination of this integration just in several years, the Academy lost its institutes [6] and was barely destroyed.

III. University-Industry Interactions and Innovative Development of Independent Kazakhstan

After collapse of the USSR in 1991, Kazakhstan entered into a period of a severe recession. The economic downturn negatively affected the country's scientific potential [11]. Given that science is a key driver of social and innovative development [12, p.7] as well as economic success, Kazakhstan's government tried to implement effective mechanisms to revitalize science and foster innovative development of the country. Thus, since the late 1990s, the government has done several structural reorganizations, carried out a number of reforms, and created new institutional formations such as technology parks, business incubators, centers of commercialization, etc.

The development of Kazakhstan's science after the country's independence can be divided into several periods: the first period from 1991 to 1995 – the period in which scientific and technical policy and governance structure of science were shaped; the second period from 1996 to 2000 – a radical reorganization of science; and the period from 2001 to the present time – the period of modernization of legislative and regulatory framework of Kazakhstan's science [13, p. 159].

Zhurinov (2010) argues that in the early years of Kazakhstan's independence the state focused on the purchase of technology from abroad [6]. That seemed to be much easier and more efficient rather than investment in basic research. However since 1999, the government has refocused its attention on the development of science [11] and innovations rather than on the purchase of technologies from overseas. Today the state provides financial support for carrying out both fundamental and applied research to satisfy the needs of industry [14].

According to the Law of the Republic of Kazakhstan "On Science" (2011), research funding may take three forms: grant – funding research projects in accordance with the national priorities of the country; program-oriented – funding in strategic areas; and fundamental – funding research organizations through the state orders.

Nevertheless, even though this funding scheme looks quite adequate the overall funding level is insufficient – only 0.17 percent of GDP is spend on research and development [15]. In addition to scanty funding, there are many other problems which are common for all CIS countries: poor management of science, ageing research personnel, weak level of training in scientific and technical spheres, low demand for research, and weak public-private partnerships [16].

Bhuiyan (2011) compares Kazakhstan's situation in science with the African case where researchers and university faculty get low salary, universities and the government do not provide enough incentives to hardworking knowledge workers [3]. However, Bhuiyan (2011) also notes that the government of Kazakhstan has recently introduced a scheme of generous grants and awards to productive faculty researchers. Thus, every year the government provides 75 research grants for talented scientists at the age of 35 and younger. Other yearly prizes for all age categories include awards for the best research in the field of natural sciences, agricultural sciences, humanities, pedagogy, and Turkic Studies [3].

One of the latest initiatives of Kazakhstan's government was introduction of some fiscal incentives for companies engaged in R&D. Thus, according to the Tax Code of the Republic of Kazakhstan, costs associated with scientific research and development operations, except costs associated with the purchase of fixed assets, their installation and other capital costs, are referred to deductions (Article 108). Quite often fixed assets (e.g. experimental equipment) may be more costly than the research itself. This suggests that this kind of deductions may not always motivate firms to engage in research.

It is important to note that in 2013, the government made few positive adjustments concerning R&D which were reflected in the latest edition of the Tax Code of the Republic of Kazakhstan. Hence, a firm's taxable income is subject to deductions at a rate of 50 per cent of the expenses actually incurred in respective tax periods in connection with the performance of works recognized by the authorized body in the field of science (e.g. scientific research, research engineering, and/or experimental development works). Deductions are applied only if there is a protection document for the utility models or industrial designs granted by the authorized body and provided that the result of the specified works is implemented in the Republic of Kazakhstan (Article 133).

Definitely, there is some progress in the incentives scheme over recent years but this is not yet enough to push scientific and technological development in Kazakhstan. There must be a systemic approach to management of science under which all research, government, and private objects would interact.

As an observation shows a systemic approach has not yet been in use in Kazakhstan – direct interactions between universities and firms are still rare and not well developed. The most common ways of university-industry collaboration in Kazakhstan seem to be the recruitment of graduates for work and the recruitment of students for internship which was also the case in the era of the USSR. Indeed, Kazakhstani employers prefer to recruit younger candidates as they tend to be more receptive to learning and better conform to the aggressive market environment than their older counterparts [17]. This is a good start for developing linkages but the relationships between universities and enterprises should

expand into more sophisticated forms of collaboration. In the end, this could have become companies' social responsibility to contribute to education, science, and innovative development of the nation. But it looks like that the majority companies are mostly concerned with making profits. In this regard, it is necessary to underline that fulfilling legal responsibility is perceived to be the most important in Kazakhstan [18]. This suggests that companies may be influenced to collaborate with universities by a legislative framework, for example to make it obligatory to collaborate with at least one or two universities. Of course, this can hardly be applied to small firms where the number of employees does not exceed ten members. However, this may be considered as an option for medium and large companies.

In any case, the enhancement of university-industry linkages requires a developed science and innovation infrastructure. At the moment, the research sector of Kazakhstan is represented by the National Academy of Science (NAS), National Academy of Engineering (NAE), branch academies, research institutes, and universities. As Darenskih (2009) notes, NAS provides effective framework for the dialog and linkages with industry: more than 20 research and production centers operate under the Academy. Additionally, NAS was actively involved in the creation and development of Kazakhstan's technology parks; its departments and branches closely work with manufacturing enterprises in a number of regions [19]. However, the research sector still remains highly centralized with little focus on regional development of science [20].

Although science infrastructure has been created in Kazakhstan and some financial support to researchers is provided, commercialization of inventions still presents a challenge. The analysis of the innovation activity of the research sector showed that the main problem is the transfer of knowledge and technologies developed by research institutes and universities [19]. In other words, it turns out to be very difficult for the inventor to get reasonable profits after patenting the invention. As of today, the best options for gaining as much as possible from the invention in terms of profits are: to sell the invention abroad or to a local company, use own funds, or keep the patent without disclosure for better times. However, in order to assist inventor a number of commercialization centers have recently been opened at leading universities and research institutes. The effectiveness of commercialization centers is not yet known as they are relatively new units but the government places a lot of hopes on them.

Despite the attempts of Kazakhstan government to revitalize science and foster innovative growth the level of innovation activity tends to remain relatively low. Kazakhstan stands only 79 out of 143 economies in the Global Innovation Index 2014 [21]. The report shows that the country is still weak in the diffusion of knowledge (ranked 81) and is even weaker in its production (ranked 83). Kazakhstan stands 58 in research and development indicator which is calculated on the basis of the number of researchers in the economy, R&D expenditures as percentage of GDP, and average score of top three universities in the country. The situation of Kazakhstan concerning innovation is even worse in the Global Competitiveness Report 2014-2015, despite that the country is ranked 50 (out of 144) in the competitiveness index worldwide. The weakest points of Kazakhstan are: quality of scientific research institutes (ranked 99), availability of scientists and engineers (ranked 83), company spending on R&D (ranked 68), capacity for innovation (ranked 69), and university-industry collaboration in R&D (ranked 88) [22].

Innovative development is an ardently discussed topic in Kazakhstan's scientific community. For example, Alzhanova F. (2010) states that in order to create favorable institutional conditions for innovative development the government should focus on four directions: (i) development of science and human capital, (ii) creation of the innovation infrastructure, (iii) development of innovative institutes, and (iv) creation of new markets [23]. Zhumagulov (2011) emphasizes the importance of polytechnical universities for innovative development of the country [8] while Bekturganova (2011) stresses a need for stimulation of small innovative businesses [24].

According to Tuimenbayev (2010), the best option for Kazakhstan is to adopt Finnish model of innovative development which has been recognized as the most effective in the world. This model is built upon three pillars: high level of education, competitive distribution of funds for science, and developed innovation infrastructure. It is also important to take into consideration Chinese model which combines both centralized and market elements [16]. Although studying experiences of other countries adds to the understanding of their successful practices and mistakes, it is vital to remember that adopting foreign experience without adapting it to the local economic, political, and socio-cultural context may be a direct way to utopia.

IV. CONCLUSION

Kazakhstan's science has passed through a thorny path of ups and downs. Based on the discussion in the paper it is possible to divide the development of university-industry linkages in Kazakhstan into three periods: a rise of science-industry interactions in the era of the USSR, scientific stagnation after Kazakhstan's independence, and a hard gradual recovery after 2000s.

A number of attempts to revitalize science and foster innovative development have been taken by the government of Kazakhstan over recent years. But the recognition of a need to create synergy of science, universities, business sector and government came along with the creation of the Concept of Innovative Development of Kazakhstan till 2020. The government has also acknowledged that private sector should have played an important role in financing R&D as it facilitates the transfer of knowledge and technologies.

However, despite the government of Kazakhstan tried to develop new policies, programs and laws, made systemic and structural changes, no concrete mechanisms were developed to

stimulate university-industry interactions except equivocal tax incentives. Moreover, it seems tricky to develop these mechanisms at the moment as the factors preventing universities and firms form collaboration are not yet deeply studied. Furthermore, while developing these mechanisms in future it is important to remember that the legacy of the Soviet Union is still apparent almost in every aspect of the country's life, especially in public organizations and education system of Kazakhstan, which obviously creates difficulties for implementing new practices.

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