

Mukhtarova K.S.,
Zhidebekkyzy A.

**Commercialization of green
technology projects in
Kazakhstan: key factors and
barriers**

Мұхтарова Қ.С.,
Жидебекқызы А.

**Жасыл технологиялар
жобаларын коммерция-
ландыру: кілтті факторлар
мен кедергілер**

Мухтарова К.С.,
Жидебекқызы А.

**Коммерциализация проектов
по зеленым технологиям:
ключевые факторы и барьеры**

Green technologies are essential tools to ensure sustainable development of the economy. The transition to a green economy requires changes in existing governance approaches, institutions, and markets. One of the important indicators is a successful implementation of research results in green technologies. In this regard, the author analyzed green technology projects in Kazakhstan in terms of commercialization. Research objectives are to patent analysis of projects and to identify key factors and barriers that affect the successful commercialization of technologies based on the respondents' opinions. Interviews with representatives of 14 green technology projects and 9 experts were conducted and analyzed. In the result of total 23 interviews factors and barriers affecting the commercialization of green technologies in Kazakhstan were identified. The overwhelming majority of experts emphasized the importance of financial, infrastructural, technological and personnel factors. It is necessary to take into account all mentioned factors and develop complex measures to overcome barriers. That would be basis for successful of transition from "brown" to green economy.

Key words: commercialization, green technology, research results, innovation management, sustainable development.

Жасыл технологиялар ел экономикасының тұрақты дамуының бірден-бір маңызды құралдарының бірі болып табылады. Жасыл экономикаға өту жолында қазіргі нарықтар, институттар мен басқару тәсілдерінде өзгеріс қажет. Маңызды көрсеткіштердің бірі – жасыл технологиялар саласындағы ғылыми-зерттеу жұмыстарының нәтижелерін қолданысқа енгізу. Осыған орай, авторлар мақалада Қазақстандағы жасыл технологиялар бойынша жобаларды коммерцияландыру тұрғысынан саралаған. Зерттеу міндеттері жобаларды патенттік талдау және сәтті коммерцияландыруға әсер ететін факторлар мен кедергілерді анықтау болып табылады. Зерттеу барысында 14 ғылыми-зерттеу жобасының жетекшілері мен 9 сарапшыдан эксперттік интервью алынды. Жалпы саны 23 сұхбаттың нәтижесінде Қазақстандағы жасыл технологиялар саласындағы өнертабыстар мен патенттерді коммерцияландыруға кедергі болатын факторлар анықталды. Сарапшылардың басым бөлігі қаржылық, инфрақұрылымдық, технологиялық, кадрлық факторлардың маңыздылығын атап өтті. Аталған факторлардың барлығын ескере отырып, кедергілерді жою үшін кешенді шаралар құру қажет. Бұл «қоңыр» экономикадан жасыл экономикаға өту негізі болады.

Түйін сөздер: коммерцияландыру, жасыл технологиялар, ғылыми зерттеу нәтижелері, инновациялық менеджмент, тұрақты даму.

Зеленые технологии являются важнейшими инструментами обеспечения устойчивого развития экономики. Переход к зеленой экономике требует изменения существующих подходов в управлении, институтах и рынках. Одним из важнейших показателей является успешное применение результатов НИР по зеленым технологиям. В этой связи, авторами проанализированы проекты по зеленым технологиям в плане коммерциализации. Задачи исследования заключаются в проведении патентного анализа по проектам, а также определении ключевых факторов и барьеров для успешной коммерциализации зеленых технологий на основе экспертного опроса. Было проведено экспертное интервью с представителями 14 проектов по зеленым технологиям и 9 экспертами в данной области. По результатам интервью был выявлен и классифицирован ряд факторов и барьеров, влияющих на коммерциализацию патентов и изобретений по зеленым технологиям. Большинство экспертов подчеркнули важность финансовых, инфраструктурных, технологических и кадровых барьеров. Необходимо выработать комплексные меры по их преодолению с учетом выявленных факторов. Это послужит основой перехода из «коричневой» экономики к зеленой.

Ключевые слова: коммерциализация, зеленые технологии, результаты научных исследований, инновационный менеджмент, устойчивое развитие.

COMMERCIALIZATION OF GREEN TECHNOLOGY PROJECTS IN KAZAKHSTAN: KEY FACTORS AND BARRIERS

Introduction

Today the task of ensuring the sustainable development of human civilization is being viewed as the guiding principle of the life of the economy and of the society in general. Sustainable development is considered to be a development which "... satisfies our current needs without jeopardizing the capability of generations to come to satisfy their own future needs [1]. In a most general sense, the solution of this task is linked to the shaping of "a new model of green economy" [2].

Researchers focus their interests on the commercialization of new green technologies that will substantially improve social welfare and ensure process of transition to green economy.

The OECD has defined green growth as follows: "Green growth is about fostering economic growth and development while ensuring that the natural assets continue to provide the resources and environmental services on which our well-being relies. To do this, it must catalyze investment and innovation which will underpin sustained growth and give rise to new economic opportunities" [3]. The Earth Summit Rio 1992 provided the vision and important pieces of the multilateral machinery to achieve a sustainable future.

Literature review

Nevertheless, many authors around the world, such as environmentalists, scientists, politicians, economists have made a huge contribution in attempting to create a more sustainable future.

For example, A. Leopold published his well-known book in 1949, wherein the main message is that the land is not there to serve us, but that we need to live in community with the land [4]. P.L. Ehrlich states that population growth and environmental deterioration are inextricably linked, and proposes four action items to address the crisis [5]. He also accentuated that gargantuan efforts are necessary to increase food production and feed all human-being. R.Buckminster Fuller argues that shortsightedness and siloed thinking are the main causes of impending ecological crisis [6]. His book is a remarkable for its overall message as for its elaboration of concepts that were ahead of their time. Also, he suggested considering the planet as a

closed system, using a metaphor “Spaceship Earth” to indicate it, so there is no “away”. In 1972, Meadows D.H. and other authors published a commissioned report to the Club of Rome, which is known as a book “The limits to growth”. Their book was revolutionary, and reports 13 scenarios for the future based on a computer simulation model developed at MIT [7]. Despite variations, all of them produce a sobering conclusion, namely that “the behavior mode of the system is clearly that of overshoot and collapse. Authors claim that growth trends in world population, industrialization, pollution, food production and resource depletion suggest that biophysical limits will be reached sometime within the next 100 years.

One of the turning points in the sustainable development is the publication of The Brundtland report, also known as “Our common future”. This report introduces the three fundamental components of sustainability – environment, economy and society – and highlights what is needed in each area to achieve sustainable development [8]. It makes it clear that we cannot achieve success in one of these areas at the expense of areas. Being considered one of the first comprehensive assessments of both the social, environmental and economic problems facing the world, one should admit that the UN Conference in Environment and Development held in Rio de Janeiro in 1992 was a direct outcome of this Brundtland Report. Doubtless, Kazakhstan has a distinct understanding of the state management assuming that promotion of the green economy is the main way and the only one in maintaining a sustainable development.

President of Kazakhstan N.A. Nazarbayev in the message “Strategy” Kazakhstan-2050”: new political course of established state” indicates 10 global challenges that the twenty-first century poses to hu-

manity, as well as measures taken in Kazakhstan to address them. In addition, he instructed the Government to revise the legislation on copyright and patents, as well as an analysis of all previously issued patents and registered copyrights for possible commercialization.

Research methodology

This paper aims to consider the commercialization issues of green technologies in Kazakhstan as a main tool of establishing sustainable economy. In this research, 14 projects were selected out of 43 potentially successful projects and 9 experts were invited from this field. As a result, 23 interviews with experts in the area of green technology were conducted and analyzed.

Research objectives are to determine availability of patents in projects and to identify key factors and barriers that affect the successful commercialization of technologies based on the respondents’ opinions.

Questions for the representatives of the projects were based on a literature review and pilot interview. It is important to distinguish main research question and subsidiary questions according to methodology of qualitative research [9]. All experts were interviewed on condition of anonymity. Interviews were conducted by the method of story-telling, where the researcher asked basic questions to guide conversation in the right direction, subsequently the story of an expert based on his personal experience and deep knowledge [10], [11].

A great experience and professionalism of the experts revealed several hidden factors and the specific problems of green technologies. For the clarity of selection Figure 1 and Figure 2 presents the segmentation of respondents.

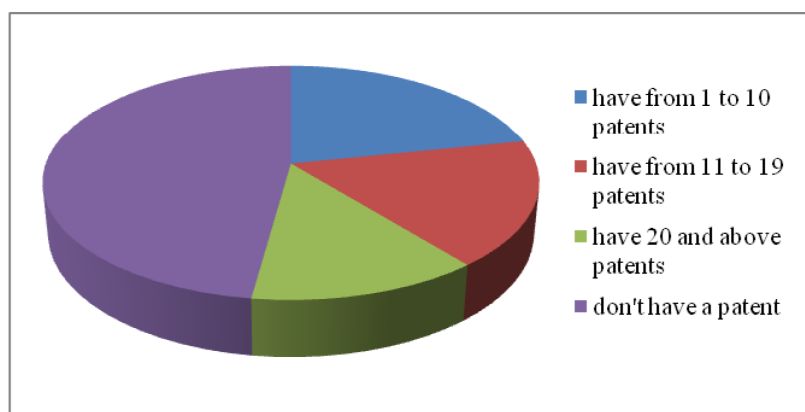


Figure 1 – Segmentation of experts on the number of patents

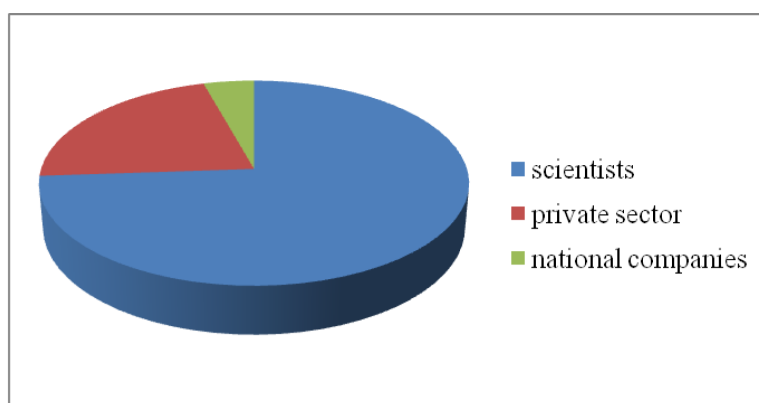


Figure 2 – Segmentation of experts

Research results and discussion

Analysis of inventive activity is traditionally held with the study of statistical data on the availability of patents and other protective documents. However, the existence of a patent does not guarantee its use. Unfortunately, the low level of commercialization of domestic developments proves this theory. Therefore, it is important to understand the commercialization process from the inside, to find out the reasons for the

low level of implementation of university research, to take into account the opinion of scientists and immediately take the necessary measures.

Conducted expert interviews have allowed to reveal some factors that were noted during the preliminary literature review. As a result, we have selected the most significant factors and important barriers that affect the successful commercialization of green technologies in Kazakhstan (Table 1).

Table 1 – Factors and barriers affecting the commercialization of green technologies in Kazakhstan

Factors	Description
Financial	<ol style="list-style-type: none"> 1. Lack of funding of R & D phase of the project 2. Lack of funding for clinical research, field testing, or production of the industrial design 3. The high cost of the necessary technology 4. Lack of scientific capital to start their own production 5. Low wages of scientists
Infrastructure / Technical	<ol style="list-style-type: none"> 1. Insufficient development of domestic production, which could be applied for green technology 2. Lack of development of the material-technical base for advanced research 3. Poor communication with the industry, making it difficult to conduct tests of the invention and its further advancement on the market 4. Priority use of ready-made foreign technology
Legislative	<ol style="list-style-type: none"> 1. Lack of incentives for the introduction of new green technologies in the industry. Payment of the fine for causing harm to the environment is much cheaper than the introduction of green technology into production. 2. Lack of incentives for cooperation with domestic research institutes to long-term research projects 3. Lack of intellectual property protection
Personnel	<ol style="list-style-type: none"> 1. The deficit of professional staff in the field of innovation management 2. Deficit of highly skilled economists and managers, their isolation from the production 3. Deficiency of lawyers in the field of intellectual rights, including international qualifications 3. Poor communication between scientists and government officials due to the lack of expertise of specialists in the management of commercialization
Socio-cultural	<ol style="list-style-type: none"> 1. Low demand for green technology in the domestic market 2. Lack of awareness about the relevance of the use of green technology, low environmental awareness 3. The low purchasing power of the population

Table 1 continuation

Personal	<ol style="list-style-type: none"> 1. The scientist is an inventor, but not a seller. The reluctance of scientists to engage in self-promotion and commercialization of the invention. 2. Weak market research, resulting in the first scientist comes up with an invention, and then looking for a buyer. 3. Reluctance to risk and not to disclose information on the intellectual property
Others	<ol style="list-style-type: none"> 1. The presence of a rich hydrocarbon reserves in the country, which reduces the profitability of renewable energy 2. Bureaucratic obstacles 3. Low effectiveness visit thematic exhibitions 4. High competition from foreign suppliers
Note – Compiled by the author on the basis of research	

56% of respondents noted the importance of the financial problem. It is known that the universities are mainly carried out research works, but to commercialization of the product, it must pass the R & D stage, the production of industrial design, testing and field studies, the creation of the final product / technology, the search for investors, start-up of production, marketing, promotion, etc. That is not entirely correct to expect the commercialization of technology from the research project with a small budget. For each of the above steps it requires huge resources and time.

47% of respondents noted the infrastructure and technical problems. Most projects have domestic and international patents. However, links with industry and production scale are necessary for further commercialization. In the absence of the corresponding production in the country, a scientist forced to seek foreign producers, where the disclosure of intellectual property secrets carries a certain risk. Therefore, companies in the field of green

technologies, working in Kazakhstan are inclined to buy ready-made foreign technology than to invest in non-tested invention, which requires additional costs.

Experts generally noted positive trends in the development of the legislative framework relating to the protection of intellectual rights, and the development of innovative activities. However, 47% believe that additional legislation stimulating the use of green technologies in the industry. 21% of respondents confronted with the facts of misuse or insufficient protection of intellectual property.

The importance of having highly skilled personnel has noted 43% of respondents. It should be noted that the state began training in innovation management are only a few years ago. Therefore, there is a shortage of professionals in the field of innovation management. The vast majority of scientists reported that they do research and invents, and other specialized staff should carry out economic calculations, do market research, search for investors, manage projects, sell technology and so on.

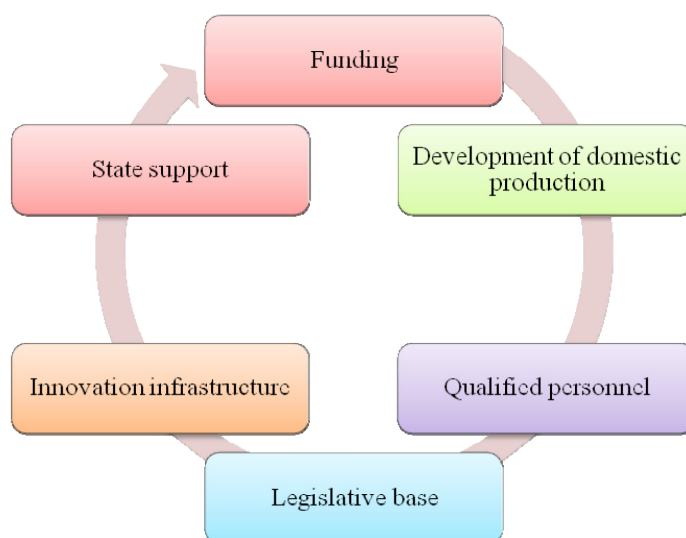


Figure 3 – Key factors influencing the successful commercialization

The important role played by social and cultural factors. 30% of the experts believe that the lack of awareness on the relevance of the use of green technology, low environmental awareness determine the low demand in this area.

34% of experts drew attention to the personality of the scientist. As noted earlier, the scientist is not an economist or businessperson, so often research project is not aimed at solving existing problems of production or business, and is a continuation of previous research scientist. That is, the scientist first gets the patent, then looking for ways to implement.

After analyzing the interviews of both scientists and businessmen, we concluded that the successful cooperation needed dialogue platforms and qualified mediators / managers. In addition, we have identified six key factors influencing the successful commercialization of green technologies in Kazakhstan (Figure 3).

On the commercialization of green technologies in the country is influenced by other factors. For example, the experts noted that the presence of the

rich hydrocarbon reserves in the country reduces the profitability of renewable energy. High competition from foreign suppliers, where green technologies are developed with 60 years of XX century, is also a significant impact on domestic inventors.

Conclusion

It is important to build an effective relationship between science, production and business. This applies to all fields of science. Commercialization of new green technologies significantly contributes to sustainable development. Necessary measures have been taken for this purpose, but there are problems and challenges that need to be solved. The green economy is more than just environmental in scope; it is also about development and the economy. From a development perspective, a green economy might benefit both developed and developing countries. Kazakhstan cannot remain aside from the sustainable development through green technologies; in fact, it can be a new impetus for the future development of the country.

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