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CHALLENGES WITH THE TRANSITION TO A RESEARCH-BASED ECONOMY IN KAZAKHSTAN

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This study offers several qualitative and mixed approaches to explore the challenges with the transition to a research-based economy in Kazakhstan. Some findings have been drawn from a doctoral study of science policymaking in Kazakhstan focusing on experts' involvement in agenda setting.

According to the results of this study, despite the significant structural transformation and numerous economic development strategies, the economy of Kazakhstan remains dependent on extractive industries. It is mainly because the structure of the economy of Kazakhstan is more export-oriented than service-based. The macroeconomic situation is characterized by an unpredictable business environment.

The findings of this research highlight that the business sector is not interested in R&D activities and relies most on accelerated foreign technologies. The Kazakh Government likely needs to facilitate specific subsidies and tax preferences for business enterprises involved in research and development activities. This kind of state support may encourage business representatives to invest more in scientific activities that could help the country move smoothly to a research-based economy.

Keywords: a research-based economy, knowledge economy, research and development, diversification, export volume, industrial innovation, extractive industries.

ПРОБЛЕМЫ ПЕРЕХОДА К НАУКОЕМКОЙ ЭКОНОМИКЕ В КАЗАХСТАНЕ

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Данное исследование предлагает несколько качественных и смешанных подходов к изучению проблем, связанных с переходом к наукоемкой экономике в Казахстане. Некоторые выводы были сделаны в ходе докторского исследования разработки политики в области науки в Казахстане, в котором основное внимание уделялось участию экспертов в формировании повестки дня.

Согласно результатам данного исследования, несмотря на значительные структурные преобразования и многочисленные стратегии экономического развития, экономика Казахстана остается зависимой от добывающих отраслей. Это происходит главным образом потому, что структура экономики Казахстана больше ориентирована на экспорт, чем на сферу услуг. Макроэкономическая ситуация характеризуется нездоровой и непредсказуемой деловой средой.

Результаты исследования свидетельствуют о том, что бизнес-сектор не заинтересован в научно- исследовательской деятельности и не участвует в развитии научных и инновационных сфер. Правительству Казахстана, вероятно, необходимо предоставлять субсидий и налоговые преференций для предприятий, занимающихся исследованиями и разработками. Подобная государственная поддержка может побудить представителей бизнеса больше инвестировать в научные исследования, которые могли бы помочь плавному переходу к экономике, основанной на исследованиях.

Ключевые слова: наукоемкая экономика, экономика знаний, исследования и разработки, диверсификация, объем экспорта, промышленные инновации, добывающие отрасли.

ҚАЗАҚСТАННЫҢ ҒЫЛЫМҒА НЕГІЗДЕЛГЕН ЭКОНОМИКАҒА КӨШУ МӘСЕЛЕЛЕРІ

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Бұл зерттеу Қазақстандағы ғылымға негізделген экономикаға көшумен байланысты қиындықтарды зерттеудің бірнеше сапалы және аралас әдістерін ұсынады. Кейбір қорытындылар күн тәртібін құруға сарапшылардың қатысуына бағытталған Қазақстандағы ғылым саясатын жасақтау жөніндегі докторлық зерттеуден алынды.

Осы зерттеу нәтижелеріне сәйкес, елеулі құрылымдық өзгерістерге және көптеген экономикалық даму стратегияларына қарамастан, Қазақстан экономикасы өндіруші салаларға тәуелді болып қала беруде. Бұл, ең алдымен, Қазақстан экономикасының құрылымы қызмет көрсету саласына қарағанда экспортқа көбірек бағытталғандығына байланысты. Макроэкономикалық жағдай сау емес және болжауға болмайтын кәсіпкерлік ортамен сипатталады.

Зерттеу нәтижелері кәсіпкерлік сектордың ғылыми-зерттеу қызметіне қызығушылық танытпайтынын және ғылыми-инновациялық бағыттарды дамытуға қатыспайтынын көрсетеді. Қазақстан үкіметі ғылыми-зерттеу және тәжірибелік-конструкторлық жұмыстармен айналысатын кәсіпорындар үшін нақты субсидиялар мен салықтық преференциялар беруді жеңілдету қажет болуы мүмкін. Мұндай мемлекеттік қолдау бизнесті зерттеуге көбірек инвестиция салуға ынталандыруы мүмкін, бұл зерттеуге негізделген экономикаға көшуді жеңілдетуге көмектеседі.

Түйін сөздер: білімге негізделген экономика, білім экономикасы, ғылыми-зерттеу және әзірлемелер, әртараптандыру, экспорт көлемі, өнеркәсіптік инновациялар, өндіруші салалар.

Introduction. Over the last few decades, Kazakhstan has placed a high priority on promoting scientific and research activities. The nation has implemented several governmental reforms, strategies, and programs to decrease its dependence on the extractive industries, aiming at a research-based economy. More specifically, the Kazakhstan 2030 and 2050 strategies adopted in 1997 and 2012, respectively, call for extensive political and economic changes, with a focus on diversifying the economy and achieving high-value-added production. The national government encourages industrial innovation due to the decarbonization tendencies worldwide.

Along with other objectives, Kazakhstan's 2030 and 2050 strategies have set the goal to move Kazakhstan into the top 30 countries by 2050. Science and technology have been identified as the driving forces behind this process. The nation pursues the development of special industrial and economic zones, innovation clusters, digital and industrial infrastructure, support of programs to increase R&D and innovation, high-tech exports, venture capital, development of human capital, etc. The adoption of the Kazakhstan 2030 and 2050 strategies has been a significant step toward establishing the agenda for innovational and scientific development and diversification of the economy.

Despite such ambitious plans, R&D and innovational outcomes remain comparatively lower at 87th out of 132 on the “innovation output” sub-index of the Global Innovation Index in 2023 [1]. This result however is noticeably higher than those from previous years (97th in 2022, 101st in 2020). The government expenditure on science remains significantly low compared to more developed countries (0.13% of GDP vs 2.5% of GDP) [2].

One of the recent reforms on accelerating scientific and innovational activities in Kazakhstan has been establishing a separate governmental body responsible for scientific development with relevant legislation on Science and Technology Policy. The latter reflects the logic of national development toward science and innovation and effective measures to support private initiatives to create innovative infrastructure - business incubators, commercialization centers, technology parks, and design bureaus.

Literature review. A research-based economy or knowledge economy is an economic system that relies more heavily on intellectual capabilities than

natural resources. This term was initially coined by Peter Drucker in the 1969 [3] essay ”The Age of Discontinuity.”

The Austrian economist Fritz Machlup defined knowledge and prescribed knowledge's utility from a multifaceted perspective in The Production and Distribution of Knowledge in the United States [4]. This definition focused on knowledge's use in production, namely in the creation of the knowledge industry.

This concept also refers to the increased demand for knowledge, information, and highly trained workers, as stated by the Organization for Economic Cooperation and Development [5]. This transformation includes adjustments to the political, economic, technological, and value systems of societies [6]. This shift has led to a reinterpretation of the function of human capital, which is now deemed to be more significant [7].

The European Bank for Reconstruction and Development (EBRD) has recently advanced the idea of the knowledge economy as an aspect of economic development, where productivity growth is driven by innovation and information availability [8]. The shift to the knowledge economy involves several components of new developments like digitization and the Internet.

Meanwhile, theory and empirical study on the economic effects of R&D spending received a significant boost from Robert Solow's groundbreaking work (1956), which emphasized the significance of R&D as a driver of technological development, innovation, and economic growth.

Studies highlight that subsidies for business R&D encourage optimal private R&D spending and returns on research and development [4-9]. According to Dai & Liwei [5-10], a saturation limit beyond which an increase in public subsidies would either partially or entirely drown out a firm's private R&D investment instead of increasing the firm's total R&D spending. Studies also support the assumption that although government support for firm-performed R&D has a positive impact on business-financed R&D, the degree of this effect's stimulation varies [11,12].

Yet, discovering the impact of government subsidies on business R&D spending piqued likely the curiosity of many scholars. The study conducted by Czarnitzki and Lopes-Bento [13] examined the effect of a government-sponsored commercial research and development program in Flanders from different policy perspectives. The findings indicated that the policies are not fully crowding out, the treatment effects remain constant over time, and additional subsidies do not reduce the estimated treatment effects. In the case of Germany, the coexistence of national and European policies is described as complementary by the same authors, Czarnitzki and Lopes-Bento [13].

In their studies, Hud and Hassinger [14] discovered a positive effect for 2006-2010 and a crowding-out effect for the crisis year 2009 due to the reluctance of German small-medium enterprises (SMEs) to engage in innovation through subsidies. According to their findings, public subsidies have a generally positive impact since they keep R&D spending from stopping, which would have otherwise happened.

Large treatment effects were observed for European SMEs, when it came to input additionality from national and international programs separately for firms supported by both sources compared to firms supported just by national programs [15].

The study on the long-term relationships between regional Trade Facilitation Programs, R&D, human capital, and public infrastructure in Italy from 1980 to 2001 demonstrates that geography matters for R&D spillovers, as R&D has a positive impact on productivity and the R&D stock in one region influences productivity levels in neighboring regions [16].

Using data from 23 OECD nations from 1991 to 2006, Wang et al. [17] discovered that R&D spending for high-tech sectors affects GDP per capita levels. Another study by Inekwe [18] stated that the influence of research and development spending on the economic growth of 66 selected nations varies over the short and long term, as in upper-middle-income and low-income countries, and the impact is much more pronounced and substantial. Thus, studies suggest that science and technology enormously affect sustainable growth and economic transformation.

Methods and materials. This article draws from a study conducted by the first author using online interviews with Kazakh governmental administrators, independent experts, and scholars. The data was collected as a part of dissertation research focused on science agenda-setting in Kazakhstan. The first author conducted in-depth, semi-structured online interviews with 24 participants using snowball sampling for these interviews. Interview questions focused on science policymaking and experts’ involvement in this process.

Additionally, the current study includes an analysis of the current state of the economy and the official data of the National Bureau of Statistics and other

sources. To expand the understanding of the research subject, the findings from this current study have been combined with the findings of the previous dissertation research.

The role of extractive industries in the economy of Kazakhstan. Despite the significant structural transformation of Kazakhstan's economy, its sustainability and competitiveness likely remain in a high degree of dependence on extractive industries. While many macroeconomic trends look strong, the benefits of resource-led growth have not been sufficiently distributed across the economy, leading to uneven growth in productivity, investment, and inclusion.

Yet, developing the private sector and promoting economic diversification remain among critical government priorities. The government developed numerous economic development strategies, invested significant public resources in industrialization programs, and implemented several regulatory reforms to support domestic and international business. The environment for doing business in Kazakhstan has become much easier and more attractive (25th in the World Bank Doing Business 2020 ranking), and the country's macroeconomic performance over the past two decades has been impressive [19].

At the same time, progress in changing the role of the state in the economy from a main driver of output growth to a driver of private sector growth, as well as progress in diversifying and increasing the sustainability of the economy, remains slow. Economic growth continues to be driven primarily by the extraction and export of natural resources. Moreover, Kazakhstan's economic growth has likely correlated with world oil prices for more than two decades. As oil prices rise, so does GDP, and the opposite. It reflects that net exports – most of which are hydrocarbons – are critical drivers of annual economic growth.

Specifically, high oil prices have contributed to offsetting a large portion of the national government spending during the worldwide pandemic. In 2022, government revenue increased by 70% due to the international oil price, when the growth of oil revenues amounted to 177% versus 27% of non-oil revenues with a slight increase in volumes [20]. As a result, the extractive industry continues to be the primary driver of growth and fiscal sustainability, enabling the Kazakh government to accumulate substantial reserves.

Yet, according to the International Energy Agency [21], one of the challenges the Kazakh government needs to address is the volatility created by macroeconomic dependence on resource rents and the challenges associated with unstable business environment. While the country remains a competitive exporter of hydrocarbons, the government should recognize that its competitiveness could decline the transition to decarbonization. Moreover, hydrocarbons and other minerals exports constitute a large portion of the national budget [22]. Despite Kazakhstan having expanded the range of products it exports, becoming the most diversified exporter in Central Asia in the number of different export products, its impact on the export volume seems limited.

According to the latest data, Kazakhstan’s trade turnover with the outside world amounted to $134.4 billion in 2022. The country has a positive trade balance: exports amounted to 84.4 billion dollars, and imports - 50 billion. Yet, oil and petroleum products constitute 65.17% of exports; the rest represent raw materials such as copper and various ores. The export volume with the EU, Russia, and China is dominated by minerals and metals, which account for more than 80% of all exports [23,24].

This situation is generally because the structure of the economy of Kazakhstan is less service-based and more export-oriented. The production of goods accounts for almost 40% of GDP, including 14.5% from the mining industry and 13.2% from manufacturing. Oil and gas production accounts for 80% of the mining sector. The manufacturing industry of Kazakhstan is 44% metallurgical production, 15% mechanical engineering, and 5.5% production of non-metallic mineral products. The rest comes from small industries, such as pharmaceuticals [25].

Meanwhile, according to the national statistics, the largest share in exports with the EAEU countries is occupied by machinery, equipment, vehicles, instruments, and apparatus - 26.5%, followed by products of the chemical and related industries - 26%. The structure of imports from the EAEU countries was dominated by animal and plant origin, finished food products - 19.9%, metals and products made from them - 19.3% [26].

Table 1 - Commodity structure of exports and imports of Kazakhstan with the EAEU countries in 2023

	Name of goods	Export	Import
1.	Metals and products made from them	17,8	19
2.	Mineral products	16,8	12,1
3.	Vehicles and devices	26,5	18,6
4.	Foodstuffs	7,5	19,9
5.	Chemical industry products	26	16,7
6.	Other products	5,4	13,4

Source: Bureau of National Statistics [26]

In the total volume of foreign trade turnover of Kazakhstan with the countries of the EAEU, the Russian Federation occupies 91.6%, followed by Kyrgyzstan - 5%, Belarus - 3.3%, and Armenia - 0.2%.

The trade turnover amounted to 25,7 million US dollars in 2023, which in nominal terms is 3% less than the same period last year. Exports of goods amounted to 9,9 million US dollars (more by 10%), imports – 15,8 million US dollars (less by 9.7%).

What hinders the transition to a research-based economy in Kazakhstan*?* The results of the study conducted by the first author as part of the doctoral dissertation show the insufficiency of resources and the lack of interest from the business sector as critical problems of science and research development in Kazakhstan.

"Due to the absence or a limited number of high-tech industries in the country, there is practically no demand for science from the real sector. Thus, while setting the scientific agenda, the authorized body often proceeds from the interests and capabilities of scientific organizations and universities." (a government official, 49 years old).

"Business is not interested in science. Business is interested only in accelerated technologies and startups, where it is possible to make quick money." (an independent researcher, 34 years old).

"The authorized bodies in science, while setting the policy agenda, often proceed from the existing potential of scientific organizations. Decision makers struggle with the insufficiency of resources and business R&D." (49 years old).

Table 2 - The volume of domestic expenditures on R&D by sources of financing in 2019-2021

	Name of goods	Export	Import
1.	Metals and products made from them	17,8	19
2.	Mineral products	16,8	12,1
3.	Vehicles and devices	26,5	18,6
4.	Foodstuffs	7,5	19,9
5.	Chemical industry products	26	16,7
6.	Other products	5,4	13,4

Source: The National Academy of Sciences, 2022

Indeed, the data from the National Academy of Sciences [27] demonstrates that 58.6% of the R&D costs in Kazakhstan are state-funded, 33.5% - by scientific institutions, and 8.3% - by business enterprises (Table 1). Meanwhile, within the EU zone, the business sector covers more than half (57.9%) of R&D spending, while government subsidies account for about one-third (30.3%) of R&D costs.

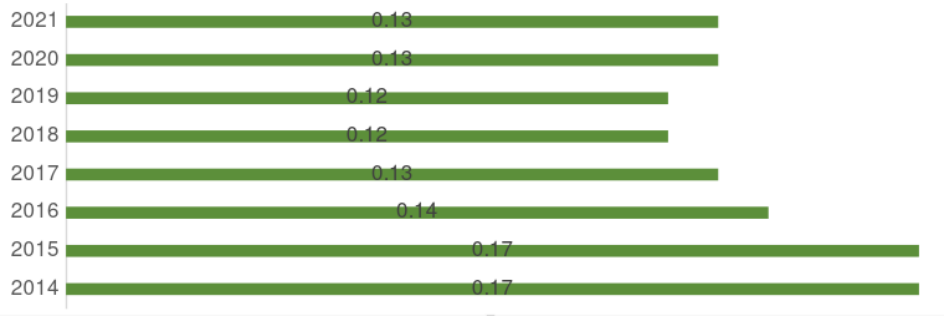
According to the opinion of Kazakh scientists, the provision of state support for research activities is essentially acute in developing states since the business enterprises are not actively involved in scientific

research and funding. Most likely, compared to more industrialized governments, the availability of state assistance for research activities in Kazakhstan is essentially acute. Research and development spending by funding sources in developed nations looks impressive as in South Korea, business funding for R&D makes up approximately 80% of the total budget, while in Japan, China, and the US, it accounts for 79%, 76%, 75%, Belgium, Ireland, Germany, Sweden, and Malta, 42.4%, 62.6%, and 61.2%, respectively [28].

The official data highlights that the business community in Kazakhstan contributes little to R&D. The country's scientific endeavors are heavily supported by the national government. As a result, the state bears most of the R&D expenses (51.95%), with the business bearing only 8% of these costs. The latter prioritizes the natural sciences (16%), engineering (about 75%), and agriculture (7%). Due to such characteristics, foreign experts suggest that Kazakhstan is still in the early stages of research and development investment, with a large portion of its resources going toward the extraction of energy reserves [19].

This situation is heightened by the small share of R&D spending in GDP, which is only 0.13% (Figure 1). According to the OECD [2], the average R&D spending across the OECD states grew from 2.5% in 2019 to roughly 2.7% in 2020.

Figure 1 - The average R&D spending from 2014 to 2021 as a percentage of GDP.



Source: The National Academy of Sciences, 2022

Discussions and conclusions. According to the results of this study, the volume of funding for research activities and its distribution is among the most critical issues in the Kazakh scientific and innovation field. A large share of funding comes from the national government, and this policy likely adheres to the vision of a well-known American science administrator, Vannevar Bush [29], who suggests that the central government must sponsor basic science as it produces broad social benefits.

The results highlight that the provision of state support for research activities is essentially acute in developing states, and compared with more industrialized states, the business enterprises in Kazakhstan are not actively involved in R&D. In more developed countries, business-funded R&D accounts for more than 60%. The business sector seems to play a minor role in performing R&D in Kazakhstan.

The structure of Kazakh business R&D prioritizes the engineering field (about 75%), natural sciences (16%), and agriculture (7%) [5]. Thus, foreign experts estimate that Kazakhstan is at an early stage of R&D investment, and many of its resources are devoted to the discovery and processing of energy reserves [19].

In addition, the average value for research and development expenditures remains at 0.13% of GDP, while across the OECD, R&D intensity increased from 2.5% in 2019 to about 2.7% in 2020 [30].

Kazakh policymakers likely lack efficient policies to increase scientific and innovation productivity in the country. Thus, they should adopt more rational and evidence-based policymaking by engaging experts and the scientific community. Moreover, considering the shortage of resources and the limited business R&D, scientific evidence and expert consultation should be part of policymaking.

Beyond financial support, the government should encourage innovation through various channels, including trade assistance, research network development programs, business strategy consulting,

and basic introductions. One way to assist early-stage and long-term strategic R&D that can help innovation creation and growth is probably to facilitate collaboration with universities. There is no denying that government funding for innovation is important, but so is the broader commercial support they can offer, reflecting the rise of business R&D share in Kazakhstan.

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