



Research Article

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Kazakhstan: Socio-Economic Development, Research and Innovation

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Abstract

Today Kazakhstan economically is the dominant nation of Central Asia with an estimate population close to 19 million people. Indeed, it is the region's largest country and has in abundance of both natural and human capital resources. Kazakhstan was a Soviet Union republic the last that in 1991 to declare independence during the dissolution of the Soviet Union; therefore, all planning for its development has been strongly centralised outside of the country rather than in its own new capital Astana, now called Nur Sultan. In 1991 Kazakhstan was. With its independence, the situation in Kazakhstan has changed radically, under new popularly elected leadership, the country has committed itself to achieving a level of socio-political, economic, and technological development comparable to that which exists in most mid-sized economically advanced Western countries. The major vehicle for bringing about this transformation is a series of carefully constructed scenarios whose implementation turned around on extensive public-private investment and partnerships in research and development, especially thanks to the state grants that support of industrial and innovative activities. This article will discuss two scenarios currently under way that have as their shared goal the advancement of Kazakhstan's socioeconomic development through an emphasis on human resource development and innovation.

Keywords: *Kazakhstan, socioeconomic development, research and innovation*

1. Introduction

The rapid advancement of all societies depends on "strategic investments in research and development" (R&D) for both scientific and technological development and advancement of the quality of life of their people (Miller & Morris, 1999).

According to Pisano (2012), such investments may involve the application of already established technologies (secondary R&D) or the creation of entirely new technologies and areas of scientific inquiry (primary R&D). Although these innovations primarily involve "hard" or physical science (Anderson, 2000), they may also involve the social sector, such as new types of political, economic, or familial systems (Sherwin, 2016).

Research and development on the one hand, and innovation on the other, represent the two poles between which the technologically equipped industrial production moves: with the block of the first two terms, we indicate the pure scientific and technological research, with the third we indicate instead research applied to production. These three terms have given rise to a truly consistent literature: not wrongly, the key points for understanding the dynamics that lead from the invention to the success of this invention and to its stable inclusion in the production of goods or services based on a technical support (innovation), and therefore to face the relationship that links technology and economy. Another aspect is the role of the educational system and its impact, the relationship between universities and the business world, between universities and the labour market

(Sustainable "University – Enterprise" partnership, Figus, 2009).

In fact, "sustaining cooperation across different institutional cultures requires a long-term commitment of time, labour, skills and finance. The return on investment can be significant, in terms of human resource development, high value-added innovation, new market creation, but this is not necessarily the case" (Figus, 2009).

Most societies invest in both types of innovations, especially societies that are undergoing dramatic restructuring (OECD, 2018). Such investments have proven to be especially essential to the newly independent countries of the former URSS whose economies have shifted from being centrally planned to become more open and globally focused market systems (Investopedia, 2016). The goal in every case has been to advance the human technological capacity of these countries so that they can compete more successfully in highly competitive global markets. Economic diversity, involving multiple sectors of collective life, has proven especially effective in advancing the global competitiveness of developing post-Socialist societies (Graham & Werman, 2017; Lipovsky, 2016).

Kazakhstan, as a former republic of the former URSS, is really developing "post-Socialist nation" and its approach to introducing R&D is the primary subject of this article (Hiro, 2009; Marvin 2016; Wight, 2018; World Bank, 2016). Now it is the time to give a historical overview of the Republic of Kazakhstan since it regained its independence in December 1991 (Golden, 2011; Lipovsky, 2016). Next step will be to consider the natural and human capital resources available to Kazakhstan to promote its socio-political and economic development. We will be identified the special set of social and economic indicators that are essential for advancing R&D in this country and will be introduced with a particular reference to the aspect of innovation, the economy, the education and labour market relationship. The critical contributions made by R&D in accelerating the pace of Kazakhstani social and economic development will be identified, along with the pathways for accelerating the pace of Kazakhstan's development over the near term (Socor, Weitz, & Witt, 2016). If we wanted to show the potential that Kazakhstan has Kazakhstan we could say that it has natural resources in very large quantities. This is his great strength. It occupies the 12th place in the world for oil reserves and the 14th for gas reserves. Kazakhstan is also the first world country for uranium production, and second for its reserves. Finally coal, chromium, copper, tungsten, barium, lead, fluorite, molybdenum, silver, zinc, and gold are present in large quantities. Now I understand better what we are talking about (ICE report, Italy, 2018).

2. Modern Geographic and Ethnic Structure of Kazakhstan

The Republic of Kazakhstan is a fully independent nation-state located in Central Asia. A land locked country, Kazakhstan borders with China, Kyrgyzstan, Russia, Turkmenistan, and Uzbekistan. Along with other Central Asian nations, Kazakhstan shares access to the Caspian Sea, consisting of more than 134,000 square miles of surface area of 371,000 kmq.

As reflected in figure 1, the country's landmass is substantial (2,724,900 sq. km); Kazakhstan is the ninth largest country by land mass in the world. The country's population (2017) numbered 18.6 million people, the most populous of Central Asian nations. As of 2009, Kazakhstan's ethnic mix consists of Kazakhs or Qazaqs (63.1%). Other important is the Russians community that is around 24% (CIA, 2017). Also as of 2009, the country's religious mix was diverse as well: Muslim, around 70% and Christian (mainly Russian Orthodox; around 26%. Kazakhstan has been out of a period of state atheism for only twenty years. During the Tsarist era, the hegemonic creed, especially in urban centers, was the Orthodox Christian one. Over the past 150 years, the Muslim influence, previously felt, has been suppressed or "bureaucratized".

Today we try to return to both Islam and the spiritual cult of "Tengrism", a belief typical of Central Asia, based on shamanism and animism. Monotheistic religions consider "Tengrism" a "pagan" cult. At the state level, Kazakhstan proclaims itself a secular state and promotes no religious superiority, despite the division between "traditional" and non-traditional religions.

The idea of the President Nursultan Nazarbayev to make Kazakhstan as the place of dialogue, a bridge between world religions is a way to avoid religious confrontation; religious communities can therefore compare themselves within the country.

As of 2017, approximately 40.3 percent of Kazakhstan's population was younger than twenty-five years, a demographic pattern that characterizes most Central Asian post-Socialist countries and indeed most developing countries.



Figure1: Map of the Republic of Kazakhstan (CIA, 2016. Reprinted with permission.)

3. Historical Background

3.1 Kazakhstan's Natural and Human Capital Resource Base

The availability of natural and human capital resources is essential to a country's development. Kazakhstan is particularly advantaged in having a rich array of both (Witte, 2016; World Bank, 2018). All of these resources are being used to accelerate the pace of the country's social and economic development as well as to build a strong network of economic partnerships with other nations in the Central Asian region and with other countries worldwide (Legvolf, 2003; World Bank, 2018).

3.2 Kazakhstan's Natural Resources

Kazakhstan's natural resources are substantial and highly diversified. Along with its vast stores of petroleum and natural gas reserves, Kazakhstan's major industries include the production of a lot of metals as well as gold and silver, (Open Energy Information, 2016; Vigar, 2018), all of which add to the country's foreign exchange reserves of US\$ 32,837 million of January 2017 ("Kazakhstan's foreign exchange reserves 1993-2017," 2018). Kazakhstan's energy economy, each of these sectors will continue to increase in importance as the country's five-year national development strategy unfolds (U.S. Department of State, 2013).

3.3 Kazakhstan's Human Capital Resources

The exact number of Kazakhstan's full-time researchers and technicians, including those engaged in R&D, is not known with any degree of precision. Their numbers are expected to be substantial, however, especially in the country's multifaceted energy and public enterprises. Many R&D specialists are also working in Kazakhstan's state-centred health industry as well as in its large network of primary and secondary schools and more than 140 state-supported universities and other types of institutions of higher education (Silk Project, 2009). Typically, however, R&D activities are just a part of the job responsibilities of most research scientists, a reality that makes the number of researchers engaged in R&D on a full-time basis even more difficult to measure.

3.3.1 Kazakhstan's General Human Resource R&D Profile

Readers are referred to data collected by the UNESCO (2018), which reports R&D personnel data for most nations of the world. These data typically cover the period from 1996 to 2017 and offer a general picture of the R&D profile in Kazakhstan in comparison to other countries.

3.3.2 National Estimates of Kazakhstani R&D Personnel

Official reports prepared by the Kazakhstani government offer more precise estimates of the number of R&D personnel working across the country's major economic sectors from 2013 to 2017. Table 1, for example, summarizes these data by percentage distribution between specialist/researcher and technical personnel. As reflected in these data, the number of Kazakhstani researchers in 2017 decrease to 22,081, to 6.9-percent increase since 2013. This increase occurred in all categories of researchers: to 0.06 percent increase for the specialists/researchers (to 17,205) and to 22.0-percent decrease (to 2,797) for technical personnel (R&D maintenance staff). The number of R&D workers per one hundred thousand people in 2017 was 122.4, a decrease of at least 16.8 percent compared to 2013. The percentage of R&D workers had the same development tendency (Table 2). Thus, the percentage of specialists-researchers in 2017 was 77.9 percent, up 5.4 percent from 2013.

The number of the Kazakhstani researchers with scientific degrees in different sectors of economic activity also shows a positive development tendency (see Table 3). In 2017, the number of R&D workers with scientific degrees was 7,302, which represents a decrease of 0.9 % compared to 2013/14.

3.3.3 Future R&D Personnel Enrolled in Kazakhstani Universities

Kazakhstan recognizes the importance of continuous investments in educating future generations of R&D personnel. Indeed, the nation allocates a substantial share of its total resources to more than one hundred universities and institutions of high education. This is consistent with the nation's strategic goals and the scenarios.

Avery large percentage of these students have declared majors in physics, chemistry, mathematics, and other specializations that contribute directly to R&D research staffing (Silk Road Project, 2009). Such a larger number of potential workers in the R&D sector adds further strength to the country's efforts to enhance the overall level of socio-economic development and global competitiveness.

Table 1: Types and distribution of Kazakhstani R&D workers, 2013–2017 (Aydapkelov, 2018)

Base year	Population of Kazakhstan (000)	No. of R&D workers	No. of R&D workers by specialty			No. of R&D workers per 100,000 people
			Specialists/researchers	Technical personnel (maintenance staff)	Others	
2013	17,035.40	23,712	17,195	3,586	2,931	139.2
2014	17,289.25	25,793	18,930	3,882	2,981	149.2
2015	17,544.15	24,735	18,454	3,692	2,589	141.0
2016	17,794.16	22,985	17,421	3,326	2,238	129.2
2017	18,037.81	22,081	17,205	2,797	2,079	122.4

Table 2: Job classifications of R&D workers in Kazakhstan, 2013–2017 (Aydapkelov, 2018)

Year	Percentage of R&D workers by job classification		
	Researchers	Specialists/Technical personnel (maintenance staff)	others
2013	72.5	15.1	12.4
2014	73.4	15.1	11.6
2015	74.6	14.9	10.5
2016	75.8	14.5	9.7
2017	77.9	10.4	11.7

Table 3: Distribution of Kazakhstani University students by area of specialization, 2013–2017
Number of R&D workers with scientific degrees by economic sector

Year	Public	Business	Higher education	Noncommercial	Total (all sectors)
2013	1,484	674	4,847	366	7,371
2014	2,185	852	4,813	430	8,280
2015	1,903	766	4,701	550	7,920
2016	2,023	591	4,494	446	7,554
2017	1,987	510	4,351	454	7,302

Sources: Aydapkelov, 2018; “Kazakhstan—Number of technicians in R&D,” 2017.

4. Kazakhstan’s R&D Investments and R&D Outcomes since Achieving Independence

The R&D data for Kazakhstan’s private sector throughout the article should be regarded as estimates only until more rigorous accounting systems are developed for both the public and private sectors over the near term (“Kazakhstan’s annual GDP growth rate 1995–2017,” 2018; UNESCO, 2016). The data presented in Table 4 pertain to selected aspects of public and private expenditures on R&D in 2017. Mostly likely, these figures under estimate actual expenditures on R&D, but they are nonetheless suggestive of the general pattern of investment in inventions and technological innovations (UNESCO, 2016). Additional data confirming Kazakhstan’s educational and training investments in R&D are reported in detail in the annual statistical reports prepared by UNESCO (2016).

Table 4: R&D expenditures by sector of performance and source of funds in Kazakhstan, 2017

R&D expenditures			Sources of funds		
Amount (million tenge)	Share (%)	Sector	Amount (million Tenge)	Share (%)	
20,961.4	30.4	Government	41,964.2	60.9	
6,078.2	8.8	Private nonprofit	1,801.4	2.6	
13,179.6	19.2	Higher education	863.5	1.3	
28,665.0	41.6	Business enterprise	20,841.6	30.3	
-	-	Foreign investments	1,197.2	1.7	
-	-	Other	2,216.3	3.2	
68,884.2	100.0	Total	68,884.2	100.0	

In the main, Kazakhstan has been an adopter of technological innovations developed outside the country. Since regaining its independence, however, Kazakhstan has developed its own emerging R&D culture. Today, Kazakhstan ranks third among the CIS in inventions (“Kazakhstan is third in CIS by inventions,” 2011): the Institute (NIIP) received 32,857 applications. Kazakhstan is very active in this sector and opens up interesting prospects for the future

4.1 Positive Outcomes Associated with R&D

Since regaining its independence in 1991, Kazakhstan’s pace of national development has been rapid and has affected virtually all aspects of the country’s collective life. Important reforms, for example, resulted in Kazakhstan’s emergence as a democratic society with a strong and diversified open market economic system. Kazakhstan also joined the United Nations as a fully autonomous member and is among the leadership countries of the CIS and other regional associations. Additionally, Kazakhstan is a contributor member of the community of nations that is helping poorer nations of Central Asia, as well as Afghanistan and the Caucasus, to speed up the pace of their development (Golden, 2011). Kazakhstan is a major provider of international technical assistance and has steadily increased its purchase of goods and services from less affluent members of the CIS. These activities are considered essential to attaining Kazakhstan’s strategic goals as laid out

by the nation's parliament (Orazgaliyeva, 2014)

Much of Kazakhstan's rapid development is associated with its adoption of new technologies that support its highly competitive energy system. Major national investments in healthcare, educational reforms, arts and culture, human services, and the country's newly emerging not for profit sector are also helping to stabilize the country's rapid development into a fully modern nation state. These important societal achievements are being realized while Kazakhstan is adhering to its highly diverse and traditional multi-ethnic values and norms (Aitken, 2012).

Investments in at least moderate levels of R&D are major drivers of Kazakhstan's increasing development and are intended to enhance the country's comprehensive growth and global competitiveness, including its sparsely populated rural areas.

Increasingly, the country is expected to shift from its historic role as an adopter of technological innovations developed by others to a nation that is providing leadership in the creation of innovations that work to its own benefit and that of other nations in Central Asia (Graham & Werman, 2017; Hiro, 2009; Lipovsky, 2016). Given the development priorities identified by the country's national leadership, every reason exists to believe that this level of technological leadership will continue to prevail in Kazakhstan (Witt, 2012; World Bank, 2016).

4.2 Pathways for Accelerating Kazakhstani Development over the Near Term

Although it is developing rapidly across a wide range of sectors, Kazakhstan is still at an early stage of R&D investment (World Bank, 2016c). Many of the resources allocated for this purpose are dedicated to the discovery and processing of its energy reserves; comparatively lower but still substantial investments are being made in other market sectors (Rashkin, 2007). However, turbulence in global energy markets makes it clear that investing in a single industry is not sufficient to sustain the country's comprehensive economic growth over the long term (Mahroum & al-Saleh, 2016). It is expected that the dramatic uncertainties and market fluctuations in the value of energy will continue at least over the near term ("Crude oil price forecast," 2017); thus, Kazakhstani economic growth levels are expected to rise and fall in response to broader market forces. As a result, more diversified R&D approaches to a wider range of economic and technological sectors will be needed to offset the current and inevitable future declines in the energy sector. Several approaches for dealing with these new challenges are suggested below (Legvolf, 2003).

A more robust strategic approach to planning and national development is needed at this point in the country's history. At a minimum, public strategic planning for both the short and long term involves the following elements:

- Identifying strategic priorities and goals
- Allocating sufficient human and capital resources to the pursuit of these priorities and goals;
- Initiating specific programs and other activities that support each of the country's identified priorities and goals;
- Developing continuous monitoring mechanisms to ensure that the designated activities have been implemented efficiently and effectively;
- Modifying all aspects of the continuous monitoring mechanisms as necessary to ensure that the designated strategic goals and objectives are being achieved consistent with the plan

As Kazakhstan continues to move forward, there is a broad range of strategic pathways that it can follow. For purposes of this article, these pathways will be referred to as *scenarios*, defined as postulated sequences or series of events that are to be achieved during discrete time periods. Three scenarios have been selected as most practical for the short term:

1. Scenario 1: Staying the Course (2017–2025)
2. Scenario 2: Accelerating the National Development Pace (2026–2040)
3. Scenario 3: Dramatically Accelerating the National Development Pace (2041–2060)

5. Strategic Scenario Frameworks

The discussion that follows details two scenarios: Scenario 1 (2017–2025) and Scenario2 (2026–2040), whose central purposes are to strengthen the R&D goals of Kazakhstan. As in the past, both scenarios depend on financing from oil revenues received and budgeted by the country's government across a broad range of sectors.

5.1 Scenario 1. Staying the Course (2017–2025)

Research and development activities in Kazakhstan have been financed primarily by state-funded economic sectors, especially those associated with the petro- chemical sector and related activities. These and other investments have been directed at accelerating the pace of the country's overall development during a period of declining petrodollars. Among the strategic goals of conducting rigorous scientific and technical policy, the primary goal has been the pursuit of innovative leadership that is directly linked to the entry of Kazakhstan into the top thirty countries in the world's R&D industry. The development of young scientists and a large pool of technicians to support their activities is a central feature of this policy that is designed to advance the country's objective and subjective level of living.

5.2 Strategic goals

The goals of the first strategic plan are those articulated by President Nursultan Nazarbayev. Strategic investments in the R&D sector are central to the plan, with a target of 3.0% of GDP expenditures by 2050 (compared to Kazakhstan's current very low expenditure level of approximately 0.17% on R&D). The plan identifies various milestones for realizing the ultimate commitment and at the same time identifies a broad range of supportive activities needed to make efficient use of the eventual target expenditure level.

5.3 Strategic initiatives

The government's program of R&D development during Scenario 1 (2017–2025) emphasizes the implementation of considerable innovative activity in the sciences that, in turn, is expected to stimulate the development of more aggressive investment patterns in the country's extensive network of private businesses and industries. A central goal in this commitment is to reduce the gap in level of adaptability and innovation vis-à-vis the technologically rich and high- income countries of the OECD.

These supportive outcomes include:

- (a) Encouraging the development of high-tech industries in developing sectors,
- (b) Providing substantial financial incentives to make the demand for innovation grow, and (c) improving the technological and managerial skills of the country's largest and most complex industrial enterprises.

If successful, as an out- come of Scenario1, increased expenditures are expected to achieve the following results:

- (a) To increase the share of R&D investments in 20 percent of Kazakhstan's most innovative enterprises (in accordance with the OECD methodology [OECD, 2018])
 - a. To increase the share of innovative products inside the total of the gross domestic product (GDP) by more than two points.
 - b. To improve country's standard of life and well-being
- (b) To substantially increase the share of intramural R&D spending of GD's Low level of business response to technological innovation
- (c) Lack of technical and managerial skills
- (d) Lack of development to innovative technologies in the educational system
- (e) Inadequate systems for monitoring the implementation of innovative projects

All these challenges to Kazakhstan's development must be resolved if the country's strategic

national plans are to move forward. The following sections discuss each of these roadblocks to development more fully, especially as they relate to innovations associated with increased R&D.

In this scenario we must remark that nowadays our society is going through unprecedented changes in the spheres of technology and economy.

These new systems are forcing radical mutations in our working environment, in the realization of our civil rights, of growing new generations. It's fundamental now for the country to prepare and face these modern demands, and in order to do that, the Kazakh government approved the «Kazakhstan-2050 Development Strategy». The country wants to become one of the thirty most developed in the world. In fact, 60 of the 100 steps which constitute Kazakhstan's development plan have already been achieved. The remaining ones are substantially of a long-term nature and are gradually being realized.

5.4 Organizational issues

One organizational issue is that the R&D enterprises in Kazakhstan must follow European OECD standards for implementation of policies in the scientific sphere (OECD, 2018). It is very important that R&D enterprises and control in authorities adhere to the essence and definition of the term *R&D* in the Frascati manual, not only for internal and external R&D expenditures, but also in the development of public policies in other sectors that impact private and public investments in R&D. The problem here lies mainly in the separation of any scientific activity from R&D in accordance with the Frascati guidelines. Thus, the issue is scientific novelty: innovations and new knowledge obtained because of R&D. In foreign countries, this issue is considered by the research/scientific fund or agency, attracting scientists in relevant fields as jurists and experts.

6. R&D Actors

A broad range of economic actors will be involved in the implementation of the strategic scenarios discussed below: government, businesses, not for profit organizations, international development assistance organizations, and consumers (individuals families, and extended kinship systems). The plans are organized to benefit from the experiences of other countries and economic associations of countries in promoting their own R&D activities. The contributions of scholars and distinguished scientists are also expected to figure prominently in the framing of these plans.

6.1 Business and Non-profit Sector

Each year, the state statistics bodies organize seminars for businesses engaged in the implementation of R&D. During these seminars, issues related to record keeping are explained. We believe that these seminars should include experts in the relevant branches of science who will clarify the differences between R&D research activities in accordance with OECD standards. Without proper control (from the Scientific/Research Fund) of organizations conducting R&D, the amount of intramural R&D expenditure and its share of GDP expenditures may be incorrect and distorted.

In several countries that are leaders in innovation, business tax benefits in the form of additional deductions are considered in calculating the corporate income tax. The tax legislation of the Republic of Kazakhstan has similar measures. These measures were adopted in 2018 and are currently being tested. At the same time, there are many controversial issues that are contrary to practices in OECD countries. One is a tax deduction certificate that is received when research results are implemented in production. Often positive research results cannot be obtained initially and therefore the business cannot qualify for a tax credit for the implementation of R&D (although the expenditures have already been made). This may have a negative effect on the growth of the number of companies that would be interested in pursuing R&D. Therefore, the second issue in their focusing goals is the development of indirect measures that would contribute to a positive R&D environment in Kazakhstan.

Again, there are some methodological issues:

- Research and development expenditures need to be allocated consistent with OECD standards
- Research and development expenditures must be made in a manner that reflects both OECD standards and international accounting methods

The introduction of internationally agreed upon standards for assessing R&D allocations is expected to contribute to the growth of R&D entities, as well as the workers they employ, and to achieve positive growth in the level of intramural R&D expenditures relative to the GDP.

6.2 Higher Education (Including Universities, Academies, and Research Institutes)

Every three years the committee responsible for science and education grants funding for R&D projects in the following areas: (1) conscious use of energy and its sources energy; (2) information and communication technologies; (3) life sciences; and (4) increasing the country's intellectual potential. The national research councils were established to examine and approve submitted applications.

Introduction of these research approaches may raise several methodological questions. One regards the novelty of the result (its correspondence to OECD standards). The solution of this problem must begin with the study and implementation of OECD standards among all sectors of performance (OECD, 2018). Today in Kazakhstan young scientists must learn these norms to be competitive in the future.

6.3 Refocusing Goals

The refocusing goals in R&D at this stage should include implementation of measures promoting and contributing to innovative activity. There should be a national plan for R&D (conception) until at least 2025, expressing the concrete steps needed to achieve innovative leadership in Kazakhstan and containing a list of the responsible state bodies. During the fulfilment process, all these bodies should monitor the plan and make modifications for improvement.

To successfully implement Scenario 1, several refocusing goals are needed. First, it is necessary to study and implement European R&D standards (OECD, 2018). The priority should be to train future Kazakhstan scientists in accordance with these norms and regulations to ensure that they understand the meaning and essence of innovations and modern world novelty with reference to an R&D project. Second, in-house R&D departments should be formed within comparable public and private research enterprises that, among other goals, aim to train employees with the help of international R&D experts. Third, a system of direct and indirect incentives for R&D businesses should be developed to stimulate investments in R&D projects.

One of the basic conditions that affect the funding of R&D projects is the potential commercialization of the research results. For several years, when "Ministry of Education and Science of the Republic of Kazakhstan" (<http://sc.edu.gov.kz/ru>) offered scientific grant funding, many projects were conducted in the five areas outlined in the previous section. These results should now be presented to the market. The corresponding "Law on the Commercialization of the Results of Scientific and (or) Scientific-Technical Activity" (<http://adilet.zan.kz/rus/docs/Z150000381>) has created new opportunities for the higher education sector to present R&D products to the market. One of the main problems here is to verify the novelty of R&D results. Therefore, the fourth refocusing goal is to continue considering and implementing European R&D standards (OECD, 2018). In conjunction with this goal, the authors note that new developments in various fields of science are presented in journal articles published by leading publishing houses such as Elsevier, Springer, Wiley- Blackwell, and Taylor and Francis.

Currently, Kazakhstan has free access to some journals published by Springer and Elsevier publishing houses. Limited access to these articles and lack of access to journals published by Wiley-Blackwell, Taylor and Francis, and others reduces exposure to new scientific knowledge and slows the growth of scientific-research potential in the Republic of Kazakhstan.

Today, most research of world importance is published in English. Therefore, knowledge of

the English language is essential to scientists working on R&D in Kazakhstan. Scenario 2 is aimed at further diversification of R&D projects. This diversification will be characterized by further creation of innovative solutions in various industries.

6.4 Scenario 2: Accelerating the Pace of National Development

A second substantially more accelerated scenario for the promotion of R&D will follow the conclusion of Scenario 1. Scenario 2 will build directly on Scenario 1 and will lay the foundation for Scenario 3, which will be the subject of a separate article. All three scenarios are built on the ambitious goals for the country's development formulated by President Nursultan Nazarbayev and, taken together, will advance Kazakhstan's scientific and technological development through the year 2050 and beyond.

7. Strategic Goals

In subsequent years, we will continue to improve the innovation environment, developing sectors of performance that will focus on innovation. The new economy that will be brought by R&D results will be based on modern technologies such as mobile and multimedia technologies, nanotechnology and space technologies, robotics, genetic engineering, and research of future energy resources. The expectation is that the successful achievement of the goals of all three scenarios will advance Kazakhstan's R&D position to among the top thirty nations in the world. The main strategic goal for Kazakhstan is to increase intramural R&D expenditures to at least 1.1 to 1.2 percent of the GDP by 2030. At the same time, the business share of intramural R&D expenditures should be no less than 8 to 10 percent. The current situation is the basis for formulating and refocusing the goals for Kazakhstan for the next ten years.

7.1 Strategic initiatives

The government's programs of R&D development during Scenario 2 (2026–2040) should emphasize the development of branches of science in which R&D products will meet the needs of domestic and foreign clients and thus will be in demand in local and CIS markets. One example is a food industry in which Kazakhstan will certainly possess a leading position. The government and business will continue to encourage development of modern food industries, providing various financial incentive schemes to increase the demand for innovation. As an outcome of Scenario 2, the authors prognosticate (a) a relevant boost in the number of enterprises engaged in food products R&D (in accordance with OECD methodology [OECD,2018]), (b) an increase in the share of innovative food products to 1.0 percent of the total GDP, and (c) a substantial increase in food-product-related intramural R&D expenditures to 2.0 percent by 2040.

7.2 Human and capital resource base

During further development of the R&D sphere in Kazakhstan, the share of state participation should decrease to 30 to 35 percent of the total funding for scientific research. The state will primarily fund fundamental and applied research. To keep pace with global competition, more qualified scientific personnel will be needed to carry out R&D projects characterized by originality and novelty in accordance with international OECD standards. A key goal is the creation of new products that are in demand on the market.

The government will support businesses engaged in R&D in implementing various programs. For R&D projects that are to be developed and modified in accordance with OECD standards and principles, special attention should be paid to qualifying criteria, such as novelty, creativity, inventiveness, systematic activity, and transference and reproduction capability.

Depending on market conditions, the share of the state and business participation will be determined separately for each R&D project. For example, 70 percent of funding might be provided by the state and 30 percent by business, with different caps established according to the size of the

business.

7.3 Monitoring progress

One of the main goals is systematic state control and monitoring of the level of innovation development within the Republic of Kazakhstan. Growth is expressed mainly by the level of intramural R&D expenditures in relations to the Gross Domestic Product;

Target for expenditures is 1.1 to 1.2 percent of the GDP by 2030. An important aspect of monitoring involves inviting international experts to provide consulting services in the R&D sphere.

7.4 Refocusing goals

At the completion of Scenario 2, the refocusing goals will be centered on the development of final targets for 2026 to 2040, when Kazakhstan is expected to achieve leadership in R&D as one of the thirty top countries in this sector. The primary refocusing goal here will be furthering growth of innovative activity through increased business investment in R&D and an increased level of intramural R&D expenditures equivalent to at least 3 percent of the GDP by 2050.

8. Discussion with a Focus on Next Steps

Kazakhstan is on its way to achieving a more enlightened and technologically advanced path to reform its economy toward becoming one of the major global actors. This advancement is especially reflected by the country's steadily increasing R&D activities as well as its growing numbers of university-educated R&D researchers, scientists, and technicians. Kazakhstan has been joined in this effort by other former Soviet Union members, as well as major R&D centres located in Europe and South and South East Asia. Kazakhstan's rapidly expanding numbers of R&D scientists illustrate its new commitment to knowledge development through research, as does the percentage of its national economy currently committed to R&D activities. These important gains are contributing to increases in the standard of living of the country's highly diverse population.

The country's next steps in advancing its R&D profile will be realized through the more complete implementation of its presidentially driven national plans of action for 2020, 2030, and 2050. This process will also involve meaningful partnerships with the country's profit and not-for-profit sectors and, to a lesser extent, with the country's families, who have made multifaceted contributions toward strengthening local community capacity for scientific and technological innovation.

Meaningful contributions to economic development by these critical actors will bring about the dramatic scientific and technological changes needed to modernize Kazakhstan. We believe that the country is successfully moving forward toward achieving these goals; its prospects for the future remain positive and forward looking.

9. Conclusion

As we have tried to highlight, the Kazakh government has initiated various development plans focused on the one hand on diversification with respect to dependence on hydrocarbons and on the other on the enhancement of transit potential. The main objectives are therefore the development of the road and rail network, the agri-food industry and manufacturing. The most important issue remains the desire to strengthen the national innovation system and create a managerial class capable of facing the new challenges of the country. Research will become increasingly important, attracting investors and at the same time appropriate managers, a central issue. To do this, the Kazakh government must implement numerous reforms with the aim of encouraging greater openness to international trade and foreign investment. The accession to the WTO, the launch of the "Plan of the 100 Steps" (wide program of structural reforms that aim at a greater transparency of the country system), if we also want to have hosted the EXPO 2017, these are all elements that

show a strong desire for internationalization, and a strong desire to attract foreign investors to the country, which are fundamental to launch a serious research and innovation program.

Simultaneously with Kazakhstan, following the sharp devaluation of its currency (the peak was recorded in December 2016 with 14%) it will also be necessary to focus on technology transfer and training, with possible locally production. Therefore, in the program of the newly elected President Tokayev, Kazakhstan looks at the world market for geological exploration, with the intention of attracting investments from foreign engineering companies to this sector and simplifying the legislation. Already during the previous five-year plan, the country has developed a production capacity in the automotive and aeronautical industry sector, as well as in the railway sector, etc.

Consequently, further development and innovation is expected in sectors such as: nanotechnologies and space technology, robotics, genetic engineering and the exploration of future energies. The Government's fundamental priority is to create the most favourable conditions for companies in Kazakhstan, especially small and medium enterprises.

Finally, as regards the educational system, the country needs a gradual transition of universities leading to academic and administrative autonomy. During the speech to the nation, Tokayev spoke of building a market economy and improving the living conditions of the citizens that have been mentioned, among the main successes of the Nazarbayev presidency. There is a need to dare; Kazakhstan also dares to use the mega infrastructures of maritime transport fielding the proposal of a "Eurasian channel" to ensure that its ships, starting from the Caspian Sea, could be able to directly enter the Black Sea and, through the Bosphorus, the Mediterranean. If implemented, this plan will make Kazakhstan a fundamental logistic platform of "Eurasia", a large centre for the sorting of goods and services and for attracting investments in the "heart of the world".

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