Korea Distribution Science Association

SHANDONG UNIVERSITY OF POLITICAL SCIENCE AND LAW

2015 International Conference on Business and Economics (ICBE2015)

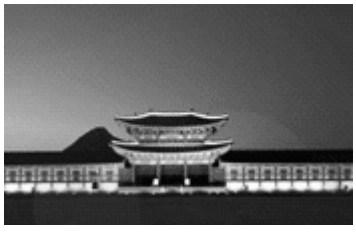
Seoul, South Korea, July 08-11, 2015

第8回 國際統合學術大會

Theme: Science, Technology and Humanities for Business and Economic Sustainability

EDITED BY:

Jung Wan Lee, Boston University, USA
Dong Ho Kim, SUNY Empire State College, USA
Myoung-Kil Youn, Eulji University, Korea
Jong-Ho Lee, Kongju National University, Korea
Hee-Joong Hwang, Korea National Open University, Korea



JULY 08-11, 2015

SEOUL NATIONAL UNIVERSITY, SEOUL, KOREA

EIGHTH INTERNATIONAL CONFERENCE OF KODISA

The publication is an official program and Proceedings of the 2015 International Conference on Business and Economics (ICBE2015) and the Eighth International Conference of the Korea Distribution Science Association and Allied Academies.

Publication Date:

The publication is printed on July 08, 2015.

Publishing Office:

Hanshin Officetel Suite 1030, 2463-4 Shinheung-Dong Sujeong-Gu, Seongnam-City, Gyeonggi-Do, KOREA (461-720).

TEL: (+82 31) 740-7292, FAX: (+82 31) 740-7361, http://www.kodisajournals.org

E-mail: kodisajournals@gmail.com

Printed by Dunam Publishing, Seoul, Korea Tel: (+82 2) 478-2066 Fax: (+82 2) 478-2068

"This publication was supported by the National Research Foundation of Korea Grant funded by the Korean Government (MEST)"

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CONTENTS

Agricultural Innovations for Sustainable Development: Analysis of Situation in Kazakhstan and Ways for Improvement

Khalima N. Sansyzbayeva*, Aknur Zhidebekkyzy**

Abstract

This paper aims to analyze the current situation of agriculture in Kazakhstan focusing on innovations, identify key problems and challenges, and propose ways for improvement. The researchers reviewed the relevant literature and collected relevant data from secondary sources. The study's methodological basis included Kazakhstan's legislative and regulatory Acts, program for the development of agriculture, and data about innovations in the agriculture sphere. Reports and statistical reviews were examined in order to determine the tendency of development of agriculture in Kazakhstan. Evaluation of the current level of technological development in crop production and animal husbandry shows that agricultural innovations in Kazakhstan are not developed enough. Government and public authorities are well aware of the need for innovative agricultural development, and take the necessary programs and measures. Despite this, researchers have identified problems in this sphere and proposed their solutions. The transition to sustainable economic growth in the agricultural sector of the country is impossible without promoting the use of science and technology, the introduction of high technology, activation of all economic entities of scientific and technical sphere of agriculture. The main priority of science, technology and innovation policy in the agricultural sector should be state support for basic and applied science with a focus on the implementation of scientific development in agriculture.

Keywords: Agricultural Innovations, Agriculture of Kazakhstan, Sustainable Development.

1. Introduction

Agricultural development depends to a great extent on how successfully knowledge is generated and applied, and indeed knowledge intensiveness has featured prominently in most strategies to promote agricultural development. Yet the changing context for agricultural development has highlighted a strong need to understand and adopt innovation systems thinking.

Agricultural science, technology, and innovation are vital to promoting rural development and poverty reduction. To this end, many studies on agricultural research, extension, and education have highlighted the importance of public investment and policies in these areas. However, as agricultural innovation becomes increasingly viewed as a complex process that defies simple solutions, it has become more and more difficult to identify the types of investment and policy interventions needed to make developing-country agriculture more responsive, dynamic, and competitive.

2. Literature Review

Technological change has been a major factor shaping agriculture in the last 100 years [1, 2]. Internationally, tremendous changes in production patterns have occurred. While world population more than doubled between 1950 and 1998 (from 2.6 to 5.9 billion), grain production per person has increased by about 12 percent, and harvested acreage per person has declined by half[3]. These figures suggest that productivity has increased and agricultural production methods have changed significantly.

The classification of innovations according to form is useful for considering policy questions and understanding the forces behind the generation and adoption of innovations. Categories in this classification include mechanical innovations (tractors and combines), biological innovations (new seed varieties), chemical innovations(fertilizers and pesticides), agronomic innovations (new management practices), biotechnological innovations, and informational innovations that rely mainly on computer technologies [4].

Although many of agricultural strategies have been successful, they may no longer be sufficient in many countries, where agriculture is increasingly subject to rapid and unpredictable change. Amid such change, it is perhaps inevitable that ideas about innovation and its sources should also change. The perceptions of what constitutes "research capacity"and how innovation occurs are being transformed, along with approaches for investing in the capacity to innovate. It is now clear that investing in the creation of stronger research systems the primary focus of agricultural research investment in the 1980s and 1990s may increase the supply of new knowledge and technology,

* First Author. Dr. Khalima N. Sansyzbayeva, Professor, Department of Management and Marketing, The High School of Economics and Business, Al-Farabi Kazakh National University. 71 Al-Farabi Avenue, Almaty 050040, Republic of Kazakhstan. E-mail: gns1981@mail.ru

** Corresponding Author, Ms. Aknur Zhidebekkyzy, Ph.D. student, Department of Management and Marketing, The High School of Economics and Business. Al-Farabi Kazakh National University. 71 Al-Farabi Avenue, Almaty 050040, Republic of Kazakhstan, E-mail: zhidebekkyzy@mail.ru

but it may not improve the wider capacity for innovation throughout the agricultural sector [5]. More recently, attention has focused on the demand for research and technology and on the development of innovation systems. An "innovation system" is a network of organizations, enterprises, and individuals focused on bringing new products, new processes, and new forms of organization into economic use, together with the institutions and policies that affect the system's behavior and performance [6].

AIS thus represents a network of organizations, enterprises and individuals that focused on"bringing new products, new processes and new forms of organization into economic use, together with the institutions and policies that affect their behavior and performance" [6]. Ultimately, it is the policy environment and active government strategies to foster and award innovation in agriculture that stimulates or hinders CD for agricultural innovation within the AIS. In short, agricultural innovation, which includes the successful development of new or traditional practices, their tailoring to the local needs of farmers, farm cooperatives and agri-business, and their adoption and up-scaling, requires adequate capacities on all levels of decision making. However, low-income countries often lack the resources and capacities to fully develop their innovation systems [7].

Since the performance of an agricultural innovation system influences the overall performance of the agricultural sector, measuring sectoral performance is vital to assessing an innovation system. Classical indicators of agricultural sector performance include measures such as agricultural sector growth rates and total factor productivity. The growth rate of the agricultural sector is an important indicator of the sector's potential to contribute to poverty reduction if distributional aspects are taken into account. Increases in agricultural productivity are a major driver of agricultural growth and are an important measure of the sector's competitiveness [8].

The main findings of the study of the World Bank, as one reviewer pointed out, were not so much important because they were all new, but because they brought together these findings in one place and gave them prominence in the form of a World Bank study. The findings included:

- Innovation is rarely triggered by agricultural research and, instead, is most often a response of entrepreneurs to new and changing market opportunities.

- Promising sectors begin to fail because with ever-changing market demands, patterns of interaction between entrepreneurs, farmers and other sources of technology and information are insufficient to support a knowledge-intensive process of innovation on a continuous basis.

- Lack of interaction weakens innovation capacity and is a reflection of deep-rooted habits and practices in both public and private sector organizations. The market is not sufficient to promote interaction; the public sector has a central role to play.

- Social and environmental sustainability are integral to economic success and need to be reflected in patterns of participation and interaction that are considered when strengthening innovation capacity.

- Mechanisms at the sector level that are critical for coordinating the interaction needed for innovation are either overlooked or missing [9].

3. Context of Kazakhstan

3.1. Analysis of Current Situation in Agriculture Innovations of Kazakhstan

Agriculture is one of the key sectors of the Kazakh economy.Kazakhstan is the 9th largest country by land mass.

More than 74 percent of the country's territory is suitable for agricultural production, representing 5.5 percent of GDP and employing over 20 percent of the labor force, with 43 percent of the population living in rural areas.

The rich soil and climate provide ideal conditions for growing wheat, barley, rice, corn, millet and buckwheat. In 2012, the total crop area reached 21.3 million ha. Corn and beans will be sown on 16.5 million ha while oilseed will occupy 1.7 million ha.

Food production increased by 2.9% at the end of 2014 and for the first time was more than 1 trillion tenge. Imports amounted to 2.9 bln. US dollars, export were 1.1 billion US Dollars [10].

To implement the program financing in the framework of the budget program 212 "Research and activities in the field of agriculture and nature" in 2014 achieved the following results: the state variety trials transferred 110 varieties and hybrids of agricultural crops, 51 recommendations on technology were developed. 166 security documents for intellectual property were obtained, including received 10 patents for inventions; 83 innovative patents for invention (for processing - 23, in water management and soil fertility - 4, animal production and health - 39, agricultural mechanization in forestry -17); 72 patents for selection achievements (69 - in horticulture, in animal husbandry 3) [11].

The Government provides subsidized loans to agricultural enterprises, subsidies for machinery upgrades and construction, state-funding of organizations developing veterinary and phytosanitary sectors, the provision of subsidies for industrial energy costs. It also waved import duties on farm equipment, raw materials and spare parts, and exemption from corporate income and property taxes. The volume of investments in Kazakhstan's agricultural sector exceeded 166 billion KZT in 2014, which is 17 percent more than in 2013.The aggregate profitability index of large and medium-sized companies operating in Kazakhstan's agricultural sector stood at 17.7 percent, while this index was equal to 4.5 percent in the same period of 2013.

The Government of Kazakhstan approved a new sectoral program of agro-industrial complex development for 2013-2020 "Agribusiness – 2020" in February 2013. The Agribusiness-2020 Program aims at developing four dimensions: financial recovery, increase of afford ability of products, works and services for the agro-industrial sector entities, development of the state system of agricultural producers support, improvement of efficiency of the state management system of the agro-industrial complex [12].

The current state of Kazakhstan's agro-industrial complex is characterized by fairly low investment activity, accompanied by increasing selectivity investment. Since investments involve action, the results of which will occur over a long period of time, the development and socio-economic situation, both the subject of investment, and its environment largely depends on proper impact assessment of the project.

3.2. Evaluation of the Current Level of Innovation and Technological Development of Agriculture in Kazakhstan

Currently, there is a need to move agricultural production harmonious combination of development, both crop and livestock production, which will in any economic environment cost-effectively develop agribusiness.

The current situation in the livestock industry has a whole set of problems: first, the overall decline in number of changes in the structure and management. If earlier there were 70 percent of livestock in agricultural formations, it is now 82 per cent is in private farms; second, the low proportion of breeding stock in the total herd and splitting its genetic potential; Third, a major deterrent for sustainable development of animal husbandry industry is the virtual absence of forage production. A huge layer of problems lies in ensuring veterinary welfare.

Crop production in Kazakhstan is seriously behind on most of the major technological trends; there is the largest gap in the use of fertilizers and plant protection products, the use of irrigation systems (See Table 1).

The main reasons for the low labor productivity in agriculture are:
- the usage of outdated technology;
- the usage of outdated and inefficient forms of economic activity;
- high level of imports of finished agricultural products;
- low depth of processing in agriculture;
- High level of exports of low value-added.

Modern technologies are not used and the highest backlog observed in the use of systems for cattle and application of feed additives in animal husbandry in Kazakhstan (See Table 2).

<Table 1> Evaluation of the current level of technological development in crop production [13]

Factors	The current technological level	Comments	The potential of output growth
Seed Production	◑	Not adapted varieties native seeds are imported - low quality, a high proportion of self-sown	+ 80-120% - productivity growth
Chemical plant protection	◔	Used in insufficient quantities (cost 1.2 thousand. tenge per hectare , in developed countries - 3.7 thousand. tenge per hectare)	+ 20-50% - increase collection by maintaining crop
Biological plant protection	○	Currently not in use. Consumption of biological crop protection should be at least 5% of the total consumption of NWR	
chemical fertilizers	◔	Consumption of fertilizers is 10 times below the level of the Western countries, especially phosphate fertilizers	+ 30-60% - an increase of productivity and improvement of product quality More efficient use of phosphate fertilizer 2-3 times at the expense of biofertilizers
Biological fertilizers	○	Used in insufficient quantities. In Europe the consumption per hectare is over 10-20 times	
Drop irrigation	○	Systems of a drop and sprinkler irrigation are not used (can be used on 30% of acreage)	+ 20-40% by reducing the effects of drought Rising yields several times under drip irrigation for individual crops
Combines	◑	Large grain farms use imported equipment	+20-30% by reducing the losses during assembly and reduce the proportion of the crushed grains
Attached equipment	◑	not adapted equipment is used	+30-70% - productivity growth Reducing fuel costs by 50-70%

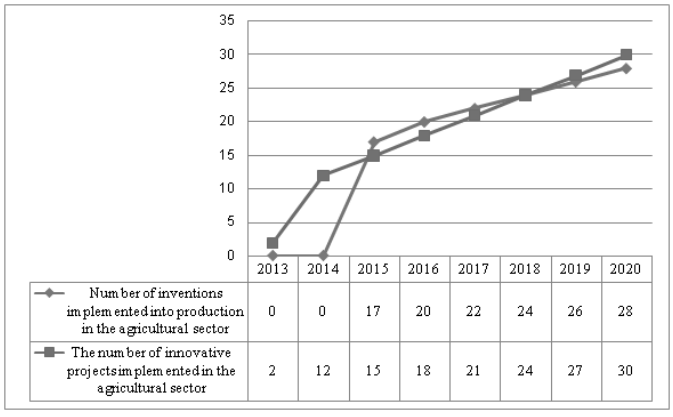
○ – Using outdated technology
◔ – About a quarter of manufacturers use modern technology
◑ – Nearly half of manufacturers use modern technology

<Table 2> Evaluation of the current level of technological development in animal husbandry [13]

Factors	The current technological level	Comments	The potential of output growth
Breeding cattle	◔	It is necessary to increase the share of breeding herd with 2-5% to 15% (the level of developed countries); necessary to create specialized breeding farms	+ 20-50% at the expense of the best indicators of productivity of livestock
Maintenance of cattle	○	A large proportion of animal products produced in small holders and small farms that do not use technology cattle	+10-30% due to the lower incidence and the best indicators of weight gain
Vaccines and test systems	◑	Low-quality imported funds are used within the state program	In case of victory over FMD, export opportunities + 10-30% will be opened due to the reduction of diseases
Combined feed	◔	Harvested pastures are used; lagging consumption of high-quality feed at times	+20-40% at the expense of the best indicators of productivity of livestock (weight gain and an increase in milk yield)
feed additives	○	Feed additives are not used	Helps to reduce feed costs At 10-20% increased productivity of livestock
○ – Using outdated technology ◔ – About a quarter of manufacturers use modern technology ◑ – Nearly half of manufacturers use modern technology			

4. Research Findings and Results

We analyzed the promotion of agro-business through the introduction of commercial and industrial use of advanced technology and know-how.



	2013	2014	2015	2016	2017	2018	2019	2020
Number of inventions implemented into production in the agricultural sector	0	0	17	20	22	24	26	28
The number of innovative projects implemented in the agricultural sector	2	12	15	18	21	24	27	30

<Figure 1> Indicators for the implementation of the results of agricultural science in Kazakhstan [12, 14]

"Kaz Agro Innovation" with government support took measures for the development of innovation in the production system. The Center of the transfer and commercialization of agricultural technologies (CTCAT), which aims to support and development of new agricultural technologies, including through the creation of new companies based on high technologies with the participation of public resources. Also, the system of "Kaz Agro Innovation" in order to provide highly information-analytical and advisory services in agriculture in 2009 established Analytical Centre for Economic Policy in the agricultural sector. CTCAT Activities aimed at supporting and developing new agricultural technologies, including through the creation of new companies based on high technologies with the participation of public resources (start-up and spin-offs). We see that there are key indicators for the development of innovations in agriculture (See Figure 1).

Based on the analysis of the current state of the industry of agricultural science in Kazakhstan the following issues has identified that hinder the development of innovations in agriculture:

- insufficient funding
- lack of motivation to improve the performance of scientists
- difficulties in implementing scientific research
- the lack of development of the dissemination of knowledge
- outdated scientific and technical infrastructure
- the aging of the scientific staff
- undeveloped level of transfer of advanced foreign technologies
- lack of available financing in the early stages of innovation
- undeveloped demand for innovation, etc.

To solve the problems mentioned above, and for adequate provision of innovative and technological development of the agro-industrial sphere of Kazakhstan, we propose the following steps and measures:

- Improvement of the state of science policy;
- Development trends of innovation in agribusiness and agricultural science;
- The introduction of market mechanisms to activate innovation in the agricultural sector;
- Development of innovative infrastructure of AIC;
- Development of cluster initiatives in the innovation system of agribusiness.
- Introduction of modern methods and acceleration of research by updating the infrastructure of agricultural science;
- Creation of a system implementation in production of scientific research;

- Integration into the international scientific environment by conducting joint research and development, the establishment of joint funds, membership in international scientific organizations;
- Implementation of measures to attract top foreign scientists in agricultural research
- Establishment of a system of labor remuneration of researchers and attract young professionals in agricultural sciences;
- The development of public-private partnership through the implementation of innovative projects;
- To ensure the transfer of foreign technologies;
- The development of institutions to support innovation in agriculture.

5. Conclusion

The use of emerging technology and indigenous knowledge to promote sustainable agriculture will require adjustments in existing institutions. New approaches will need to be adopted to promote close interactions between government, business, farmers, academia and civil society.

The aim of this paper is to identify novel agricultural innovation systems of relevance to Kazakhstan. It examines the current situation of agricultural innovation and state economic policies in the country. Positioning sustainable agriculture as aknowledge-intensive sector will require fundamental reforms in existing learning institutions, especially universities and research institutes. Most specifically, key functions such as research, teaching, extension and commercialization need to be much more closely integrated.

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