REPUBLIC OF KAZAKHSTAN

The Ministry of the Republic of Kazakhstan

Barrier Analysis and Enabling Framework

FOR ADAPTATION TECHNLOGIES

July 2016

Supported by:

UNEP

GLOBAL ENVIRONMENT FACILITY
INVESTING IN OUR PLANET

UNEP RISØ CENTRE
ENERGY, CLIMATE AND SUSTAINABLE DEVELOPMENT

AIT Asian Institute of Technology

CONTENT

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS

ACDP	Agroinustrial Complex Development Program of the Republic of Kazakhstan for 2013-2020 “Agrobusiness-2020”
ADB	Asian Development Bank
AIC RK	Agro-industrial complex of the Republic of Kazakhstan
LLP	Limited Liability Partnership
JSC	Joint Stock Company
R&D	Research and Development
GDP	Gross domestic product
CH_4	Methane
CO_2	Carbon dioxide
COP	Conference of the Parties under the United Nations Framework Convention on Climate Change
DNA	Designated National Authority
FAO	Food and Agriculture Organization
GHG	Green house gases
GEF	Global Environment Facility
IPCC	Intergovernmental Panel on Climate Change
LULUCF	Land use, Land use change and Forestry
N_2O	Nitrous oxide
PMU	Project Management Unit
PP-2020	Performance 2020" Program
TAP	Technology Action Plan
TNA	Technology Needs Assessment
LPA	Logical Problem Analysis
AP	Agricultural producers
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
URC	UNEP Risoe Center

EXECUTIVE SUMMARY

This report is the second part of the technology needs assessment for implementation of climate-friendly technologies in Kazakhstan. The first report was dedicated to the identification and selection of priority technologies on adaptation to climate change in the sector of agriculture and water resources. The agriculture sector defined (I) no-till for crops; (II) the diversification of crop production; and (III) distant-pasture and pasture stabling of sheep on an industrial scale. The water sector was also analyzed and following technology were chosen I) drip irrigation and II) system warning of dangerous hydrological phenomena. In this report, on the basis of the identified and selected technologies for adaptation to climate change, barrier analysis for the implementation of climate-friendly technologies was conducted.

The project activities were implemented in cooperation with the Ministry of Energy, research institutions, business, non-governmental organizations. The interested parties were part of the national team, divided into two working groups on agriculture and water sector.

Technology specifications were considered by the working groups and classified as a product, which potential customers are private enterprises, state agencies, research institutions, farmers' associations and others.

Barrier analysis was carried out in stages, starting with an analysis of sectoral policy, programs and action plans in the light of introduction of climate-friendly technologies and support to address climate problems in the agriculture and water sectors. Program documents, regulatory acts, research papers, other relevant information were studied during the barriers analysis, as well as the main causes of the problem of technologies introduction were identified based on the previous results of the selection process of technologies. For the barriers set in a long list of obstacles, evaluation and ranking of importance was accomplished. Following the discussion, a list of key barriers was prepared.

To understand the main problems in the sector, the logical analysis of the problem (LAP) was used and connections were organized in the tree of problems and challenges. Key elements of the problem were combined here, logical analysis of interrelated elements was applied, the relationship between the problematic elements and external factors was defined. Thus, the logical analysis of the problem was used to understand the cause-and-effect relationship of the barriers, their relationships.

The next step of the project was to identify measures that support the transfer of technologies as an action that could be taken to improve the transfer of technology. The process of identifying and describing the measures for overcoming barriers was made using the logical analysis of the problems. Findings of the cause-and-effect relationship of the barriers in technology transfer offer opportunities for intervention for the implementation of economic and social potential of technology. With the use of the logical analysis, the tree of tasks was built, which helped to visualize the goals to improve the transfer of technology. The proposed measures in accordance with their economic profile and the achievable effects were discussed.

Implementation of each of the prioritized technology is associated with the actions of several regulatory acts, which affect the implementation of the technology. Brief information about this is provided in the section of each technology. Implementation of technologies is related to financial and economic conditions. Financial and non-financial conditions are also described for each technology.

Market analysis was conducted using the display of the market approach. This approach helped to visualize the commercial and institutional environments for each of the technology market. The whole system was considered in the context of its three major components:

- Favorable business environment.
- Players of the market chain and connection.
- Service providers..

The results of logical analysis and market analysis are provided in Annexes II and III.

Table I Identified barriers and measures to technology transfer in the Agriculture and Water Sectors

Sectors	**Agriculture Sector**			
Barriers	**Technologies**			**Measures**
	No-till	**Crop production**	**Transhumant and pasture-stall**	

	diversification	**sheep keeping**	
Policy, legal and regulatory	Imperfect legal and regulatory framework;		Improvement of the: legal framework
Economic/financial	Lack of full access to financial resources		Improving access to finance resources
Market failure, imperfection	Unsatisfactory market structure; imperfect sources of increasing revenues, market prices for the environmental benefits, shortage of pastures, poor logistics, long distances;excessive fragmentation of of land plots / Small farm size		Improving the market structure, logistics, services; ensure effective coordination and etc.
Network failures	Poor interaction between the constituents, preferring new technology, Lack of coordination among the various interest groups		Organization and support for regional and national networks of groups interested in promoting climate-friendly technologies
Institional capacity	Limited i**nstitional capacity**		Strengthening the foundations of human potential of the agricultural sector
Resources	Lack of research works		Promote of research in agrucultaral sector
Information and awareness	Inadequate awareness		Strengthening the media interest in the promotion of climate-friendly technologies
Sectors	Water sector		
Barriers	**Drip irrigation technology**	**Technology of extreme events prevention**	**Measures**
Economic/financial	Limited access to financial resources		Improving access to finance resources
Policy, legal and regulatory	Imperfect legal and regulatory framework		**Improvement of the: legal framework**
Resources	Lack of research works		Promote the exchange of data and research results, development and adaptation of methods, research;
Institional capacity	Limited i**nstitional capacity**		Strengthening the foundations of human potential
Information and awareness	Low level of awareness of the economic and environmental benefits, climate change		Information campaigns on the current economic and environmental benefits of technology; climate change •

CHAPTER 1 AGRICULTURE

1.1 Preliminary targets for technology development and dissemination

The agricultural sector plays an important role in ensuring food security and improving socio-economic situation in Kazakhstan. Here 24% of the population is concentrated. Index of the share of agriculture in GDP declined against 90s when it was at 33%, in 2013 this figure was 4.6% (Statistic book, see http://stat.gov.kz).

The volume of gross agricultural output in 2013 amounted to ≈ 7 020 $ (Statistic book, "Agriculture, forestry and fisheries in the RK/ under editorship, 2014.. In this regard, the Government of the Republic of Kazakhstan in the program "Agro business 2020" set a goal of increasing the volume of gross output and volume of state subsidies by 4.5 times by 2020.

The agroindustrial complex of Kazakhstan is based on two components: crop production and livestock breeding. In 2013 on average the shares of crop production and livestock breeding in the total agricultural production accounted to 55% and 45% respectively [48]. Overall size of acreage totaled 21 271.0 thous. ha, 12 922.2 thous. ha (61%) of which accounted for the major agricultural enterprises (LLP, JSC, grain companies and holdings), 8 108,6 thous. ha (38 %) in the peasant (farmer) economies and 240.2 thous. ha (1%) for farms.

Among the categories of farms in the total harvest of wheat and availability of acreage the agricultural enterprises also lead (Figure 1.1).

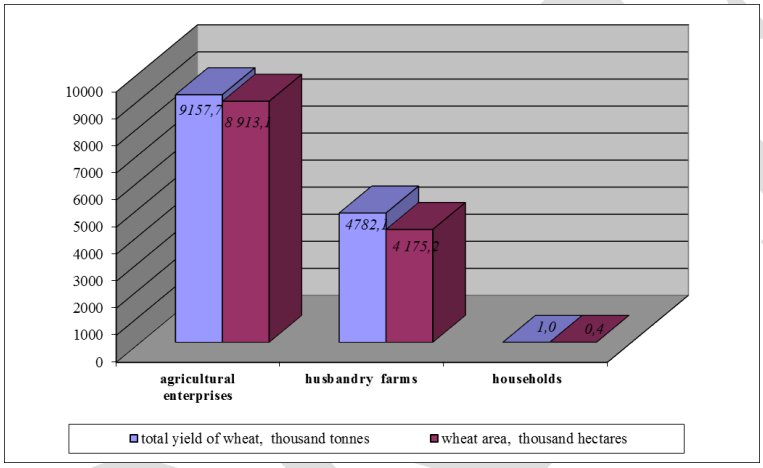

Figure 1 Share of categories of farms in the total harvest of wheat in 2013
Source: Agency on Statistics RK, 2014

Livestock, including sheep breeding, is a strategic sector of Kazakhstan, which continues to be an important source of employment, food and income for the rural population. According to the Agency on Statistics of Kazakhstan, in 2013, the number of sheep and goats totaled 17 560.6 thous. heads (Table 1.1.). The share of households accounts – 62.6% of sheep and goats from the general livestock, and peasant farmers – 32.8%, agricultural enterprises – 4.6%.

Table 2 Sheep and goats stock in 2013

Categories of households	**Number, thous. heads**
All categories	17 560,6
Agricultural enterprises	804,5
Peasant or farm households	5 760,0
Households of the population	10 996,1

Source: Agency on Statistics RK, 2014 [48]

The share of participation of peasent or farm households in sheep and goat keeping is gradually increasing, and the number of households decreases (Fig. 1.2).

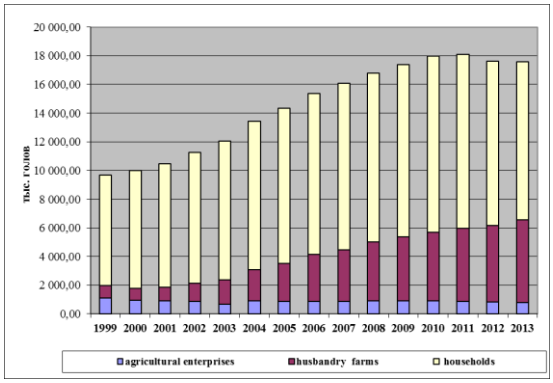

Figure 2 Structure of households in sheep breeding sector
Source: Agency on Statistics RK, 2014 [48]

The area of pastures, agricultural lands used for grazing animals, including land suitable for grazing in Kazakhstan according to the data of the Agency on Statistics of the Republic of Kazakhstan in 2013 totaled 180.9 mln. ha. [48] or 70% of all agricultural land. In the period from 2008 to 2013 there is a tendency of reducing rangeland (Fig. 1.3). According to the data of the Land Management Committee, up to 15% of agricultural land is used inefficiently, about 125 mln. ha of pastures are not irrigated and are not used, more than 20 mln. ha of pastures adjacent to settlements are classified as degraded due to irrational use.

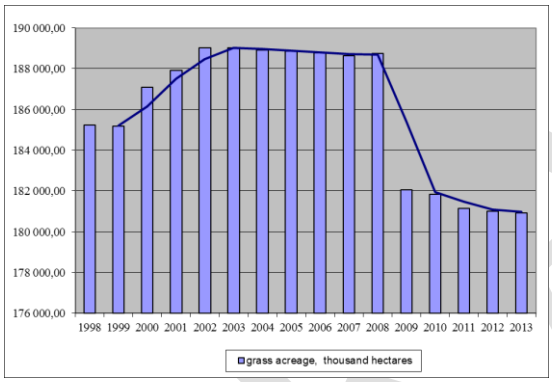

Figure 3 Grazing acreage of Kazakhstan from 1998 to 2013
*Source***:** *Agency on Statistics RK, 2014*

Areas under grasslands tend to reduce, if in 1998 their area was 5 021.6 thous. ha, in 2013 their area reduced to 4 919.3 thous. ha (Figure 1.4).

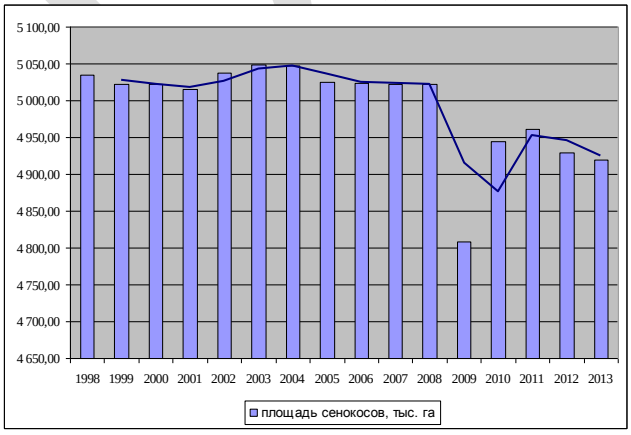

Figure 4 Areas of grasslands of Kazakhstan from 1998 to 2013
*Source***:** *Agency on Statistics RK, 2014*

The total annual funding for agriculture is increasing. The structure of the budget allocations for the development of agro-industrial complex of Kazakhstan in 2007-2011 is given in Table 1.2.

Table 3 Structure of the budget allocations for the development of agro-industrial complex in 2007-2011

Funding	Share, %
Subsidies	28
Loans	20
Investments and investment projects	30
Services for plant growing, animal breeding and processing	20
R&D and consultations	2
Total	**100**

Source: Agro business-2020 Program

Funding for agricultural scientific research and experimental design works in general has a tendency of annual growth (Table 1.3). In 2013, research funding increased by 4.4 times compared to 2004.

Table 4 Internal and external costs for R&D, mln. tenge

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Internal costs	14 579,8	21 527,4	24 799,9	26 835,0	34 761,6	38 988,7	33 466,8	43 351,6	51 253,1	61 672,7
External costs[1]						10 039,9	12 612,8	15 364,3	17 207,3	12 277,2
Total						49 028,7	46 079,6	58 716,0	68 460,4	73 949,9

Source: Statistics вооκт "Science and Innovation Activity of Kazakhstan," 2014

The share of the costs for agricultural research and elaborations in the total R&D costs in Kazakhstan from 2004 to 2013 ranged from 6.4% to 10.4% and had a positive trend (Fig. 1.5).

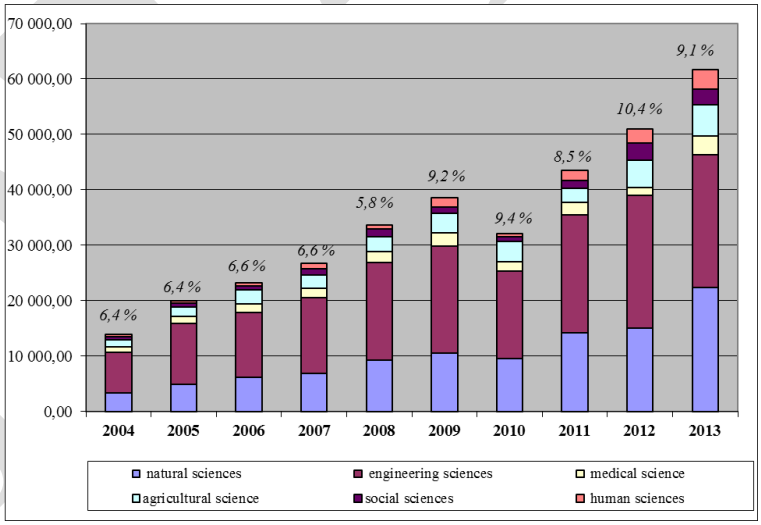

Figure 5 Structure of internal costs for research and development in Kazakhstan in 2004-2013, by fields of science

Source: Statistics digest "Science and Innovation Activity of Kazakhstan," 2009, 2013.

Evaluation of R&D costs indicates that R&D costs as shares in the national GDP do not have a smooth positive trend and varies within 0,15-0,28% (Fig. 1.6).

[1] Funding of researched by outside organizations

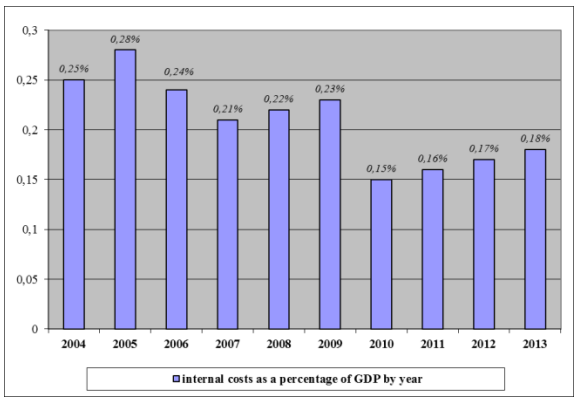

Figure 6 Internal costs for R&D as a percentage to GDP in 2004-2013

Source: Statistics book "Science and Innovation Activity of Kazakhstan," 2009- 2014.

For comparability of R&D costs in Kazakhstan with other countries, the UNESCO data on the Harmonised gross domestic expenditure on R&D (Figure 1.7.) were used, which include the costs of private and state organizations and enterprises. The figure presents the data of 12 countries group for 2011.

Comparability of expenditure on research projects of Kazakhstan and other countries is shown in Fig. 1.7. The figure presents the group of countries for the period 2009-2013. The overall of research and development intensity in Kazakhstan remains on a very low level - just 0.17 in 2013. However, the expendituures on scientific and technological services in the country greatly increased, indicating a growing demand for the products of R & D.

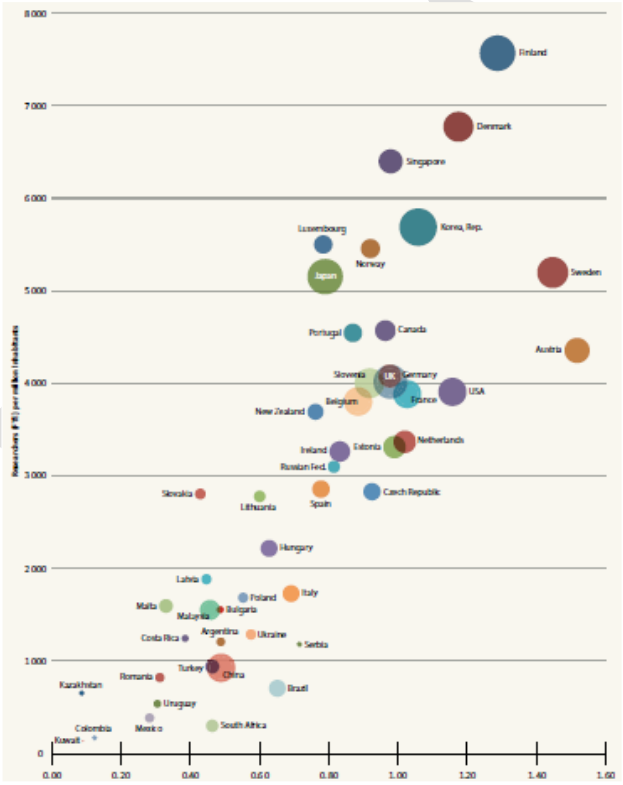

Figure 7 Costs on R&D as a proportion of national GDP, in 2009-2013

Source: UNESCO Science Report: towards 2030 – Executive Summar, *http://unesdoc.unesco.org/images/0023/002354/235407r.pdf*

Formation of modern management system on agricultural research in the Ministry of Agriculture of Kazakhstan the structure of JSC "KazAgroInnovation was created in 2007, which consisted of all sectoral research organizations and agricultural experts.

Starting in 2009, "KazAgroInnovation" JSC with the support of the state is implementing a project on creation of knowledge distribution system in order to ensure direct access of the agricultural

enterprises to the knowledge, as well as introduction of scientific developments in agricultural production. To date, there are 11 knowledge extension centers, which are located in the Akmola, Almaty, East Kazakhstan, Karaganda, Kostanay, Kyzylorda, North Kazakhstan and South Kazakhstan regions, where short-term research workshops in various areas of agriculture are conducted. Subjects are formed the basis of the actual needs of agro business entities, coordinated with the Ministry of Agriculture according to the priority areas of the agricultural sector of the Agro business-2020 Program.

In August 2015 JSC KazAgroInnovation was liquidated and on its basis a non-profit joint-stock company "National Agricultural Research and Education Center" was created (see http://adilet.zan.kz/rus/docs/P1500000659)

The subsidies available to farms in Kazakhstan should be noted:

- lubricants for spring sowing and harvesting;
- purchase of herbicides, biological agents and biological products intended for the treatment of agricultural crops for plant protection;
- purchase of seeds.

Besides, the government started to subsidize a part of interest rates on loans and leasing of technological equipment and agricultural machinery. There are loan lines through the second-tier banks in the directions of: spring sowing and harvesting campaigns, promotion of entrepreneurship in rural areas, as well as mono- and small cities of Kazakhstan (loan program "Kasipker"), acquisition of small cattle, infrastructure construction of irrigation of pastures. The loan program of microcredit (microfinance) institutions is being implemented for further crediting in rural areas, mono- and small towns in order to ensure access to loans for individuals and legal entities that organize or expand their own businesses in rural areas, in mono- and small towns. The leasing program under the express leasing and secondary leasing provides accessibility to agricultural machinery.

In 2016, the Ministry of Agriculture suggests a transition from the redistribution of budget funds with no incentive subsidies per hectare and subsidies on the volume of production in livestock, to subsidies that contribute to technological upgrading and productivity growth in agriculture (in particular investment grants and interest rate subsidies on loans and leasing) (a letter the Ministry of Agriculture of RK,19.05.2016, http://www.parlam.kz/ru/mazhilis/question-details/9261).

Reform of agriculture in Kazakhstan was aimed at creation of small private farm households and one of the characteristics of the agricultural sector is the presence of a large proportion of small farms in this sector.

Agriculture is sensitive and vulnerable to climate change. Future climate change on the territory of Kazakhstan, such as high temperatures, uneven distribution of rainfall, humidity areas offset to the north of Kazakhstan will lead to significant losses in agriculture. Adverse effects for agriculture and the processes require increased attention and active preventive actions.

In accordance with the Agro business-2020 program [23], the policy of state support for the development of agro-industrial complex is implemented in directions of:

1) subsidies, public procurement, etc.;

2) introduction of financial instruments to support the updating of the basic means of production – fleet of agricultural machinery, equipment and livestock;

3) access to financial and credit instruments;

4) creation of necessary conditions for attraction of investments in development projects;

5) support for exports;

6) provision of public services for veterinary and phytosanitary safety;

7) preservation and development of infrastructure for the development of agro-industrial complex of Kazakhstan – transport, water, storage, processing, etc.;

8) development of industrial science and spread of agro technological knowledge;

The key documents of the Government of Kazakhstan, policymakers of agriculture development (discussed in more detail in Annex V) are given below:

1. "Kazakhstan-2050" Strategy: new polical course of the established state, dated 14 December 2012;

2. Strategic Development Plan of Kazakhstan until 2020, dated 1 February 2010, No. 922;

3. The state program of infrastructure development "Nurly Zhol" for 2015-2019, dated 6 April 2015, No. 1030;

4. The concept of the transition of the Republic of Kazakhstan to the "green economy," dated 30 May 2013, No. 577;

5. Program for development of agro-industrial complex in the Republic of Kazakhstan for 2013-2020 “Agro business-2020,” dated 18 February 2013, No. 151;

6. The law “On state regulation of development of agriculture and rural areas,” dated 8 July 2005, No. 66;

7. Regulation of the Government “On certain issues of crediting of the agricultural sector,” dated 25 January 2001, No. 137;

8. Regulation of the Government “On certain issues of supporting agro-industrial complex with the participation of specialized organizations,” dated 7 July 2006, No. 645;

9. Law “On credit unions,” dated 28 March 2003, No 400.

In this report, based on the vulnerability assessment were examined the processes of implementation of priority technologies in the two sub-sectors: grain production and sheep breeding.

The potential technologies that are proposed for agriculture are the no-till technology, crop diversification, nurturing of drought-resistant varieties, chemicalization, the transhumance system, the grazing and stabling system on an industrial basis, selective animal breeding and the technology of pasture improvement. From among the enlisted technologies, the highest priority in grain production are no till and diversification of crop production, in animal husbandry (sheep breeding) - distant-pasture system and pasture-stall system on an industrial basis.

1.2 Analysis of barriers and possible measures for introduction of no-till technology

1.2.1 Description of no-till technology

According to the UN Food and Agriculture Organization (FAO), the zero technology (no till) is used in Kazakhstan at 1.85 mln. ha in the northern regions of Kazakhstan, while the total sowing area in Kazakhstan in 2013 amounted to 21.3 mln. ha, 15.9 mln. ha of which were allocated for crops. If to consider the area of the Karaganda and South Kazakhstan regions, the total area under no till is more than 2 mln. ha. [62]. According to the academician M.K.Suleimenov, the correlation of use in the total volume compared to traditional technologies - the share of zero technology is the following: traditional technology occupies 50%, minimal technology - 40%, zero - 10%[14].

It should be noted that introduction of no till is aimed at increasing plant productivity, grain quality, health protection and culture sustainability to diseases, pests and environmental stresses. The proposed technology allows to improve soil fertility through better control of wind and water erosion, enhance the ability of soil to retain water and increase organic matter content.

According to the Ministry of Agriculture of the Republic of Kazakhstan, 10.7 mln. tons of wheat were harvested from 13.5 mln. ha acreage in the country in 2012. In general, in 2010-2012, no till technology introduction in Kazakhstan allowed to increase wheat production by nearly 2 mln. tons, which brought additional revenue in the amount of 580 mln. USD [55].

According to the FAO estimates, in addition to economic, social and environmental benefits, introduction of no till in Kazakhstan allows to reduce production costs by 15 USD per hectare, giving a saving of 30 million USD per year (reduction in the use of fuel, seeds, and over time – herbicides).

In the context of climate change mitigation, the Republic of Kazakhstan can sequester about 1.3 million tons of carbon dioxide (by 0.7 tons/ha, according to the IPCC factor).

In general, introduction of new technologies will enable farmers to cover the production losses due to the impact of climate change by improving yield capacity and quality, which provides better conditions for the implementation of tasks to ensure food security of the country and will allow farmers to create a surplus of products for sale on the market, thereby increasing income for other needs.

Application of this technology meets the economic, social and environmental development priorities of the country, contributes to the priority security by improving productivity, increasing weight of the agricultural sector in the economic system, as well as raise of rural incomes.

Compared to the conventional tillage (plowing) technology, the no till technology has certain advantages and disadvantages, which are barriers to its implementation. The advantages are the speed of the sowing campaign, significant savings of human resources and fuel, accumulation of moisture and a gradual increase in soil fertility. The disadvantages are the high cost of seeders of direct seeding, the need for a powerful tractor and high-quality sprayer, increasing the cost of chemicals for weed control at an early stage, high requirements to the level of knowledge of an agronomist and enterprise management,

etc. In addition another disadvantage of no till is falling of grain yields in the transition from a traditional to a minimum or zero tillage technology.

Although the modern technology is resource-saving, its implementation requires substantial capital for the acquisition of new equipment (tractors, seeders), and various combinations of herbicides.

Introduction of the technology is due to the intensive use of herbicides and fertilizers in the early years to control weeds using herbicides. In some cases, the use of fungicides can lead to increased protection of plants from diseases. The fertilizer (herbicides) subsidy policy is pretty tough.

Economic benefits:

• improving sustainability of agriculture, including revenues;

• reducing dependence on fossil fuels, as well as fertilizers and pesticides, which are imported components;

• creation of conditions for development of small and medium-sized farms.

Environmental benefits:

Sustainable use of natural resources is achieved by preventing degradation and pollution of soil and water, conservation of biodiversity, etc. due to:

• increase of carbon absorption, which allows reduce global warming;

• reduction of soil erosion and better moisture retaining;

• reduction of groundwater pollution caused by nitrates;

• reduction of greenhouse gas emissions by reducing the amount of fuel burned by farmers.

1.2.2 Identified barriers for no-till technology

Barrier analysis is made in the relevant sectoral working group, presented by stakeholders with a common approach for the analysis of barriers and identification of possible measures. Initially, the consultants analyzed the program and other documents in order to assess the spread of technology and identify the causes that affect the delay of widespread technology. The consultation process and collection of comments on the report and evaluation were further carried out.

The working group reviewed the technology market characteristics and classified the technology as a **commodity of the consumer**, which is designed for the mass market with such potential consumers as private companies, research institutions and farms (farmers). The technique of **market mapping** was used in the work as a tool to determine the barriers and analyze problems in order to identify key market participants and a long list of barriers faced by market participants. Further, the barriers were grouped according to their relevance for technology transfer and ranked. Mutual understanding was reached on the importance of a barrier and a list of key barriers was defined at the meeting of stakeholders.

Tool of **logical problem analysis** (LPA) was used for the analysis of cause-and-effect relationships and identification of major problems in the transfer of technologies, a hierarchy of barriers and relevant reasons, the **tree of logical problem analysis** was built, which indicated the main relationships between causes and effects, their logical structure and relationship with external factors. Trees of logical problem analysis for this and other technologies are included in Annex II.

The results of the barriers determinations are shown in Annex I and tables in this subsection.

Due to the fact that all three priority technologies in agriculture have many common elements, the barriers' explanatory data will be provided for no-till technology, and for the other two technologies, description of the barriers will be brief, focusing on information for the technology. Here also was indicated the main relationships between causes and effects, their logical structure and relationship with external factors. Trees of logical problem analysis for this and other technologies are included in Annex II.

1.2.2.1 Economic and financial barriers

The above-mentioned economic factors concern farmers in the implementation of technologies that reflect the cost of adaptation in the form of loss of profits, increasing demand for skilled labor force to carry out the necessary economic policy in the short term. At the same time, a stable agricultural practice is increasingly demonstrating the economic viability and benefits, as well as traditional technologies, which are also a matter of concern and interest of farmers.

One of the main economic factors of success of the project implementation is access to financial resources. At the same time, the principle of lending by commercial banks and institutions is based on the principles of economic viability. The average annual interest rate on long-term loans in Kazakhstan amounted to 10.4% in 2014. In February 2015, according to the National Bank of the Republic of Kazakhstan, the average value of loans for large landowners increased to 13.9%. Provision of these loans requires high economic profitability, which is difficult to achieve in agriculture. Repayment of loans is complicated by the fact that farmers can not accurately predict their annual income, as the sector is dependent on natural conditions, and the Kazakhstan agriculture is an area of risk farming. Access of smallholder farmers to financial sources of banks and credit organizations is even more complicated. The issue of crediting agriculture is complex and requires the use of long-term loans at low rates.

Imperfection of the legislative and regulatory framework does not allow fully implement the functions of land mortgage, and insurance, which is also a barrier to the introduction of technology.

One obstacle is the high cost of the equipment, as well as fertilizers, herbicides and seeds required for the introduction of technology and the input custum taxes increase the cost of implementation and require additional financial resources.

There is a high dependence on fluctuations in the value of agricultural products in the international market, as well as the purchase prices on the domestic market. High prices of imported products and low for agricultural products create barriers to financing of technology implementation.

To improve the situation with acces to creditof agriculture for the implementation of climate technologies, it is appropriate to:

• To introduce environmental and social criteria, not only economic as profit and productivity for assessing agricultural activities. Environmental and social criteria shall be controlled by the state.

• Farm households, which implement climate technologies, shall be supported by the state through subsidies, tax cuts for imported equipment used for climate technologies.

Research organizations and higher educational institutions have human and intellectual capacity to promote new technologies, but do not have sufficient financial capacity. There is a great need in intrafarm researches, where farmers can cooperate with science in order to promote implementation of climate technologies. The high cost of equipment, high bank interest rate may be reduced by subsidies from the state, reducing taxes on imports, etc. New technologies can be studied in long-term field experiments, which also require government support.

Modern market barriers

Kazakhstan AIC is a chain, which covers production, processing and marketing of agricultural products. The most important AIC markets are grain markets and its processing products, bread, milk, butter and sunflower oil, meat, eggs, sugar and other products.

AIC markets in the Republic of Kazakhstan as a whole are low concentrated, sufficiently competitive, which are open to inter-regional and international trade, the number of market entities having a dominant position in the regional markets is not significant.

The state of competition on the AIC markets in the country is adversely affected by the lack of storage facilities, warehouses, centers of primary products processing, poor road conditions, lack of development of exchange trade in agricultural products, lack of competitiveness of domestic products for several reasons. This is both deterioration of the material and technical base, and a low level of labor productivity in high production costs.

The Kazakhstan's agro business has relatively low productivity in crop and livestock production. Only manufacturers who have large areas (more than 50 ha), or those who grow extra crops that can achieve large-scale economic effect (non-operational unit costs remain unchanged). Part of Kazakhstani producers cannot achieve this effect.

One of the most pressing issues is not sufficiently favorable state of agricultural machinery fleet. Currently, equipment is imported mainly for large farms that can afford to buy expensive agricultural machinery. Small farms, which also need access to equipment, have lower investment opportunities.

As a result, the current practice shows that agriculture is a sector with a low level of implementation of agricultural technologies.

This is the reason for the low competitiveness of domestic products in the regional market and reduction of supply over demand.

Lack of financial resources for the renewal of fixed assets requires small farmers to use leasing tool that is the most affordable and in demand in the market of Kazakhstan. However, there is a problem of increase in the cost of the acquired technology due to the national currency exchange rate fluctuations.

It should also be noted that a characteristic feature of Kazakhstan is the presence of a large proportion of households in the agricultural market, which have limited access to financial tools. As a result, these technology companies can not renew their fixed assets, introduce scientific and technological progress. Low purchase prices that apply to this share of farms, deprive them of the possibilities of maneuver in local and regional markets.

Import of equipment should be accompanied by services on supply of spare parts and services for maintenance of equipment, which system should be improved and that is not modern at this stage.

Limited financial resources for the development of the national production of tillage and seeding systems for minimum and zero tillage technologies, taking into account soil and climatic conditions of Kazakhstan requires additional financial investment or creation of a tool to support research and development work

1.2.2.2 Non-financial barriers

Policy, legislation and regulation: The Government of the Republic of Kazakhstan holds a policy of supporting the development of agriculture. Several support programs (Program for the development of agro-industrial complex in the Republic of Kazakhstan for 2013-2020 "Agro business-2020") are being implemented, subsidy mechanisms (seed, fertilizer, fuel, credit rate) operate, support for state and private seed producers, activities for state variety testing of agricultural plants is carried out. But, at the same time, the legislative or regulatory documents do not define adaptation to climate change, the recommended list of introduction of climate-friendly technologies, there are no specific support mechanisms that promote the use of climate-friendly technologies.

Barriers of the network imperfections: There is no holistic system approach at the management level. Collaboration between researchers and agricultural business do not realize its potential in full, interaction between these entities is not at a high level.

The Ministry of Energy (coordinates the climate change issues) and the Ministry of Agriculture should coordinate their efforts to protect the environment. There is no integration in research, courses and methodical work.

One of the main incentives to facilitate climate technologies should be a high demand for a high quality product form the consumer. Unfortunately, the level of consumer education is not high enough, and the civil society is not sufficiently actively involved in promoting the introduction of technologies.

Expansion of research on long-term trial basis in research institutes and farms in the field will strengthen mutual learning and knowledge transfer. Farmers need to learn from each other during workshops and field practice. Such workshops should be supported by various ministries responsible for the environment, agriculture, healthcare, etc. In addition, the workshops should serve the interests of not only the large farms, and also small farmers.

Barriers of institutional and organizational capacity: Researchers should to be involved in research and provision of services for dissemination of knowledge at the climate technology assistance courses. Research institutions do not have sufficient financial support for research at the modern level using advanced equipment. Climate technologies should be evaluated in long-term field experiments on the basis of their relevance to slow changes in soil fertility.

Researches, consultations and educational activities must comply with modern international standards. Lack of interest in support of local research institutions does not allow the promotion of new climate technologies.

At the state level, there is a need for multi-disciplinary research programs, since the complexity of the problem does not allow to solve it within just one institution. The lack of research, including agricultural science will increase the challenges that agriculture faces at the moment. There is no scientific recommendation deficiency at the moment. There is a lack of political will to implement the recommendations.

Poor communication between scientists and the agricultural business creates large gaps in technology transfer. This situation creates a reluctance of the scientific community to respond to the technological needs of the agricultural sector.

Professional skills: in the preface to the report on the State of food and agriculture, FAO Director-General, Mr. Graziano da Silva said, that for creating sustainable future, investing in agriculture is not only the accumulation of physical capital, but it requires the establishment of institutions and human capital accumulation. A society where everyone will eat well, and use of natural resources in a balanced way, can be built if the state investments and investments of farmers themselves will be directed to a single right track.

Currently, agriculture has the lowest level of productivity labour and makes 3 thousand USD per employee. Many factors affect the performance, among which are the level of competence of management, staff qualifications and capacity for continuous learning, i.e. human factor.

There are already several organizations that provide training of farm workers, but its coverage is not yet comprehensive. Opportunities for increasing the capacity of professionals exist, but they should be improved to meet international standards.

Social, cultural and behavioral: One of the characteristics of agriculture of Kazakhstan is its small-scale sector, which employs about 25% of the population. The lack of other activities, excessive labor, low productivity and low wages has a negative impact on rural development.

The basis of the interaction of consumers and producers is the cost, not the quality. The prices are the main criteria for selecting products. Therefore, consumer associations should be a platform to discuss the interests of consumers and producers, to change consumer attitudes to product quality and contribute to the promotion of new climate technologies, cooperation of producers and consumers in local markets and maintenance of agriculture by product certification and sustainability of practices of conducting works with environmental and climate technologies are required.

Barriers to awareness and information: the lack of awareness of soil degradation and other impacts of traditional practices of agriculture on the environment and human health is one of the main obstacles to the advancement of new technologies. Current criteria (economic, social and environmental) to assess agricultural activities and the introduction of environmentally friendly farming systems should be used to facilitate the management of agriculture sustainability.

The introduction of new technologies carries risks and costs and the farmers will not accept it without support. State policy should be aimed at supporting farmers, who in turn comply with environmental regulations, preventing degradation and salinization of soils, air pollution, reducing the use of fossil fuels.

Technical barriers: to promote climate technologies, it is necessary to improve logistic scheme of maintenance of equipment and spare parts supply, establishment of centers of consulting services.

Table 5 List of barriers on the level of ranking for the no-till technology

Barriers	**Level of ranking (1-5)**	**Classification of barriers (economic and financial, human potential, awareness, institutional regulation, etc.)**
The lack of adequate access to financial resources	5	Economic and financial
High cost of capital	5	Economic and financial
Inadequate financial incentives and initiatives	5	Economic and financial
Deficient market structure	5	Underdevelopment of the market
Imperfect legislative and regulatory framework	5	Policy, legislation and regulation
Imperfect revenue increase sources	4	Underdevelopment of the market
High interest rates	4	Economic and financial
Restrictive policy and uncertainty	4	Policy, legislation and regulation
Insufficient information distribution	4	Information and awareness
Poor interactions between constituents preferring innovative technology	4	The lack of network
Insufficient involvement of interested parties in decision making	2	The lack of network
Ineffective execution	3	Policy, legislation and regulation
High risk perception for procurement (mastering, prehension) of climate technology	3	Information and awareness
Lack of awareness of the issues related to climate change and technological solutions	1	Information and awareness

Table 6 List of the key barriers to transferring no-till technologies

Key barriers	**Classification of barriers**
The lack of full access to financial resources	Economic and financial
High cost of capital	Economic and financial
Inadequate financial rewards and incentives	Economic and financial
High interest rates	Economic and financial
Deficient market structure	Underdevelopment of the market
Imperfect revenue increase sources	Underdevelopment of the market
Poor interactions between constituents preferring innovative technology	Underdevelopment of the market
The lack of full access to financial resources	Economic and financial
High cost of capital	Economic and financial

1.2.3 Measures identified for the introduction of the no-till technology

Implementation of priority technologies is based on identification and adoption of measures to overcome barriers. The logical problem analysis (LPA) tool was used for the analysis. The problems were reformulating into positive statements about future situations, arranging measures. Measures for the corresponding barriers are grouped according to the same criteria as the barriers to get the result from problem to solution. The measures were assessed according to their economic profile, incentives used and effects achieved. The analysis results are presented in Tables 1.6-1.9 below. Tree of objectives for this technology is presented in Annex II.

No-till technology was supported by the study of a favorable environment policy in the first part of the report. In accordance with the evaluation carried out by experts, implementation of the technology is based on several instruments that promote sustainable development and environmental protection:

- "Agro business-2020" Program, dated February 18, 2013, No. 151;
- The Republic of Kazakhstan transition concept to "green economy", May 30, 2013, No. 577;
- Land Code of the Republic of Kazakhstan, dated June 20, 2003, No. 442;
- Water Code of the Republic of Kazakhstan, from dated July 9, 2003, No. 481;
- Environmental Code of the Republic of Kazakhstan dated January 9, 2007, No. 212.

The assessment of experts showing that highest impact on no till technology implementation has the national policy on green economy. The related regulatory acts complement the main law, will contribut to a policy and regulatory path for technology transfer.

The measures were assessed in accordance with their economic profile, the use of incentives and the effect of achievement. The results are shown in the tables below.

The results of undertaken work are provided in the tables of this sub-chapter.

Table 7 List of barriers and measures to to overcome barriers to technology transfer of no-till technology

Specific barriers	**Measure, determined for overcoming barriers**
Economic and financial	Reduce the interest rate on the loans requested by commercial bank. Encourage the creation of agricultural bank to lower interest rate; Reduce or exempt from tax rate farmers investing in the climatee friendly technology, including the purchase of equipment; Reduce tax for farmers, investing in climate friendly technology, including the purchase of equipment; Ask for bigger discounts for climate technologies from companies, equipment manufacturers; Take into account negative externalities (pollution, soil degradation) corresponding to the traditional system of agriculture with regard to the conservation of farming system;
Underdevelopment of the market	Improve the logistics of agricultural producers for the purchase of climate friendly equipment technology; Increase access to the local market for various manufacturers of agricultural machinery, which could increase competition and lower prices.
Policy, legislation and regulation	Improve legislation and regulations for climate technologies; Strengthen the promotion of climate technologies through subsidies on compliance with sustainable farming systems.

The lack of network	Establish national and regional networks for groups of farmers interested in promoting climate technology; Organization of workshops for farmers who are interested in innovative farming systems to improve coordination among stakeholders and ministries, research institutions, equipment manufacturers, involvement in decision-making; Creation of consumer associations to improve communication between agricultural producers and politicians to lobby for the creation of a sustainable system of food production.
Information and awareness	Improving the education system, including issues related to the innovative climate technology; Increased media interest in advancing climate technologies with a large participation of researchers, consultants, and manufacturers; more information about the positive influence of climate technology.
Human skill	Strengthening of human potential is the basis of the agricultural sector.

Table 8 List of policy and economic measures, their economic profile, incentives and their effects

Measure	Economic profile	Incentive	Effect	
			Government funding	Paid by utilities
Subsidies for farmers that implement climate technology and environmentally friendly farming systems	High initial investment from the state budget	Ensuring compliance with sustainable agriculture systems	Strengthening the financial stability of the farm	Subsidies for farmers that implement climate technology and environmentally friendly farming systems
The reduction of customs duty for new technologies	Not paid by the state	Increased access to the local market for various manufacturers of agricultural machinery	The increase in state budget	The reduction of customs duty for new technologies
Expansion of research programs on soil treatment	High initial investment	Expansion of the beneficial impact of good farming practices on the environment and human health	Improving the economic situation of farms: economic growth; the trade balance and employment	Expansion of research programs on soil treatment

Table 9 Categories of measures and incentives

Financial measures	**Non-financial measures**	**Complementary measures**	**Incentives**
Subsidies for farmers that implement climate technology and environmentally friendly farming systems.	Support for the sales of climate technologies through subsidies	Reduction of taxes for farmers using modern agricultural practices. Reducing interest rates on loans to farmers, practicing climatically favorable agricultural practices.	Encouraging the use of resource-saving practices of agricultural producers will: Reduce soil degradation due to erosion; Reduce fuel consumption for tillage and reduce GHG emissions; Reduce the area of desertification. Obtaining subsidies should be based on the by farmers adopting ecological system across farming, not only some of the components.
Reduction of customs duties for new technologies.	Increased access to the local market for various manufacturers of agricultural machinery.	Development of logistics for the procurement and provision of services for new equipment.	This will further stimulate the adoption of climate technologies until 2020
Expansion of research programs on soil treatment	Increased promotion in the media of climate-friendly tillage	Widening the circle of participants in education, including public officials. Organization of national	Research works on clean technologies will drive their adoption by farmers in different regions of Kazakhstan

	systems	and regional network groups in advancing climate technologies. Creation of consumer associations.	

Table 10. The final list of measures to overcome barriers to transfer no-till technology

	Measures
1.	Stimulate the development of agricultural bank with low interest rates
2.	Reduce/exempt from tax farmers, investing in ecological agricultural practices, including the purchase of equipment
3.	To reduce the customs duties on imports of climate technology
4.	Development of a system of economic incentives for agricultural enterprises
5.	Use of subsidies for farmers who use climate-friendly technologies
6.	Improve the logistics and maintenance service for climate-friendly technology
7.	Expansion of research programs on soil treatment
8.	Strengthen media interest in the promotion of climate-friendly technologies with the participation of research organizations, experts, agricultural machinery manufacturers, the positive influence of climate technology
9.	The organization of national and regional network groups for farmers who are interested in advancing climate technologies
10.	Creation of a consumer association to create relationships between farmers and the political parties to lobby for sustainable agricultural production systems
11.	Strengthening the foundations of human potential of the agricultural sector

1.3 Analysis of barriers and possible measures for introduction of crop diversification technology

1.3.1 Description of crop diversification technology

Diversification provides better conditions for the country's food security and will allow farmers to grow a surplus of products for sale on the market, which will allow increase income. Implementation of adaptation plant varieties will allow improve productivity, will enhance the possibilities of resistance to drought, pests and diseases, as well as open up new market opportunities.

Application of this technology meets the economic, social and environmental priorities for the country's development. It is aimed at ensuring food security, increasing productivity and implementation of the diversification strategy of the economy, increasing the weight of the agricultural sector in the economic system.

The country is working on crop diversification. According to the Ministry of Agriculture of RK, wheat areas under cultivation in 2013(10.259,8) reduced to the level of 2012 (10.529,4).by 2%, the areas of rice crops reduced by 3%, at the same time the area of forage crops expanded to 349.4 thous. ha. Oilseeds were placed on the area of 1 980.9 thous. ha, cotton – 140.6 thous. ha, vegetable and melon and potatoes – 400.2 thous. ha, fodder – 2 866.8 thous. ha. The area occupied by flax increased, this culture in 2013 was sown on 410.1 thous. ha, which is almost 2 times more than in 2010.

In accordance with the Program for the development of agro-industrial complex in the Republic of Kazakhstan for 2013-2020 "Agro business-2020," it is planned to develop the industry of crop production with an increase of production volumes based on the transfer in the science-based moisture-resource saving technologies, rational use of agricultural land, involvement of new and currently unused land in the agricultural turnover, continuation of diversification and holding acreage of crops in line with the established science-based crop rotations.

This technology can be used successfully on all agricultural land and its success can be enhanced with its joint application of the no-till technology.

1.3.2. Identified barriers for crop diversification technology

Ensuring crop diversification is based on the current state and prospects of development of seed and crop breeding. A well-organized seed production enhances productivity, therefore the main task of seed is the fastest and most complete implementation of the achievements of breeding.

The use of new technologies requires the application of appropriate techniques to ensure rapid seed multiplication at the stage of elite seed. The highest percentage of production profitability - 63-69% is achieved by using the minimum and no-till technology, improving the seed technology of elite spring wheat, and using the traditional technologies the margin is 44.3 %. (I.T. Rassomahin, N.A. Storozhenko, ... Seed of spring wheat in western Kazakhstan under new economic conditions, Proceedings of the State Agrarian University, 2011, http://cyberleninka.ru/article/n/semenovodstvo-yarovoy-pshenitsy-na-zapade-kazahstana-v-novyh-ekonomicheskih-usloviyah). It should be noted that the integrated use of diversification technology and no-till brings the greatest effect.

Kazakhstan has a fairly well developed system of variety testing and seed production, which has the following key development issues (Master plan for the development of the seed industry, http://www.fic.kz/programmy-po-razv-prom-kompleksa-v-rk-na-2013-2020/semenovodstvo.pdf):

1) violation of economically justified terms of variety change and strain renovation;

2) illegal turnover of seeds (using seeds of unknown origin, with reduced sowing (planting) characteristics);

3) lack of the necessary infrastructure to provide customers with high quality seed (planting) material of high reproductions of the best varieties, as well as service support;

4) outdated material and technical base and technological variety trials, which does not allow to implement the selection process effectively and to ensure the production of high quality seeds;

5) the problem personnel maintenance of variety trials and seed production;

6) lack of funds

7) the agrarian sector is dominated by backward technological production schemes of preparation, storage, processing high-quality crop seeds.The level of susceptibility of agricultural enterprises to innovate in the field of variety testing and seed production is also low

As mentioned above, the technologies in agriculture have many common elements. Therefore, application of crop diversification technology was evaluated in several aspects, such as economic/financial barriers, human potential, social barriers. A long list of barriers coincides with the previous one (Annex I).

Table 11 List of barriers by level of ranking for crop diversification technology

Barriers	**Level of ranking (1-5)**	**Classification of barriers (economic and financial, human potential, awareness, institutional regulation, etc.)**
The deficit of investment capital.	5	Economic and financial
Deficiency of finance for the development of seed production. Outdated technological variety testing and seed production base, which is not being effectively implemented through the selection process and to ensure the production of high quality seeds.	5	Economic and financial
Poor rural infrastructure to ensure high quality seed (planting) material of high reproduction of the best varieties, as well as service provision.	5	Economic and financial
Lack of financial resources to stimulate the agricultural labor for a favorable climate technology.	4	Economic and financial
Imperfect market structure, there is the illegal circulation of seeds (use at sowing seeds of unknown origin, with reduced sowing/landing characteristics).	5	Underdevelopment of the market
Imperfect legislative and regulatory framework (state land quality monitoring and responsibility for implementation).	5	Policy, legislation and regulation
The lack of expertise in the organization and promotion of the market in agriculture.	3	Underdevelopment of the market
Insufficient product quality, operation and maintenance		Underdevelopment of the market
Lack of interest on the part of businesses to improve the quality of seeds, soil, agricultural product.	3	Underdevelopment of the market
The lack of market prices for the environmental benefits of improved seeds, soil product.	5	Underdevelopment of the market
The lack of coordination of the various interest groups.	5	The lack of network
Lack of confidence in the sustainability of technologies.	4	Social, cultural and behavioral
Insufficient awareness	5	Information and awareness
Lack of awareness of the problems associated with climate change and technological solutions	3	Information and awareness
The lack of qualified professionals in local agricultural companies.	4	Qualification

Table 12 List of the key barriers for technology of crop diversification

Key barriers	**Classification of barriers**
The deficit of investment capital	Economic and financial
Lack of funding for development of seed production	Economic and financial
Poor rural infrastructure, long distances	Economic and financial
Imperfect legislative and regulatory framework of monitoring and accountability for the quality of the land	Policy, legislation and regulation
The lack of standards and indicators for assessing the quality of seeds.	Institutional opportunities
The lack of market prices for the environmental benefits of improving the work on sustainable farming practices	Underdevelopment of the market
Lack of coordination among the various interest groups.	Underdevelopment of the market
Lack of awareness	Information and awareness
Lack of knowledge of the relevant local government authorities and the local population about the need to have high-quality seeds and organic matter in the soil to support the quality and potential of agriculture	Information and awareness

1.3.3. Measures identified for introduction of the crop diversification technology

As with other technologies, the problem logical analysis was used as a tool to determine the measures to overcome the barriers. The problems were formulated in positive statements about future situations, organization of measures and results in a tree of tasks, as a logically organized presentation of objectives. Tree of tasks for this technology, and for other technologies are presented in Annex II.

Implementation of priority technologies is based on identification and adoption of measures to overcome barriers. The logical problem analysis (LPA) tool was used for the analysis.

The problems were reformulating into positive statements about future situations, arranging measures. Measures for the corresponding barriers are grouped according to the same criteria as the barriers to get the result from problem to solution.

The measures were assessed according to their economic profile, incentives used and effects achieved The analysis results are presented in Tables 1.12-1.14 below. Tree of objectives for this technology is presented in Annex II.

Measures were evaluated according to their economic profile, incentives are used and effect is reached. The results are shown in the tables below.

Technology for crop diversification was supported by the study of a favorable environment policy. According to studies carried out by experts in the implementation of the technology fall under the jurisdiction of several laws, among which the most important are:

- The Land Code of the Republic of Kazakhstan, dated June 20, 2003, No. 442;
- Law of the Republic of Kazakhstan "On Seed Production," dated February 8, 2003, No. 385;
- Rules of the rational use of agricultural lands, dated November 4, 2011, No. 1297;
- Program for development of agro-industrial complex in the Republic of Kazakhstan for 2013-2020 "Agro business-2020," dated February 18, 2013, No. 151;

The national policy for the development of agro-industrial complex in the Republic of Kazakhstan for 2013-2020 has the greatest influence on the implementation of the technology. Relevant regulatory acts complement the implementation of the policy, facilitating the transfer of technology.

The results of this work are given in Tables of this part.

Table 13 List of barriers and measures to transfer technology for crop diversification

Specific barriers	**Measures, determined for overcoming barriers**
Economic and financial	Development of a system of economic incentives for agricultural enterprises using plant diversification system; Develop incentives to attract investments for climate-friendly technologies in the agricultural sector; Creation of financial fund to promote the development of seed farms and provide farmers with seeds of the highest quality at the expense of internal resources.
Underdevelopment of the market	Improve the logistics of agricultural producers for the procurement of climate technology products.
Policy, legislation and regulation	Increased promotion of climate technologies through subsidies relevant systems of agricultural practices; Tax reduction for forms that promote climate technology; Ensure accountability at all levels of legislative instruments for ensuring the implementation of and compliance with technical measures of climate technologies. State monitoring of and responsibility for the quality of the land.
The lack of network	Organization of national and regional network groups of farmers and other interested persons and organizations interested in advancing climate technologies; Ensure effective coordination between the main active members of network, organizations on climate technology.
Information and awareness	Improving the education system, including issues related to the innovative climate technology; Public awareness on the implementation of environmentally friendly technologies, as an important component of the task of the propagation and implementation of technologies.
Social, cultural and behavioral	Increasing importance of sustainable climate technology through science and regulatory tools, ensuring the transparency of the process of action.

Table 14 List of measures and incentives

Financial measures	Non-financial measures	Complementary measures	Incentives
Creation of financial fund to stimulate the process of introduction of climate-friendly technologies.	Ensure changes in legislative acts: the Law on seed, the Land Code and others.	Improvement of the economic advisory services at the municipal level; Ensuring the participation of municipalities in courses; Attracting of foreign scientists and experts to participate in the implementation of economic courses.	Development of a system of economic incentives; Development of tools, at the state level for the agricultural business, which uses climate-friendly technologies.
Financial support for the development of seed farms to provide farmers with the highest quality seeds based on local varieties.	Increased responsibility and demands in agriculture in land management, the use of quality seeds and of agricultural activities in the process of agricultural production.	Support for permanent training centers for relevant professionals in the field of agriculture, research institutes and departments, specializing in agriculture, universities and colleges, agricultural, etc .; Improved national monitoring systems for agricultural soils, research and monitoring.	Improving of instruments for ensuring the implementation of and compliance with technical measures of climate friendly technologies.
Increased funding for the implementation of climate-friendly farming technologies based on land consolidation.	Strengthening the association of of farms.	Raising awareness of farmers on environmentally friendly farming practices through the organization of thematic seminars.	Loans with low interest rates and great grace period.

Table 15 Final list of measures to overcome barriers for crop diversification technology

	Measures
1	Development of a system of economic incentives for agricultural enterprises using climate-friendly technologies
2	The reduction or exemption of taxes for farmers investing in sustainable agricultural practices, including the purchase of equipment.
3	Allocation of subsidies for farmers using climate technology
4	Increasing farmers' responsibility for compliance with technical measures in the implementation of climate technologies
5	Increasing the liability of Land Management in the legislative acts of the Republic of Kazakhstan.
6	Increased farm consolidation process
7	Improving the system of scientific research on seed production, management and treatment of the soil
8	Effective coordination between the main players in the chain to diversify the technology: farmer, seed farms, the owner of the mineral and organic fertilizers, etc.
9	Organization of regional and national network of groups interested in promoting climate-friendly technologies.
10	Promoting and updating of programs providing training on sustainable management of agriculture.

1.4 Analysis of barriers and possible measures for introduction of transhumance system and grazing and stabling system on an industrial basis technologies

1.4.1 Description of transhumance system and grazing and stabling system on an industrial basis technologies

Sheep breeding in Kazakhstan is one of the most important branches of the agro-industrial complex of the country, and in a number of cases, the only source of basic products – wool, lamb meat, fur and sheepskin coata.

Grazing is a profitable industry, as Kazakhstan is among the five world leaders in terms of pasture resources. According to the data of 2013, population farming has 62.6% of sheep and goats with low productivity, which has an impact on consumption growth in the domestic market and high cost. Productivity of livestock in Kazakhstan are below international indicators by several times. The main causes of low productivity is the low proportion of breeding stock, shortage of quality feed, lack of use of modern technologies, feeding, lack of care for the health of animals, low level of mechanization and automation of processes in animal husbandry (The Program on Argo-Industrial Complex Development in the Republic of Kazakhstan for 2013–2020 "Agrobusiness–2020, http://adilet.zan.kz/rus/docs/P1300000151). Besides, the potential of natural pastures is not used due to lack of access to water for watering animals. Pasture lands for transhumance are used only by 20%, mainly cattle is grazing on pre-aul (village) territories. Irrational use of land leads to the degradation of soil and vegetation. (Ustabaev TS, Zhakashov. AM, a sustainable development path of distant-pasture cattle tending and prospects of grazing areas use, 2014 http://group-global.org/ru/publication/14296-puti-ustoychivogo-razvitiya-otgonnogo-zhivotnovodstva-i-perspektivy-ispolzovaniya).

Seasonal distant pastures are not used due to lack of infrastructure supportability (watering of structures, electricity networks, roads and means of communication).

This situation complicates the solution of the issues of improving the genetic potential of livestock, stricter veterinary and sanitary control, strengthening animal forage, as well as addressing the issue of raw materials for processing industry enterprises.

Pasture-stall sheep keeping is spread mainly in South Kazakhstan and its advantage is that the system allows for more efficient use not just of farmyard feed (coarse, green and concentrated), but also pasture available in the economy.

The basis of forage for livestock in dry and hot climate of Kazakhstan, with limited water resources, is natural pastures.

Distant-pasture system allows to combine natural and economic systems, various seasonal pastures, and is a major adaptation measure, established by a century of experience of nomads-breeders. Natural and climatic conditions and the pastures of south part of the country allow to keep the sheep in the pastures all year round. This is the cheapest way of cattle management.

Application of these technologies corresponds to the economic, social and environmental priorities for the country's development. They are aimed at ensuring food security, increased productivity, and implementation of the diversification strategy of the economy, increasing the weight of the agricultural sector in the economic system.

In accordance with the Program for development of agro-industrial complex in the Republic of Kazakhstan for 2013-2020 "Agro business-2020," a set of measures will be adopted for the development of traditional livestock industries, which will stimulate development of transhumance, including sheep breeding. Work on the creation of small and medium-sized family farms will also be strengthened. A number of measures on creation of a solid fodder base for livestock will be taken. A part of the AP investments on watering of pastures in the construction and rehabilitation of mine and tube wells will be reimbursed; in acquisition and introduction of irrigation systems for feed crop growing; construction of feed mills for the needs of livestock and poultry enterprises with quality and balanced feed.

1.4.2 Identified barriers for introduction transhumance system and grazing and stabling system on an industrial basis technologies

1.4.2.1 Economic and financial barriers

Evaluation of livestock numbers shows a general positive trend, but it is important to note that most of the animals are contained in the personal households and peasant farms. Small-scale production is

disorganized, with primitive and outdated technology, low level of mechanization of basic technological processes of farm animals' production and feeding. (Esirkepova A.M., Zhabayeva B.O. Market research and analysis of Kazakhstan's meat market, http://www.analitika.kz/images/analiz%20rynka%20m9sa.pdf)

Agricultural production today is small-scale, which is the main reason for its weak competitiveness. Concentration of livestock in private households and small farms, and lack of financial resources make it difficult to invest in the construction, use of advanced technologies for keeping and feeding, breeding achievements, recovery of pastures and wells, raising livestock using scientific methods and achieve its high efficiency.

1.4.2.2 Nonfinancial barriers

Policy, legistation and reguliration*:* Fodder stability and access of livestock to natural pastures play an important role in the development of animal husbandry. According to experts, 43% is used for grazing of the available grazing land in Kazakhstan. And these lands are concentrated mainly near settlements, which are subject to degradation by increasing the load per unit area of grazing by farm animals. Distant pastures are not effectively used because they require recovery. The deficit of pastures is the result of existing legal barriers – namely, the imperfections of the legal framework for the management, distribution and use of pasture resources. The lack of regulations of the state authority for the management and regulation of pastures, mechanism of regulation between the owners and users of pastures, approval of regulatory acts on the reduction of load on the pasture areas and other regulatory acts aimed at preventing deterioration and degradation of pastures will improve the situation with pastures. The Government has provided support for the development of agriculture. In addition to the program for the development of agro-industrial complex in the Republic of Kazakhstan for 2013 - 2020 years "Agrobusiness-2020", Master Plan "Development of sheep farming in the Republic of Kazakhstan till 2020" was developed, http://mgov.kz/master-plany/http://mgov.kz/master-plany/, Master plan for the development of fodder production in the Republic of Kazakhstan for 2013-2020 http://mgov.kz/master-plany/http://mgov.kz/master-plany/. There are subsidy mechanisms, providing support for public and private seed producers, activities for the state strain testing of crops. But at the same time, regulatory and legislative framework on pastures management, the interaction between the owners and users pastures, the load on the pasture areas and other rules aimed at preventing the deterioration and degradation pastures need to be improved.

Enabling responsibility for the quality of pastures, expansion of functions of local authorities for participation in elaborating the plan for management and use of pastures in a transparent manner would have a positive effect on the development of sheep breeding. Increasing the effectiveness of the mechanism aimed at consolidation of small farms will allow improve the efficiency and benefit of the industry as a whole.

Barriers of undeveloped inefficient market

The slow process of market development, difficulties in connecting and promoting strong relationships between businesses.

Barriers of undeveloped inefficient network

An important role in the development of animal husbandry is the presence of the stable forage and availability of natural pastures for animals. Problematic issues for the formation of a stable food base are an important role in the development of animal husbandry plays fodder stability and availability of cattle to natural pastures. According to the experts, 43% of the available grazing land in Kazakhstan are used for pasture. And these lands are concentrated mainly near settlements, which are subject to degradation by increasing the load per unit area of grazing by farm animals. Distant pastures are not used effectively because they require recovery.

Problematic issues are (Ustabaev T.S., Zhakashov A.M., The sustainable development of distant-pasture cattle tending and the prospects for the use of grazing land, 2014, http://group-global.org/ru/publication/14296-puti-ustoychivogo-razvitiya-otgonnogo-zhivotnovodstva-i-perspektivy-ispolzovaniya; Esirkepova A.M., Zhabayeva B.O. Market research and analysis of Kazakhstan's meat market, http://www.analitika.kz/images/analiz%20rynka%20m9sa.pdf; Ustabaev T.S., Zhakashov A.M.,

The sustainable development of distant-pasture cattle tending and the prospects for the use of grazing land, 2014 http://group-global.org/ru/publication/14296-puti-ustoychivogo-razvitiya-otgonnogo-zhivotnovodstva-i-perspektivy-ispolzovaniya; Esirkepova A.M., Zhabayeva B.O. Market research and analysis of Kazakhstan's meat market, http://www.analitika.kz/images/analiz%20rynka%20m9sa.pdf57):

- Lack of seed production system of grass and other feed crops;
- cessation of work on improvement of natural forage lands and the creation of cultural pastures;
- degradation of herbage on pastures and hayfields, development of erosion and soil loss on plow;
- the suspension of the implementation of fodder crop rotations;
- reduction of feed quality, only a small part of them assessed on quality indicators;
- • the decrease in the use of efficient technologies for harvesting and preparation of feed, protein deficiency is even more acute than in the past, an imbalance in the feed ofprotein-carbohydrate complex;
- no production of elite seeds of fodder for further breeding, use and improvement of forage;
- a sharp decline in the use of fertilizers and plant protection products in feed production;
- high prime cost of manufactured feeds
- Inadequate forage production systems do not ensure compliance with feed rations and contributes to low productivity, lack of competitiveness and high prices, as well as the increase in greenhouse gas emissions from enteric fermentation due to the vital activity of animals.
- An important place in the development of animal husbandry veterinary medicine takes. The master plan for the modernization of veterinary system in the Republic of Kazakhstan in accordance with international standards (http://mgov.kz/master-plany) highlighted the following key systemic problems in the veterinary field.

1. The imperfection of the legislative framework in the field of veterinary medicine;
2. Institutional imperfection of the veterinary system;
3. Deficiencies in the deployment of a network of veterinary organizations and their equipment;
4. Low quality of veterinary measures;
5. Deficiencies of animal identification procedures;
6. Staff insecurity and low qualifications of veterinary specialists;

Ministry of Agriculture, performing the formation of the state agrarian policy, strategic plans, state and other programs and projects in regulated areas and cross-sectoral coordination and governance in regulated areas and the Department of Energy (coordinating climate change) should coordinate their efforts on climate change and environment.

Cooperation between researchers and the business in the agricultural sector is not realized to the full. The integration of research into practice requires the creation of scientific studies on the use of the mechanism in practice and monitoring of implementation.

One of the main incentives to facilitate climate technologies should be a high demand for a high quality product to the consumer. Unfortunately, the level of consumer education is not high enough, but civil society are not actively involved in promoting the introduction of technologies.

Increased research on long-term trial basis in research institutes and farms in the field will strengthen mutual learning and knowledge transfer. Farmers need to learn from each other during workshops and field practice. Such seminars should be supported by the various ministries responsible for the environment, agriculture, health, etc. In addition, the workshops should serve the interests of not only the large farms, but also small farmers.

Institutional and organizational barriers

The lack of qualified professionals in the organization and promotion of technologies.

Information and awareness

Ignorance of management problems in terms of ecology, economy, addressing social and health by the relevant local authorities and the local population.

Table 16 Ranked list of barriers for technologies of distant-pasture and grazing-stall systems of sheep keeping on an industrial scale

Barriers	Level of ranking (1-5)	Classification of barriers (economic and financial, human potential, awareness, institutional regulation, etc.)
The deficit of investment capital	5	Economic and financial
Fragmentation of land, small-sized farms	5	Economic and financial
Unsatisfactory rural infrastructure	5	Economic and financial
The lack of financial capacity to stimulate agricultural labor, which use favorable climate technology	4	Economic and financial
Imperfect market structure	5	Underdevelopment of the market
Imperfect legislative and regulatory measures	5	Policy, legislation and regulation
The lack of expertise in the organization and promotion of the market in agriculture	3	Failure of the market
Poor quality of product, operation and maintenance		Failure of the market
The lack of business interest in supporting the improvement of pasture quality	3	Failure of the market
The lack of market prices for the environmental benefits of improving pastures and agricultural products	5	Failure of the market
The lack of coordination of the various interested groups	5	Failure of the network
Lack of awareness	5	Information and awareness
Lack of awareness of the problems associated with climate change and technology solutions	3	Information and awareness
The lack of qualified local agricultural organizations	4	Human skills

Table 17 List of key barriers for technologies for distant-pasture and pasture-stall systems of sheep keeping on an industrial scale

Key barriers	Classification of barriers
The deficit of investment capital, lack of financial funds, grants	Economic and financial
Excessive fragmentation of land/small farm size	Economic and financial
Poor rural infrastructure, shortage of pastures, poor logistics, long distance	Economic and financial
Imperfect legislative and regulatory framework	Policy, legislation and regulation
The lack of market prices for the environmental benefits of improving the quality of agricultural product	Ineffectiveness of the market
Insufficient coordination among the various stakeholders	Failure of the market
Insufficient information	Information and public awareness
Ignorance of the relevant local government authorities and the local population about the need to have quality pastures to support grassland potential	Information and public awareness

1.4.3 Measures identified for introduction transhumance system and grazing and stabling system on an industrial basis technologies

As with other technologies, logical analysis of the problem was used as a tool to determine the measures to overcome the barriers. Problems were considered as positive suggestions for future situations, organization of measures the results as a logically presented problems. Tree of tasks for these technologies is presented in Annex II.

Evaluation of measures is carried out in accordance with the economic profile, used by the incentives and achievable effect. The results are provided in Tables of this part.

Table 18 Final list of measures to overcome barriers to technology for distant-pasture and pasture-stall system of sheep keeping on an industrial scale

Key barriers	**Classification of barriers**
The deficit of investment capital, lack of financial funds, grants	Economic and financial
Excessive fragmentation of land/small farm size	Economic and financial
Poor rural infrastructure, shortage of pastures, poor logistics, long distance	Economic and financial
Imperfect legislative and regulatory framework	Policy, legislation and regulation
The lack of market prices for the environmental benefits of improving the quality of agricultural product	Ineffectiveness of the market
Insufficient coordination among the various stakeholders	Failure of the market
Insufficient information	Information and public awareness
Ignorance of the relevant local government authorities and the local population about the need to have quality pastures to support grassland potential	Information and public awareness

1.5 Determination of the barriers relationship

They are common for all technologies. Lack of access to financial means leads to a delay in the implementation of climate technologies by farmers due to lack of own funds.

Imperfect legislation for technologies is not conducive to the implementation of no-till technology, crop diversification and distant-pasture and pasture-stall systems of sheep keeping on an industrial scale technologies.

The lack of information about the benefits of new technologies, necessity of transfer to adaptation technologies necessary due to future climate change is also one of the main obstacles to the introduction of new technologies.

Scientific support of the introduction of technologies both crop breeding and sheep farming is an important component for high-quality technologies. Ignorance of technologies relates to social barriers, where the local population uses conventional methods of farming.

Barriers associated with the implementation of the technologies are as follows:

Table Summary of barriers for agricultural sector

Barriers	**Technologies**			**Measures**
	No-till	**Crop production diversification**	**Transhumant and pasture-stall sheep keeping**	
Policy, legal and regulatory	Imperfect legal and regulatory framework; Policy intermittency and uncertainty.	Imperfect legislative and regulatory framework	Imperfect legislative and regulatory framework	Improvement of the legal framework, the inclusion of the concept od adaptation, the definition of climate friendly technologies, priorities for their implementation Improvement of the land quality monitoring by the authorities and introduction of liability for the land and pasture quality, as well as complince with agrotechnical measures. Improvement of the management and monitoring by the authorities for the quality of pastures; The development of pasture management plans for livestock and schemes of cattle overlanding with local authorities in a transparent manner, Strengthen and support the process of unification of small farms
Economic/financial	Lack of full access to financial resources; The high cost of capital; Inadequate financial rewards and incentives; High interest rates.	Shortage of investment capital; Lack of funding for the development of seed production; Poor rural infrastructure, long distances	Lack of investment capital, lack of financial funds, grants; Excessive fragmentation of land / Small farm size; Poor rural infrastructure, shortage of pasture, poor logistics, long-distances.	Creation of an agricultural bank with low interest rates Creating a fund for grants for climate friendly technologies Reduction of tax when investing farmers doing environmental farm practices Reduction of customs duties for climate technologies Development and implementation of a system of economic incentives for agricultural enterprises using climate friendly technologies
Market failure, imperfection	Unsatisfactory market structure; Imperfect sources of increasing revenues; ..	Lack of market prices for the environmental benefits of improving the work on sustainable farming practices	Lack of market prices for the environmental benefits of improving the work on sustainable farming practices Poor rural infrastructure, shortage of pastures, poor logistics, long distances. Excessive fragmentation of of land plots/Small farm size**;**	Improving the market structure, logistics, services Ensure effective coordination between the main players in the chain of technology, improvement of logistic schemes: a farmer with seed farms, owners of the mineral and organic fertilizers, breeding farms and etc. Strengthen and support the process of unification of small farms

Network failures	Poor interaction between the constituents, preferring new technology	Lack of coordination among the various interest groups	Lack of coordination among the various interest groups	Organization and support for regional and national networks of groups interested in promoting climate-friendly technologies Creation of associations for the relationship between farmers and the political parties to lobby for sustainable agricultural production systems
Institional capacity	Limited i**nstitional capacity**	Lack of knowledge of the relevant local government authorities and the local population about the need to have high-quality seeds and organic matter in the soil to support the quality and potential of agriculture Lack of knowledge of the relevant local government authorities and the local population about the need to have high-quality seeds and organic matter in the soil to support the quality and potential of agriculture	Lack of information; Lack of knowledge of the relevant local government authorities and the local population about the need to have quality pasture to support pastures potential	Strengthening the foundations of human potential of the agricultural sector Conducting seminars, trainings. Promoting and updating of programs providing training on sustainable management of agriculture
Research				Improving the system of scientific research on seed-growing, management, treatment of the soil and applying this technology in conjunction with correctly set crop rotation. Improving the system of research and interaction with the sector
Information and awareness	Inadequate awareness.	Inadequate awareness; .	Lack of information; Lack of knowledge the relevant local government authorities and the local population about the need to have quality pasture to support grassland potential	Strengthening the media interest in the promotion of climate-friendly technologies with the participation of research organizations, experts, manufacturers of agricultural machinery, the positive influence of climate

1.6 Favorable conditions for overcoming barriers in the agricultural sector

Agriculture is a strategic sector of Kazakhstan and the Government approved a number of special programs in this area. The main aspects of agricultural development are presented in the program for the development of agro-industrial complex in the Republic of Kazakhstan for 2013-2020 "Agro business-2020." However, the development program does not cover the aspect of future trends of climate change. Therefore, special measures are needed to eliminate barriers in the introduction of climate-friendly technologies.

The main possible measures needed to address the identified economic/financial and non-financial barriers of priority technologies in the agricultural sector are placed in the table 1,18 (measeres column) and can be listed as follows:

1. Improvement of the legal framework, the inclusion of the concept of adaptation, the definition of climate-friendly technologies and priority of its implementation
2. Improving the quality of management and monitoring of land, pastures, introduction of responsibility for the quality of the land, respect for agricultural activities, pastures quality
3. Development of pastures management plans and cattle overlanding schemes involving the participation of local governments in a transparent manner
4. Enhancing the farm consolidation process
5. Creation of an agricultural bank with low interest rates;
6. Develop a system of economic incentives for agricultural enterprises using climate-friendly technologies, the allocation of funds, grants
7. Improving the structure of the market, logistics service
8. Ensure effective coordination between the main players in the chain of technology, improvement of logistic schemes: a farmer, seed farms, owner, mineral and organic fertilizers, breeding farms, etc., improving logistic schemes
9. Enhancing and supporting the association of small farms
10. Creation of associations for the relationship between farmers and the political individuals for lobbying the implementation of sustainable agricultural production systems
11. Organization of national, regional, district network groups for farmers interested in promoting climate-friendly technologies
12. Enhancing the foundations of human potential of the agricultural sector
13. Enhancing the foundations of human potential of the agricultural sector
14. Conducting seminars, training, promotion and updating of programs providing training on sustainable management of agriculture
15. Improving the system of scientific research for climate-friendly technologies, widespread knowledge of research, distribution of brochures, leaflets, etc.,
16. Increasing the institutional capacity of all stakeholders, government officials, local authorities and farmers.
17. Strengthen the interest of the media in promoting climate-friendly technologies with the participation of research organizations, government officials, local authorities, NGOs, about the benefits of these technologies.

.

CHAPTER 2 WATER SECTOR

2.1 Preliminary targets for technology development and dissemination

Kazakhstan is among the countries that face a shortage of water resources. Rivers flow (90%) of the country is formed in the spring period, at that about half the volume fall on neighboring countries. Besides, extensive use, consumption of water for irrigation and other froms of water losses such as network losses occur in the country.

The major water users are agriculture and industry respectively, 68% and 27% [51]. The main consumer of water resources is irrigated agriculture, it needs in water fall on the warm period of the year, part of the water after irrigation returns to the rivers and is used repeatedly.

Assessment of water resources' vulnerability showed the impact of climate change on river flow and especially the flow of lowland rivers of the Central and Western Kazakhstan. Thus, according to the pessimistic scenario, reduction of surface water runoff in the short term is expected (2020).

There is already an issue of solving the problem of water resources reduction. That is water scarcity may complicate the economic situation in the country and reduce the economic potential as a whole. This problem in the agricultural sector, one of the main water consumers, is the most acute.

Increasing water scarcity encourages the transition to water-saving technologies. Especially significant results of water saving can be achieved in irrigated agriculture. However, the analysis of water resources use shows an increase in irrigation rates and losses in networks. The main reasons for the inefficient use of water resources are: poor implementation of improved farming techniques, poor technical condition of irrigation and water distribution systems, equipment wear and tear, lack of water-saving technologies and water accounting. Creating an effective management system and **metering of water in agriculture** will be an important component for the reduction of water resources deficit.

Currently, surface irrigation is the most common method of irrigating crops. At present, successful development of agriculture is based on obtaining highly profitable products at low cost and the use of resource-saving technologies and technical means of irrigation, providing plants with the optimal amount of water, nutrients and aimed at preserving the environment.

One common water-saving technology is **drip irrigation**, which allows to achieve water savings up to 45-50% or more, which is especially important in the conditions of the existing and growing irrigation water deficit. The purpose of technology is aimed at adaptation to climate change and efficient management of water resources in the areas most vulnerable to climate change, as well as in the areas with potential risks of drought and high temperatures.

One of the important components of the climate change adaptation program is a **prevention system for extreme hydrological phenomena** (high water, snow melt flood, floods, etc.), which is a method to detect threatening phenomena beforehand. This allows the public to be ready for taking actions reducing the negative effects. Thus, the main purpose of the prevention system is to reduce high water, snow melt flood, flooding and other extreme hydrological events.

Taking into account the growing problem of water shortage, frequent cases of environmental disasters, irrational use of water, water facilities pollution, etc., there is a need to elaborate regulations in accordance with such factors. Currently, the policy of the water sector development in the country is determined by the key documents listed below (references to them are given in Annex V):

1. "Water Code of the Republic of Kazakhstan" (2003), the main purpose of which is to achieve and maintain environmentally safe and economically optimal level of water use and protection of water resources, water supply and sanitation for the preservation and improvement of the living conditions of the population and the environment;
2. National Plan of Integrated Water Resources Management and Increase of Water Use Efficiency of the Republic of Kazakhstan for 2009-2025" (2009). At the second phase (2012-2025) of the National Plan the issues of further institutional strengthening of the water sector of the economy are provided. The sources of financing (subsidizing) of water supply and sanitation facilities, and measures to assist in addressing the urgent and long-term objectives, including the issue of inventory of the water-and-sewage system, monitoring of the municipal facilities system, introduction of new technologies and techniques, personnel training should be identified.
3. The concept of the transition of the Republic of Kazakhstan to the "green economy" (2013). Measures and mechanisms to reduce water scarcity provided in the Concept are water saving in agriculture (6.5-7 billion m3 by 2030); improving water use efficiency in industry by 25% (will

allow save 1.5-2 billion m3 by 2030); improving water use efficiency in public and housing utilities by 10% (will allow save up to 0.1 billion m 3); increasing availability and reliability of water resources (4.5-5 billion m 3); reconstruction and development of the main irrigation canals, water supply from water-abundant to water-scarce regions of the country; limits, prices and tariffs for water, new regulations and standards, etc.

It should be noted that one of the tasks of the Concept was to develop the Water Resources program. Thus, in 2014 the ***State Water Resources Management Program was adopted until 2040***, which sets clear goals, objectives, stages of implementation and financing.

4. "State Water Management Program of Kazakhstan for 2014-2040" (2014). Target indicators of the program are:

- reduction in water consumption per unit of GDP in real terms by 33% by 2020 compared to 2012;
- increase of additional surface water resources by 0.6 km3 by 2020;
- share of water users with continuous access to the central system of drinking water: in the cities – no less than 100% and in rural areas no less than 80% until 2020;
- share of water users with access to water disposal systems: in cities at least 100% until 2020; in rural areas at least 20% until 2020;
- satisfaction of annual needs of natural objects in water and preservation of navigation at the level of 39 km^3.

Potential technologies proposed for the water sector are: metering of water for watering and irrigation, drip irrigation, technology of extreme events prevention.

2.2 Analysis of barriers and possible measures for introduction of drip irrigation technology

2.2.1 Description of drip irrigation technology

Rational use of water resources is achieved through the use of water-saving technologies such as drip irrigation. Kazakhstan is among the countries where irrigated farming in agricultural production plays a leading role, but at the same time high unit costs of water per 1 kg of the crop is observed in the country. Productivity of agricultural products per 1 m3 of irrigation water in Kazakhstan makes 0.4-0.8 kg [53]. Actual water consumption per 1 ha ranges from 9,500 to 10,500 m3, and in the rice fields up to 36.0 thous. m3 [53].

Currently, drip irrigation technology is increasingly used in the farms of Kazakhstan. 75% of the area irrigated in Kazakhstan with the help of such a technology fall on the South Kazakhstan region. This is more than 20 thous. ha of cotton, vegetables, orchards and vineyards.

The total irrigated area in Kazakhstan in 2014 amounted to 1 587.9 thous. ha. If we compare the irrigated area to total arable land in the country, about 7.5% of agricultural land is irrigated. According to the Ministry of Agriculture (2014), in 2013 the share of the total irrigated area of drip irrigation technology was as follows: 89% (furrow), 7% (sprikling) and 4% (drip irrigation). Moreover, the furrow technology has water use efficiency 70% (30% loss), sprinkling technology – 80% and drip irrigation technology – 92% [53].

The Kazakhstan market has suppliers of products from: Europe, Israel, China, Russia and Ukraine, as well as the Kazakh producer, which equipment cost is at the level of the Chinese and Ukrainian producers.

Advantages of drip irrigation:

1. Increase of productivity, followed by savings in water consumption per unit of product;
2. Reduction of moisture loss due to evaporation rather than with other types of irrigation. Wind does not affect the distribution of moisture;
3. Does not require careful planning of irrigated area, prevents surface discharge in difficult topographical conditions;
4. Possibility of farm works during irrigation (in orchards, vineyards, etc.);
5. Provides supply of fertilizers directly into the root zone;
6. There is no peripheral loss of water at sufficient rainfall, salinity does not pose a problem. In insufficient rainfall, additional irrigation rate, often supplied by sprinkling, is needed;
7. The possibility of irrigation by small irrigation rates with short irrigation intervals;
8. The number of weeds is less than with other methods of irrigation.

Disadvantages:

1. Not suitable as advance irrigation;
2. It is not acceptable for additional technical irrigation;
3. Problematic to irrigate young trees (plants) in arid areas with sandy soils and strong winds.

2.2.2 Identified barriers for drip irrigation technology

In accordance with the market characteristics, the drip irrigation technology was classified as a consumer product that has potential consumers such as private enterprises, farms and others.

Identification of barriers is implemented in analogy with the previous technologies. Annex I contains a table with a long list of barriers for the drip irrigation technology.

LPA emphasized the main links between causes and effects, and organized them in logical relationships, the major issues were considered and relationship with external factors was highlighted (Annex II).

As in the previous technology, the use of drip irrigation technology is made by categories: economic/financial barriers and non-financial barriers.

2.2.2.1 Economic and financial barriers

Providing farmers with irrigation water is a serious problem for local administrations. The local budget is mainly focused on social projects and funding for additional projects is limited, therefore, this type of activity can be carried out at the coincidence of the public interest, the interests of business and the interests of donors. Large projects are subsidized by the budget, and the interests of medium and small businesses are quite limited. In 2015, the Order of the Minister of Agriculture of the Republic of Kazakhstan approved the Rules of subsidizing the costs incurred by companies in investing. Subsidizing of the introduction of irrigation systems of drip irrigation (≈1800 USD per 1 ha) was indicated among the priority areas. In 2015, "Fund for Financial Support of Agriculture" JSC within the program "Agribusiness-2020" started crediting implementation of drip irrigation systems. In 2015, 38 loans worth ≈625 thous. USD were issued for the implementation of drip irrigation systems on an area of 441 ha, these funds provided employment to 91 people.

Cost of drip irrigation systems is quite high, so it is very important to schedule all works on operating of the system. The costs for implementing the system of drip irrigation make: in vegetable farming 1500-4000 USD/ha, in horticulture and viticulture 2000-3000 USD/ha, depending on the type of the used tube, water supply source, geometry and field layout, equipment, crop and variety, distance from the source of water supply, etc. (54).

At the preparatory stage, survey operations of the land array are carried out, which are needed to create a drip irrigation map. The final costs depend on the characteristics of the terrain, soil structure, culture and access to energy and water sources. Besides, the farmer will bear the costs for training personnel, which are usually included in the cost of the project, providing spare parts. Equipment suppliers prioritize large projects.

Annex VI of this report includes an example of the economic and financial analysis of drip irrigation technology.

2.2.2.2 Non-financial barriers

Introduction of technology requires skilled personnel for operation and maintenance of the systems, since it requires a competent installation, detection and elimination of problems in the system, planned and preventative maintenance, replacement of individual parts of the system. Implementation of the system requires training and periodic retraining of personnel.

The use of drip irrigation involves high yields with the mandatory implementation of all agricultural activities on plant protection, fertilization, care of plants. Therefore, users of these systems need to know the agricultural techniques of cultivation of crops in drip irrigation.

Not adapted to local conditions technologies of cultivation of certain crops will not meet the goals, objectives and spent expenses. The study of soil structure and climatic conditions, identification of natural and industrial factors on plant growth followed by processing and analyzing the obtained data require cooperation with research institutes.

Underdevelopment of infrastructure is not always conducive to the introduction of technology. Inadequate electrical energy requires the use of autonomous systems, lack of quality water sources require additional financial investments.

Increasing the volume of production requires the development and modernization of storage and processing of fruit and vegetable production, protection of domestic market and evaluation of the impact on importers market.

Logical problem analysis for the economic/financial barriers of the spread of drip irrigation technology is shown on Fig. 1.5, Annex II.

Table 19 List of barriers by level of ranking for drip irrigation technology

Barriers	Level of ranking (1-5)	Classification of barriers (economic and financial, human capacity, awareness, institutional regulation, etc.)
Insufficient access to financial resources	5	Economic and financial
Insufficient financial incentives and interest	4	Economic and financial
Ineffective execution	4	Economic and financial
Insufficient legislative and regulation frameworks for advancement	4	Politics, legislation and regulation
Formalism (bureaucracy)	3	Politics, legislation and regulation
Limited institutional opportunities	4	Institutional and organizational opportunities
Lack of qualified personnel both for drip irrigation systems and for maintenance of agrotechnical measures	3	Professional skills
Formalism (bureaucracy)	3	Politics, legislation and regulation
Limited institutional opportunities	4	Institutional and organizational opportunities
Consumers' preferences and social prejudices	4	Social, cultural and behavioral
Insufficient information about the technology	4	Social, cultural and behavioral

2.2.3 Measures identified for introduction of the drip irrigation technology

Adaptation measure of the use of drip irrigation by the rural population was considered as a consumer product, for which a logical problem analysis (LPA) was made to determine the measures to overcome the barriers. For the sector specific information on policy issues were considered, as well as other useful information for discussion with stakeholders.

National consultants used a common approach with the involvement of stakeholders. The measures were defined on the basis of grouped barriers and a logical problem analysis was used to get the result from the problem to the solution.

The Working Group identified the measures that have been considered in the context of the barriers. The tree of problems and the tree of tasks for drip irrigation technology are presented in Annex II to this report.

The measures were assessed in accordance with their economic profile, incentives and achieved effects. The results are shown in the tables below.

Table 20 List of barriers and measures to transfer the drip irrigation technology

Determined barriers	Measures determined for overcoming the barriers
Economic and financial	Elaboration of incentive mechanism for attracting private resources in the sphere of sustainable development technologies Stimulation of the investment attractiveness for commercial banking means in the rural area to solve water problems Attraction of international means (UNDP, USAID, etc.) to implement demonstration projects in small farms Analysis of state measures on investment activity to ensure investment attractiveness in adaptation measures to climate change
Politics, legislation and regulation	Updating of the existing legal framework for its strengthening and elaboration of rules for adaptation to climate change

Market underdevelopment	Creation of favorable climate for long-term investments in economic and social development
Lack of the network	Institutional frameworks, elaborated and introduced in the industry to ensure support of the introduction of drip irrigation by small farms Elaborate cooperation mechanism, which will allow eliminate barriers among stakeholders to use the technology and create the feedback mechanism
Information and awareness	Increase of efficiency of the training process in colleges and universities in the sphere of technologies favorable to climate change, expansion of trainings for farmers Strengthen measures on informing the rural population to solve the tasks of water resources saving, projects implementation, publishing recommendations, brochures, etc. Reseaches on adaptation, improvement and evaluation of efficiency of drip irrigation technologies for Kazakhstan for different cultures, soils and climatic conditions to ensure farms Involvement of research structures, NGOs, mass media and other stakeholders to solve the tasks of introducing drip irrigation
Social, cultural and behavioral	To extend the traditions of drip irrigation in the rural municipalities, attention of experts, consultants and NGOs, and others should be focused on the solution of this problem. Develop and implement appropriate and effective mechanisms to monitor the social effectiveness of developed and implemented measures

Table 21 List of measures, their economic profile, incentives and effect of proposed measures for the drip irrigation technology

Measures	**Economic profile**	**Incentive**	**Effect**	
			Government expenses	**Company expenses**
Search of financial resources to ensure the use of drip irrigation technology	High initial investment	Increase funds, attract international organizations for financing of small-scale farming projects	Positive impact on local and national budgets	Contribution to the development of enterprises; Creation of new jobs.
Development of financial incentives to solve the problem of providing the rural population with irrigation water of appropriate quality	Minimum investments or termination of investment	Free tariffs for water supply	Favorable impact on the republican and national economic climate	Favorable impact on the enterprise and business development
Strengthening of legislative and regulatory framework for local water suppliers in order to strengthen the regulatory framework in relation to the construction of local water supply systems	Minimum investment or termination of investment	The Ministry of Agriculture and Energy put efforts to monitoring and implementation of climate-friendly technologies	Positive impact on public health and quality of life	Positive impact in the provision of farms with water
Development of national and local institutional capacities to ensure the implementation of farmers with climate-friendly technologies in the water sector	Moderate initial investment	Public support of reasonable policy decisions.	Positive impact on the development of farms	Positive impact on the economy of farms
Ensuring better learning for climate-friendly technologies in universities, colleges and training to ensure solution to water problems	Moderate rate of initial investment	Expanding research in the field of water resources and irrigation methods. Improvement of curricula and training programs	Positive impact on improvement of water resources management	Positive impact on the enterprise and business development
Development of research on the introduction of technological methods, models of using systems to ensure water resources, climate-friendly technologies in rural areas	Moderate investments	Include the problems with irrigation in the national priorities. Develop a program of grants for researches in the field of protection of water resources,	Positive effect to public health and quality of life	Positive effects on ensuring water resources to agriculture

		adaptation of crops, etc.		
Strengthening the legislative and financial incentive for the involvement of decision-makers	Minimum investments	Establishment of private foundations and involvement of international organizations to financing of small farms.	Positive effect on the regional and republican budget	Positive effect on enterprise and business development
Increased public awareness and strengthening confidence in the new technologies for development of traditions, habits	Moderate financing	Develop public awareness to strengthen confidence in the new technologies for development of traditions, habits and preferences	Positive impact on health and quality of life	Positive impact on the supply of quality water to the rural population

Table 22 Final list of measures to overcome barriers on the way to transfer of the drip irrigation technology

№	**Measures**
1	Elaboration of incentive mechanism to attract private resources in the field of technologies of sustainable development
2	Stimulating investment attractiveness of commercial banking assets in the settlements, rural water supply problems.
3	Review of the state policy in the field of investment, including the activities of banks in order to create attractiveness of financing adaptation measures to climate change and prevention of extreme phenomena
4	Development of the institutional framework to support small farms in the transition to drip irrigation
5	Elaboration of a mechanism that will allow effectively remove the obstacles between the structures, which develop and implement new water supply technologies
6	Research on the assessment of groundwater resources from sources both in terms of scope and quality for the subsequent argumentation of villages with drinking water supply policy.
7	Improvement of the regulatory framework with a view to strengthening and development of new rules in this area.
8	Improving the awareness activities of the rural population to address the challenges of expansion of introduction of water saving technologies among farmers.
9	Involvement of NGOs, media and other organizations in rural area to address the tasks of introduction of water saving technologies.
10	Improving efficiency of the training process in universities, colleges, trainings in the field of water-saving technologies

2.3 Analysis of barriers and possible measures for introduction of prevention technology of extreme phenomena

2.3. 1 Description of technology of extreme events prevention

In recent decades, the risk of disasters has increased and it is expected that more extreme weather conditions will increase the number and scale of disasters in the future. Impact of weather and climate extreme events are the increase in socio-economic risks and the projections show that extreme weather conditions are more likely than before and ultimately affect negatively the economies of Central Asian countries. Main sectors of the countries of this region economies are under the direct influence of meteorological, hydrological and climate-related hazards, such as heat waves, forest fires, droughts, floods, etc. According to the AR-5of the Intergovernmental Panel on Climate Change (IPCC), the frequency and impact of natural hazards increase due to variability and climate change.

Dangerous hydrological phenomenon is a phenomenon which by its intensity, extent and duration can cause negative consequences for the life of the people, economy and environment.

In Kazakhstan, natural hydrological phenomena (NHP) include:

- high spring floods on the lowland rivers,
- rain and thawed rainfall floods in the mountain rivers,
- mud flows,
- floods caused by mash-ice dams phenomena.

During 1969-2012, 340 NHP were reported in Kazakhstan [52]. From among all types of NHP, the largest number falls on the floods in the mountain rivers (41%), floods in lowland rivers (33%), blocking on the rivers and associated overflowing and flooding (9%), mudflows (9%) and extreme water scarcity (7%) (Table. 2.10).

Table 23 Types of natural hydrological phenomena and quantity of each species in% of the total number

NHP types	**In % of the total NHP number 1969-2012**
Flooding on the mountain rivers	41
Flooding on the lowland rivers	33
Blocking	9
Mudflows	9
Shortage of water	8

Source: Third-Sixth National Communication of the Republic of Kazakhstan

When considering the change in the number of NHP in 1991-2012 relative to the preceding period 1969-1990 it is seen that the number of flood in mountain rivers, mash phenomena, floods and water shortages increased. The number of floods in the lowland rivers declined (table 2.12).

Table 24 Number of different types of NHP in 1969-1990 and 1991-2012

Types of NHP\periods	**1969-1990**	**1991-2012**
Flooding on the mountain rivers	51	88
Flooding on the lowland rivers	65	49
Blocking	11	21
Mudflows	11	18
Shortage of water	7	19
TOTAL		340

Source: Third-Sixth National Communication of the Republic of Kazakhstan

The objectives of organizations involved in forecasting and warning about NHP are to improve efficiency of the early warning system of the threat of natural hydro-meteorological phenomena and prompt response to the received warning. Early warning allows to take actions to avoid the risk or reduce the risk and prepare for effective response. Existing methods and tools for disaster risk reduction, and in particular climate risk management, provide opportunities to significantly reduce of risks and adaptation to climate change

The key problem lies in the fact that the country must have data in real or near-real time about the phenomena taking place both on its territory and beyond. The presence of this data and access to them in real or near-real-time is the main factor in the effectiveness of early warning systems and measures in response to natural disasters.

Kazakhstan has its own hydro-meteorological service, which provides a systematic monitoring and forecasting of flood, high water, snow melt floods, landslides, avalanches and warnings about them. Republican State Enterprise "Kazhydromet" provides operational support of state bodies, branches of the economy of the Republic of Kazakhstan and population with information about the weather, the actual and expected changes in hydro-meteorological conditions and the reasons for these changes. Providing weather forecasts is performed with a lead time from day to month, the forecasts about the hydrological regime of surface water flows, forecasts of possible avalanches and occurrence of mudflow and storm warnings about the expected hazardous and extreme hydro-meteorological phenomena.

Provision of the republic territory with hydro-meteorological monitoring in 2015 made - meteorological 77%, hydrological – 60%. In accordance with the standards of the World Meteorological Organization, the minimum necessary monitoring network should consist of 421 meteorological stations (in fact – 297 stations), 500 hydrological stations (in fact – 298 stations), 280 agro-meteorological observation points (in fact – 202 stations).

The main problems related to the prevention of NHP are:

1. Insufficient provision of the republic with meteorological monitoring (actual provision of 71%), hydrological monitoring (actual provision of 59%), agro-meteorological monitoring (actual provision of 72%).

2. Lack of modern numerical forecasting models and tools for the data model calculation. To use accurate data in the operational mode, annual purchase of expensive licenses is necessary. Use of approximate methods of integration gives inaccurate forecasts.

The scope of the risk of such a scheme is underdeveloped infrastructure in the field of information, communication and space technology, as well as the inability to process the information due to the lack of analytical tools. The current warning system requires modernization.

One of the priority technologies in the water sector is the use of satellite imagery for forecasting of hydrological phenomena and natural hydrological phenomena of high water, snow melt flood (flooding) with the use of modern models of forecasting of hydrological phenomena. In order to prevent the phenomenon, constant monitoring of the weather conditions is required, which will help identify and assess hazardous hydrological phenomena, and on the basis of the forecast will enable decision makers to reveal the magnitude of the phenomenon and what segments of the population may be at risk.

To ensure the monitoring and forecasting of the phenomena, flood warning system will include hydro-meteorological, meteorological and tidal detection systems and river and coastal flood forecasting models. Once the event exceeds the predetermined threshold, a warning will be given. This signal is likely to be spread among the "risk group" population through a number of channels. The media, such services as police and fire and the basic signals such as sirens and flags play an important role.

2.3.2 Identified barriers for technology of extreme events prevention

In accordance with the characteristics of the market, the warning technology about extreme hydrological phenomena were classified as a consumer product that has potential customers, such as state bodies, private enterprises, farms and others.

Identification of barriers is made in analogy with the previous technologies. The results are also presented in the tables.

The basis of the barriers analysis is the logical problem analysis with cause-and-effect relation of the technology transfer, a hierarchy of causes and effects was developed. Tree of the logical problem analysis, the main line between causes and effects, reflects logical connections aimed at the main issues and emphasizes the relationship with external factors. Tree of the logical problem analysis shows initial problems and effects. Figure is placed in Annex II.

Implementation of measures to improve the early warning system for extreme hydrological phenomena is carried out within the following regulatory acts:

- Environmental Code of the Republic of Kazakhstan of January 9, 2007, article 145-2);
- The law "On civil protection" of April 11, 2014 No. 188-V 3RK;
- Charter of the Republican state enterprise on the right of economic management "Kazhydromet" of the Ministry of Energy of the Republic of Kazakhstan, 2014.

The greatest impact on the implementation of the technology may the Law of civil protection concerning public safety.

Annex V presents a summary of this regulatory act.

2.3.2.1 Economic and financial barriers

Preventive measures, such as development and support of early warning systems, are considered as an investment. For all types of hazard phenomena, early warning systems, ensuring operational efficiency, profitability and sustainability of these systems over time, are costly and resource-intensiveПревентивные.

Kazhydromet is being funded from the republican budget, but at the moment it can not cover all the requirements necessary to ensure the prevention of extreme hydrological phenomena. It is necessary to attract additional financial resources from external sources, possibly from the private sector, although the private sector is underdeveloped especially in rural areas, international sources. Financial resources should be involved not only in the form of a loan, but also investments, contributions of beneficiaries and holders and other stakeholders. Here private interests with the interests of local authorities should be united.

Shortage of qualified personnel in this field can be addressed through training of existing employees in training, additions to college training programs and high schools with developed curricula.

2.3.2.2 Non-financial barriers

Technology and database need to be developed. Collaboration among research centers is necessary. Elaboration of display data in real-time, flow forecast is required.

Gaps in the network operation

Most efforts in disaster risk reduction focus on measures of response and recovery from emergencies. However, at the international level the need to move to the dangers prevention is considered and such experiences is demonstrated by the economic benefits of early warning systems. Such a system provides a timely accurate information to the authorities, all interested parties involved in addressing disaster risks, and populations at risk, and should be based on:

1) cooperation, coordination and information shared at the international and local levels based on characteristics of hazards and their potential impact;

2) possibilities for:

a) observing, monitoring and development of forecasting and warning of hazardsнаблюдения, мониторинга и развития прогнозирования и предупреждений опасных явлений;

b) Assessing the potential risks and integration of risk information in warning;

c) fast and reliable dissemination of authoritative and understandable warnings to authorities, entities involved in addressing disaster risks, and to population;

d) preparedness and response to warnings at all relevant levels to reduce the potential impact of disaster;

e) educate the public and other stakeholders involved to increase understanding of the potential hazards and the creation of opportunities for effective prevention and response measure.

At the same time Kazakhstan has an insufficient number of observation points of hydrometeorological network, which leads to a decrease in the volume and reliability of hydro-meteorological information about the current and prognostic state of the environment and affect the quality of notifications and extreme weather phenomena warnings There is some inconsistency in the assessment of extreme events from operational reports. In assessing the economic losses, there are problems with record keeping due to lack of precision of the estimates of damages due to inconsistency on the types of events in the absence of a unified methodology and instructions There is a lack of communication between the stakeholders and enterprise specializing in the provision of early warning of extreme hydro-meteorological phenomena that provides and supports the warning system and its operation. There is a lack of traditions and experience. These barriers can be eliminated with the participation of stakeholders in the decision-making process.

Institutional and organizational opportunities

There is no experience with the high-resolution data, models and a new generation equipment. These barriers can be eliminated by creating and strengthening institutional capacity in forecasting offices. To remove the barrier, it is necessary to strengthen the structures, which would provide operational hydro-meteorological services.

Human potential

The warning system of extreme events is not very familiar to the general public, except for the dissemination of extreme hydro-meteorological phenomena. Even among the interested parties, not everyone knows this system in detail.

There is a need to:

• conduct staff training and capacity building for decision-making persons, experts to forecast events and the use of software to take

A shortage of qualified personnel can be corrected by training of employees in the middle system of vocational education and higher education is observed. Provision of experts in the field should be made by the higher school, retraining and advanced training of specialized organization or investors.

Social, cultural and behavioral

Psychological features of the person are connected with a delay of response to unusual events, as used to trust the past, usual experience and reject unusual, considering it as an incredible one. Lack of reliable information about the situation is a breeding ground for the emergence and spread of rumors; estimates claim to authenticity

Information and awareness

Removing the barrier requires awareness campaigns carried out by the authorities, the media and NGOs. To remove the barrier, it is necessary to intensify the campaign to highlight the activities of the hydro-meteorological service, types of forecasting and warning opportunities of the phenomena, the benefits of using early forecast, government, business and the media.

Table 25 List of barriers by level of ranking for warning technology of extreme phenomena

Determined barriers	**Level**	**Classification of barriers**
Inadequate access to financial resources	5	Economic and financial
Inadequate access to to technical resources	5	Economic and financial
Lack of solutions for the improvement of natural disasters warning system	5	Policy, legislation and regulation
The insufficient number of observation points of hydrometeorological network The system imperfection of loss and damage	5	Network gaps
Limited institutional capacity	4	Institutional and organizational capacity
The lack of qualified personnel to ensure the prevention of natural disasters, deciphering images and techniques	4	Human potential
Traditions and customs	3	Social, cultural and behavioral
Lack of awareness	4	Information and public awareness
Inadequate access to financial and technical resources	5	Economic and financial
Imperfect legislative and regulatory framework for the evaluation of a system of early warning of natural hydro-meteorological events	4	Policy, legislation and regulation
Limited institutional capacity	4	Institutional and organizational capacity
The lack of qualified personnel to ensure the prevention of natural disasters, deciphering images and techniques	4	Human potential

Consumer preferences and social biases	4	Social, cultural and behavioral
Lack of awareness	3	Information and public awareness

Table 26 List of key barriers for technology warning of extreme phenomena

Determined barriers	Qualification of barriers
Inadequate access to financial and technical resources	Economic and financial
Inappropriate financial to technical resources t	Economic and financial
Lack of solutions for the improvement of natural disasters warning system	Policy, legislation and regulation
Lack of involvement of stakeholders in the decision-making process	Network gaps
Lack of qualified personnel to ensure the prevention of natural disasters, deciphering images and techniques	Human potential
Consumer preferences and social biases	Social, cultural and behavioral

2.3.2.3 Measures identified for introduction of technology of hydrological phenomena

Adaptation measures to prevent technology hydrological events has been viewed as a consumer product and the working group carried out a logical analysis of the problem to determine the measures to overcome barriers. Experts used specific information concerning the sector, policy documents, as well as other useful information for discussion during the meetings with stakeholders.

The working group discussed measures, in the context of relevant barriers grouping with the same criteria. Problems have been reformulated into positive statements of future situations, actions and results ranked in the Tree of tasks logically organized presentation purposes. The Tree of tasks of this technology are presented in Annex II.

The measures were assessed in accordance with their economic profile, and use incentives to achieve the effect. The results are shown in the tables in this section.

Table 27 List of barriers and measures to transfer of technology of hydrological phenomena

Determined barriers	**Measures identified to overcome determined barriers**
Inadequate access to financial resources	Development of an incentive mechanism to attract private resources to the prevention of natural hydrological phenomena Involvement of international donors in the implementation of measures for prevention of natural hydrological phenomena Stimulation of investment attractiveness of commercial banking resources in this area
Lack of financial incentives	Public policy analysis of investing activities, including the activities of banks, for the attractiveness of investments in adaptation measures to prevent extreme weather events
Lack of arguments regarding the decision to improve early warning systems on extreme weather phenomena	Carrying out a national study to assess the effectiveness and benefits of early warning of natural hydro-meteorological phenomena, assessment of risk, loss and damage.
Lack of legal and regulatory frameworks and enforcement	Improving the existing legislative framework to strengthen and develop early warning systems extreme hydro-meteorological phenomena
Lack of stakeholder involvement in decision-making in the field of improvement of early warning systems for extreme hydro-meteorological phenomena	Developing and implementing measures to increase the participation of stakeholders, decision-makers in advancing the process of improvement and modernization of early warning systems extreme hydro-meteorological phenomena
Limited institutional capacity	Developing the institutional framework to ensure that the system of early warning of natural hydro-meteorological phenomena
Weak relationship between the parties, preferring the new technology	Develop a mechanism that will allow eliminate the barriers between agencies that develop and implement new technologies
Lack of qualified personnel to work with new technology	Strengthening of the learning process at universities, colleges, international courses for this area
Insufficient information	Strengthen public, population awareness measures in the early warning issues and measures for their elimination

	Involvement of the media and other organizations in coverage of problems and their solution for this area
Traditions and customs	Establish, develop and disseminate knowledge and efficiency of technology, promoting the development of new traditions and customs in organizations, society, focusing on the work of consultants, NGOs, etc.
Lack or inadequate feedback mechanism	Develop or improve or increase the effectiveness of the feedback mechanism of the measures, on the implemented measures for early warning about natural hydro-meteorological phenomena
Monitoring of effectiveness of the taken measures	Develop and implement an appropriate mechanism for monitoring the effectiveness of early warning of natural hydro-meteorological phenomena

Table 28 List of measures and incentives

Financial measures	**Non-financial measures**	**Additional measures**	**Incentives**
Search of financial resources to improve the system of early warning of natural hydro-meteorological phenomena	Strengthen the legislative and regulatory framework for the strengthening and development of early warning systems on extreme weather phenomena	Strengthen the legal and financial incentives for involvement of stakeholders in the decision-making process and support of this system.	Strengthen popularization of this system with the aim of confidence in the new technology and develop new traditions, habits and preferences of consumer and social biases
Develop appropriate financial incentives to solve the problems of the development of early warning system	Develop institutional framework to ensure the system of early warning of natural hydro-meteorological phenomena		The current system will allow to take appropriate action and prevent or reduce
	Strengthening of the learning process at universities, colleges, international courses for this area		Qualitative forecasts and warnings will reduce economic losses
	Provide researches in assessing the impact and effectiveness of early warning of natural hydro-meteorological phenomena		Investigations will allow to make quality warning and prevent economic losses

Table 29 List of measures, their economic profile, incentives and effect of the proposed measures to prevention technology of hydrological phenomena

Measures	**Economic profile**	**Incentive**	**Effect**	
			Government expenses	**Company expenses**
Search of financial resources to improve the system of early warning of natural hydro-meteorological phenomena	High level of investment	Improvement of hydro-meteorological system: expanding the list of paid services, advertising of the business products, cooperation with mobile centers on paid services to the population, etc.	Favorable effect on local and national budgets	Contribution to the development of business Creation of new jobs
Development of appropriate financial incentives to address	Minimum funding or lack of funding	Mandatory use of the forecast or warning for insurance claims	Favorable effect on the local and national budgets	Favorable effect on the development of enterprises and

the issue of early warning system				businesses
Strengthen the legislative and regulatory framework for the development of the early warning system of extreme hydro-meteorological phenomena	Minimum funding or lack of funding	Ministry of Economy, Energy (Kazhydromet), Internal Affairs (Committee for Emergency Situations) will make efforts to improve and strengthen regulation to modernize the early warning emergency system. Regulatory framework should apply to both national as regional levels	Favorable effect on the economy and public health of the population	Favorable effect on the development of enterprises and businesses and public health
Develop institutional framework for ensuring early warning system of natural hydro-meteorological phenomena	**Small investments**	Public support of taken decisions	Favorable effect on the economy	Favorable effect on the enterprises and businesses
Strengthening of the learning process at universities, colleges, for this area	Average investment	Inclusion of the study of early warning system in the curricula of colleges and higher school	Favorable effect on the economy	Favorable effect on the enterprises and businesses
Provide research to assess the impact and effectiveness of early warning of natural hydro-meteorological phenomena	Average investment	Set priority for researches to assess the impact and effectiveness of prevention of natural hydro-meteorological phenomena. Develop a program of grants for scientific works in this area	Favorable effect on the economy	Favorable effect on the enterprises and businesses
Strengthen the legal and financial incentives for the participation of stakeholders in decision-making	No need for funding	Expanding the list of paid services, advertising of the business products, cooperation with mobile centers on paid services to the population, etc.	Favorable effect on the economy	Favorable effect on the enterprises and businesses
Increase awareness and knowledge of the new early warning technology to enhance credibility of warnings and timely actions, developing the traditions, habits, consumer preferences and social biases.	Average investment	Increase awareness and knowledge of the new early warning technology to enhance credibility of warnings and timely actions, developing the traditions, habits, consumer preferences and social biases.	Favorable effect on the economy	Favorable effect on the enterprises and businesses

Table 30 Final list of measures to overcome barriers to technology transfer of warning of extreme hydrological phenomena

№	Measures
1	Development of a mechanism to stimulate attraction of private and international resources for climate-friendly technologies
2	Promotion of attractive investments of commercial banks in socially and economically important technologies that prevent destruction and loss of human life associated with extreme hydro-meteorological phenomena

3	Review of the state policy on investment activities, including the activities of banks, for the attractiveness of investing in adaptation to climate change, extreme climate change phenomena
4	Development of an institutional framework to support early warning system of extreme hydro-meteorological phenomena
5	Development and implementation of measures to improve decision makers for the benefit of the design and construction of centralized water supply systems.
6	Develop a mechanism that will allow effectively eliminate the barriers between agencies that ensuring activity of the early warning system of extreme hydro-meteorological phenomena
7	National studies to assess the effectiveness and benefits of stocks of early warning of extreme hydro-meteorological phenomena.
8	Improvement of the existing legal framework with a view to its development in this area
9	Intensify measures to inform the population, involve NGOs, the media and other organizations to address the problem of improving the quality of early warning system of extreme hydro-meteorological phenomena.
10	Improve the effectiveness of the learning process in colleges and universities to ensure this area

2.3.3. Determination of barriers relationship

This sector includes a number of organizations and institutions aimed at preventing economic damage and human losses. However, it does not provide high-performance and coordination to respond to the risks of extreme hydro-meteorological phenomena. By applying the logical analysis, barriers that reduce the transfer of technology were identified.

The lack of legal support for the provision of financial resources for health centers in order to ensure benefits for the affected environment. Thus, health is a central financial supporter to purchase water for the affected subject, its air conditioning in temporary medical care and rehabilitation units during the heatwave.

General barriers are:

- Lack of financial resources
- Inadequate legal framework
- Limited institutional capacity
- Lack of confidence in the new climate technologies
- Lack of research

2.4 Favorable conditions for overcoming barriers in the water sector

The water sector plays an important role in the process of adaptation to climate change. Current existing rules do not fully cover the issues of introduction of climate-friendly technologies, therefore, special measures are needed to eliminate barriers to adaptation technologies.

The basic possible measures necessary to address the identified economic/financial and non-financial barriers of priority technologies in the water sector are listed below:

Table 31 Barriers and measures for the water sector

Barriers	**Measures**
Drip irrigation technology	
Limited access to financial resources for the acquisition of equipment Limited market for equipment acquisition	Credit policy should be conducted in the interests of technology adoption; Issuance of government subsidies should be focused on the implementation of the technology; Access of small farmers to financial resources should be increased; The state should assist in regulating or subsidizing technologies
Technology of extreme events prevention	
High investment costs; Lack of budget	Increased government support for monitoring in real time and conduct research; Use of different funds
No special support mechanism for the promotion of	Developing a support mechanism to promote technology

echnology	
Lack of research works, including model of short-erm forecasting runoff and weather forecasting	Promote the exchange of data and research results; Increasing budget for the techniques and support the development and adaptation of methods, research.
Lack of specialists to support the automated analysis of programs and processes, interpretation of data storage and data update	Increasing staff capacities in the field of mathematical research and development programs; Increasing cooperation with international agencies / private sector research. Development of public sector staff in the field of mathematical programming and GIS Research.
Low level of awareness about the economic and environmental benefits; Ignorance of new technology	Information campaigns on the current economic and environmental benefits of technology; Establishment of institutional opportunities for awareness; Implementation of a campaign of pilot projects

State support and subsidies for each of the priority technologies is considered to be an effective instrument for promoting the introduction of technologies. In the subsector of agricultural irrigation, farmers often cannot afford the introduction of modern technologies, since it requires significant funds. With a clear financial mechanism it is possible to increase the level of adoption of new technologies.

Also, for the implementation and effective operation of the new technologies the barrier of lack of qualified personnel needs to overcome. Therefore extensive work on capacity building needs to be conducted, i.e. work to improve the knowledge and conducting trainings.

Information campaign on the benefits of the introduction of a particular technology is an effective tool for raising public awareness of the economic and environmental benefits of that technology. Information is disseminated through the media, publications, organization of workshops and seminars.

REFERENCES

1. Technology Needs Assessment for Climate Change, UNDP,2010;
2. Technology for Climate Change Adaptation (Water Sector), UNEP RISO Centre, 2011;
3. Technology for Climate Change Adaptation (Agruculture), UNEP RISO Centre, 2011;
4. Multi-criteria analysis: a manual, DecideWise, 2009;
5. Statistics Agency of Kazakhstan - www.stat.kz;
6. Kazakhstan's Second National Communication to the Conference of the Parties of the United Nations Framework Convention on Climate Change. Astana. Agroizdat LLC, 2009;
7. Arinov K.K., Shestakova N.A. Crop production of North Kazakhstan. Manual. Astana, 2009;
8. Konyukhov N. A. The organization and sanitariness of maintenance of sheep in the pastures. - Alma-Ata: Kynar, 1972;
9. Handbook for breeders / Ed. K.U.Medeubekova - Alma-Ata: Kynar, 1990. p. 242;
10. Chekeres A. Weather, climate and transhumance - L.: Gidrometizdat. 1973;
11. Torehanov A.A., Alimayev I.I. The potential of the animals in the pastures and the effective use of forage resources in different areas of the Republic of Kazakhstan (past and present), Ministry of Agriculture. Almaty, 2004. p. 97;
12. Baysholanov S.S., Kozhakhmetov P.Zh. Modern zoo-climatic conditions of the sheep breeding in the southern part of Kazakhstan / / Bulletin of KNU, Geographical Series. No. 2 (25). Almaty, Kazakh National University, 2007;
13. Kaskarbaev Zh.A. Crop diversification - the basis of crop rotation in the arid steppes of northern Kazakhstan / / International conference on "No-Till and crop rotation - the basis of agricultural support policies on conservation agriculture for intensification of sustainable production." Astana-Shortandy, SPC on Grain farming named after A.I.Baraev, 8-10 July 2009, p. 68-77;
14. Suleimenov M.K. The transition from conservation to resource-saving cropping system of North Kazakhstan. / / International conference on "No-Till and crop rotation - the basis of agricultural support policies on conservation agriculture for intensification of sustainable production." Astana-Shortandy, SPC on Grain farming named after A.I.Baraev, 8-10 July 2009, p. 48-55;
15. Kaskarbaev Zh.A. No-till technology in the arid steppes of Kazakhstan // International conference on "No-Till and crop rotation - the basis of agricultural support policies on conservation agriculture for intensification of sustainable production." Astana-Shortandy, SPC on Grain farming named after A.I.Baraev, 8-10 July 2009, p. 91-95;
16. Kaskarbaev Zh.A. Minimum and zero technology - as one of the main trends in resource-saving agriculture. // International conference on "No-Till and crop rotation - the basis of agricultural support policies on conservation agriculture for intensification of sustainable production." Astana-Shortandy, SPC on Grain farming named after A.I.Baraev, 8-10 July 2009, p. 56-68;
17. Friedrich T., Kassam A., Taher F. Adoption of conservation agriculture and the role of policy and institutional support. // International conference on "No-Till and crop rotation - the basis of agricultural support policies on conservation agriculture for intensification of sustainable production." Astana-Shortandy, SPC on Grain farming named after A.I.Baraev, 8-10 July 2009, p. 11-14;
18. Akshalov K. No-till farming in North Kazakhstan: environmental aspects. // International conference on "No-Till and crop rotation - the basis of agricultural support policies on conservation agriculture for intensification of sustainable production." Astana-Shortandy, SPC on Grain farming named after A.I.Baraev, 8-10 July 2009; p. 115-120;
19. Yushchenko N.S., Yushchenko D.N. No-till technology - solving the main problems in grain production in Central Kazakhstan. // International conference on "No-Till and crop rotation - the basis of agricultural support policies on conservation agriculture for intensification of sustainable production." Astana-Shortandy, SPC on Grain farming named after A.I.Baraev, 8-10 July 2009, p. 104-109;
20. Sagymbaev M. and others. Conservation and resource-saving technologies of grain farming: the experience of testing of elements No-till farming at the farm level // International conference on "No-Till and crop rotation - the basis of agricultural support policies on conservation agriculture for intensification of sustainable production." Astana-Shortandy, SPC on Grain farming named after A.I.Baraev, 8-10 July 2009, p. 127-132;

21. Narushev V.B. Current problems in agronomy. Manual. - Saratov: Saratov State Agrarian University, 2011. p.56;
22. Strategic Development Plan of the Republic of Kazakhstan till 2020;
23. The Program on Argo-Industrial Complex Development in the Republic of Kazakhstan for 2013 – 2020 "Agro business – 2020";
24. "Sybaga" Program on crediting peasant and farm households for purchase of cattle stud stock;
25. "Zhailyau" Program for 2013-2023, which provides for development of family farms;
26. Abdimanapov A.A. Analytical work "The economic potential of rural areas of Kazakhstan." - Almaty: TsEKiA, 2005. p.12;
27. Isabekov K.I. and others. Methodological guideline for beef cattle farming. Astana, 2011. p.24;
28. Serekpaev N.A. and Stybaev G.Zh. Ways of development of fodder production in the food sector of the capital of the Republic of Kazakhstan / / AgroDom, #19 (32), October 1, 2011. p. 6-7;
29. Sheep breeding. The technology of breeding. Website of the Voronezh State Agricultural University. http://www.flok.vsau.ru/keep/tec.php;
30. Abdildenov K. What kind of sheep should the grazed in Kazakhstan / / Monthly Bulletin of Newspaper Agro Zharshy, September 10, 2011;
31. UNDP Report "Fundamentals of the National Concept of Kazakhstan on adaptation to climate change". Astana, 2010;
32. IPCC 2007: Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. [Core Writing Team, Pachauri, R.K. and Reisinger, A.], IPCC, Geneva, Switzerland;
33. Statistical bulletin "Environmental protection and sustainable development of Kazakhstan" / under. ed. A. Smailova. - Astana: Agency on Statistics of RK, 2009;
34. National report on the state of the environment in the Republic of Kazakhstan in 2009, "KazNIIEK" RSE, Almaty, 2010;
35. Guidance on water and adaptation to climate change. UNECE, New York and Geneva, 2009;
36. Core indicators of intake, use and disposal of water in the RK for 2009 (In terms of water use areas) / Report of CWR of the Ministry of Agriculture. Astana, 2009;
37. Regarding the work of water supply facilities in the Republic of Kazakhstan for 2009 / Agency on Statistics, Series 2. Industry, Almaty, 2009;
38. The population of RK by regions, cities and regions / Agency on Statistics of the Republic of Kazakhstan. - Statistical Bulletin. - Astana. – 2009;
39. The "Agrarian Sector" magazine;
40. Site kazakh-zerno.kz;
41. Analysis of the stock-breeding sector, the analytical service of RFCA Reyting Agency, Almaty, 2010;
42. The Site of "Kazagroproduct" JC www.kazagroonim.kz;
43. "AgroZharshy" magazine # 38 (216) dated 28.09.2012 г.;
44. Master-plan "production and export of wool and products of it", Kazagromarketing, Astana 2009;
45. The press-service of the Administration of the Mazhylis of the Parliament of RK, Draft Law "On Pastures";
46. The stock-breeding of Kazakhstan - support of the sector's rebirth, the Program on joint economic studies of the Government of the Republic of Kazakhstan and the World Bank;
47. "Water resources and prospects for their use in the irrigation of the Republic of Kazakhstan," R.A. Kwan, A.A. Kalashnikov, A.I. Paramonov, S.M. Kaldarova, "KazRIWM" LLP, "KazAgroInnovation" JSC;
48. Statistical digest "Agriculture, forestry and fisheries in the RK / under editorship of A. Smailov. - Astana: Agency on Statistics RK, 2014;
49. Statistical digest "Kazakhstan 2013" / under editorship of A. Smailov. - Astana: Agency on Statistics RK, 2014;
50. Aksagov T.M. – Saving tillage technologies as a way of reducing the production cost of wheat variety Omsk 18. Scientific article, "Kostanay Agricultural Research Institute" LLP, v. Zarechnoye 2011;

51. State program on water resources management of Kazakhstan for 2014-2040 years;
52. Third-sixth National Communication of the Republic of Kazakhstan to UNFCCC, Astana, 2013;
53. Report of DIW ECON «Policies and measures to ensure increased efficiency of water usage and water supply for growth in agriculture», 2014;
54. Analysis of the results of implementation of water-saving irrigation technologies in southern Kazakhstan, K.A. Anselm, SA "South Kazakhstan hydrogeological-reclamation expedition" of the Committee on Water Resources, Ministry of Agriculture of the Republic of Kazakhstan;
55. Progress in the development of conservation agriculture technologies / zero tillage and its effect on agricultural production in Kazakhstan, Information Note, FAO Investment Centre, December 6, 2012;

ANNEX I

Table-A 1 Long list of barriers to transfer of no-till and crop diversification technologies

Main market players	Identified barriers		
	A wide range of categories of barriers	**Barriers within categories**	**Detailed barrier description**
Farmers	Economic and financial	Inadequate access to financial resources	Distorted capital market; Lack of venture capital; Lack of access to credit;
		High cost of capital	Lack of cheap capital;
		Funding does not encourage efficient operation	The high cost of capital resources; High cost performance; High levels of discounts;
		Inadequate financial incentives and lack of incentives	Lack of incentives for the development of climate technologies; external factors are not taken into account; Taxes on climate technology;
		The uncertainty in the macroeconomic environment	Unstable inflation and large fluctuations in value; Unstable current and exchange rates; Condition of payment problems and the uncertainty of economic growth;
	Market failure, imperfection	Imperfect market infrastructure	Weakly expressed demand; The absence or underdevelopment of the supply chain (i.e. logistical problems); Distorted or opaque markets;
		Underdevelopment of competition	Insufficient number of competitors;
		Limited access to technology	Problems with importing technology or equipment;
		Imperfect increase revenue sources	Cost of rewards only on the high investment level; The small size of the market; Low ability or willingness to pay among consumers;
	Policy, legal and regulatory	Insufficient legal and regulatory framework	Absence of laws and bylaws on climate technologies; Inadequate or unwieldy regulations for climate technologies; Lack of coherent economic policies;
		Inefficient enforcement	Insufficient willingness or ability to enforce laws and regulations;
		Policy intermittency and uncertainty	Lack of long-term political commitment; Stability of laws (frequent amendments);
		Red tape (bureaucracy)	Corruption and bureaucracy contributes to the instability of agricultural sector

			development;
	Network failures	Week connectivity between actors favoring the new technology	Insufficient cooperation between sectors and research institutes; Lack of effective trade associations and consumer bodies (weak lobbying for the promotion of technology transfer);
		Lack of stakeholder involvement in decision-making	The culture of cooperation with concerned parties is missing; Difficulties of interaction; Fear of opposition (objections);
	Institutional and organizational capacity	Lack of professional institutions	The lack of institutions to promote and enhance market;
		Limited institutional capacity	Lack of interest or capacity in existing institutions; Limited R & D culture (lack of appreciation of R & D role in technology adaptation;
	Human skills	Lack of skilled personnel for the installation and operation of climate technologies;	Lack of entrepreneurs (with the corresponding yield, bulky or deterrent control, leading to a lack of competition or restrict supply); Lack of service and maintenance specialists;
	Social, cultural and behavioral	Consumer preferences and social biases.	High discount rates on consumers
		Traditions and habits	Resistance to change, due to cultural reasons
		Lack of confidence in new climate technologies	Unknown product, due to inadequate information, lack of local participation
	Information and awareness	Inadequate information; High risk perception of climate technologies; Language; Feedback mechanism lacking or inadequate; Lack of awareness about issues related to climate change and technological solutions	Poor dissemination of information to technology users; Poor infrastructure for communication of small-scale project support; Uncertain benefits; High investment risks; Perception of complexity
	Technical	Poor O & M facilities	Lack of skilled personnel; Slow after-sales services; Limited availability of spare parts; Need to import spare parts;
Research Institutions and Universities involved in researches	Economic and financial	Lack of inadequate access to financial resources	Lack of access to credit
		High cost of capital	Scarcity of cheap capital; Government policies on cost of capital;
		Financially not viable	High resource costs; High implementation costs; High discount rates;

			Use of payback time criterion limits consideration of overall economic lifetime benefits;
		Inappropriate financial incentives and disincentives	Insufficient financial incentives to develop climate technologies; Non-consideration of externalities; Taxes on climate technologies (import duties on equipment;
		Uncertain macroeconomic environment	Volatile inflation rate and high price fluctuations Unstable currency and exchange rates Balance of payment problems and uncertain economic growth
	Market failure imperfection	Poor market infrastructure	Poorly articulated demand; Missing or under developed supply channels (e.g. logistic problems); Disturbed or non- transparent markets;
		Underdeveloped competition	Insufficient number of competitors (property developers and rental market have no incentive to invest);
		Restricted access to technology	There is no local manufacturer of equipment; Problems with importing of technology and equipment because of the tax policy, etc.;
	Policy, legal and regulatory	Inefficient enforcement	Insufficient willingness or ability to enforce laws and regulations
		Policy intermittency and uncertainty	Lack of long-term political commitment o Stability of laws (frequent amendments); Lack of long-term political commitment; Stability of laws (frequent changes);
	Network failures	Weak connectivity between actors favoring the new technology	Stakeholders dispersed and poorly organized; Multiple stakeholder collaborative learning and knowledge transfer activities absent or weak; Insufficient coordination between relevant ministries and other stakeholders; Insufficient cooperation between industries and R and D institutions; Absence of trade associations and effective consumer bodies;
		Lack of involvement of stakeholders in decision making	Stakeholder consultation culture missing; Difficult communication; Fear of opposition;
	Institutional and organizational capacity	Lack of specialized institutions; Limited institutional capacity;	Lack of institutions for the promotion and strengthening of the market; Lack of interest or opportunities in existing institutions; Lack in scientific culture (lack of understanding of the research role in adaptive technology);
	Professional skills	Lack of qualified personnel for the introduction and implementation of climate technologies; Weak response of scientific community to the needs of agricultural research;	Lack of specialists for service and maintenance; Lack of motivation for researchers to produce innovative product ;

	Social, cultural and behavioral	Consumer preferences and social biases; Traditions and customs; Lack of confidence in climate technologies;	High levels of consumer discount; Resistance to change because of cultural traditions; Ignorance of the product due to the lack of information, a limited number of local participants;
	Technical	Inadequate possibilities for operation and maintenance	Lack of qualified staff; Low level of after sales service; Limited access to spare parts; The need to import of spare parts;

Table-A 2 Long list of barriers to transfer of transhumance system and grazing and stabling system on an industrial basis technologies

Main market players	Barriers			
	A wide range of categories of barriers	**Barriers within the category**	**Elements of the barriers**	**Detailed barrier description**
State bodies (Ministry of Agriculture, Energy, Economy)	Policy, legal and regulatory	Imperfection of laws	Uncertainty on the issue of pastures; Lack of relationship between the owner of the pasture and pasture user;	Authorized agency for regulation of pastures is not defined on the legal field; Inappropriate use of land, poor rangeland, degradation of rangelands around villages, concentration of more than 60% of sheep livestock in household, low yield of marketable products for small farms, poor social conditions of work in sheep breeding; Imperfect control mechanism;
	Economic and financial	Lack of financial ability to create a fund to encourage transition to the climate system	Lack of resources for creating fund to promote agricultural enterprises due low economic benefits in agriculture;	Low productivity, high production costs, low prices for agricultural products purchased from the manufacturers;
	Information and public awareness	Lack of qualified agrarians	Improving local educational programs based on international experience;	Lack of knowledge of the respective local state administration, local experts and public about the benefits of climate technologies and their benefits;
	Market failures	Undeveloped market	The imbalance between agricultural production and construction prices of structures, equipment, fuel, maintenance services; Lack of market prices for the environmental benefits of livestock production systems;	Low prices for agricultural products, purchased directly from the manufacturers and high prices for construction, equipment, transportation, fodder, services, etc.; Unclaimedness of product on the market (wool, leather, etc.); Low quality of services (veterinary, food, etc.);
	Network failures	Weak connections between actors	A large number of households began to approach the management of the level of subsistence farming and non-agricultural market;	The process of market development of agriculture is slower and therefore difficulties in connecting and promoting strong relationship between the companies in agriculture, procurement and traders of agricultural products and equipment;
	Institutional and organizational capacity	Lack of expertise in the organization and promotion of the agricultural market	Inadequate expertise in the organization and promotion of agricultural market;	Unsatisfactory training of specialists in this field;

	Technical	Inadequate institutional and organizational capacity of state authorities, professionals and companies in agriculture; Inadequate standards of the quality of agricultural products, technical requirements, as well as maintenance services, including veterinary and compliance of purebred herds; Lack of support for the implementation of these types of work.	Low characteristics of work in the field of agricultural product standardization, quality control of agricultural products;	At the national level, imperfect system of standardization and quality control for agricultural products;
Municipal	Policy, legal and regulatory	Imperfect legislation on participation (of akimats) in planning the use of pastures and responsibility for the quality of the pasture;	Regulations on the activities of akimats do not have the obligation to support the quality of pastures;	Non-participation of the state administration for the quality control of pastures and the cadastral office is not responsible for their quality;
	Social, cultural and behavioral	Lack of confidence in technology sustainability	Lack of knowledge for intensive approach; Lack of transparency;	Lack of transparency and the quality of work of regulation institutions and responsibility for the technology sustainability;
Farmers	Economic and financial	Imperfect pricing for agricultural products and machinery;	Lack of protection policies and domestic support of the producer;	Insufficient financial support for investment, maintenance of works on pure breed, feed purchase, etc. ;
	Information and public awareness	Low knowledge among the agricultural business	Insufficient access to information of training centers for the state of agricultural enterprises	Expand the forms of access to information by training centers (creation of web sites, free access to the workshops, lectures, widely use of forms of communication as webinars, etc.);; Creation of the republican training center for attracting international scientists, well-known companies with lectures on climate technologies, regional centers for staff training, development of recommendations for updating themes of the programs. Ignorance by the majority of agricultural enterprises of climate technologies, which implementation will ensure high productivity

				of agricultural production

Table-A 3 Long list of barriers to water metering technology for watering and irrigation and drip irrigation technology

Main market players	**Determined barriers**		
	Broad range of categories of barriers	**Barriers within the category**	**Detailed description of the barriers**
Local administration	Economic and financial	Lack of financial resources	Lack of funds in the budget
		Lack of access to financial resources	Lack of knowledge and motivation of companies and farmers about the introduction of financial support for water and drip irrigation;
	Policy, legislation and regulation	Ineffective legal and regulatory framework for application	Lack of preparedness or ability to enforce laws and regulations;
	Professional skills	Lack of qualified personnel	Lack of service and maintenance specialists;
	Information and awareness	Lack of awareness	Inadequate dissemination of information for technology users;
Farmers	Economic and financial	Lack of financial resources	Lack of funds in the regional budget;
	Policy, legislation and regulation	Ineffective legal and regulatory framework for application	Lack of preparedness or ability to enforce laws and regulations;
	Professional skills	Lack of qualified personnel to work with the climate technologies	Lack of service and maintenance specialists;
	Underdevelopment network	Poor infrastructure	Use of self-contained power systems; Availability of a water source and quality;
	Information and awareness	Lack of awareness	Lack of access to users on information technologies; Inadequate infrastructure for interaction of design support;
Research organizations	Research programs	Lack of accounting research of geomorphological and climatic characteristics of the region;	No studies on the identification of natural and industrial factors on plant growth, followed by processing and analyzing the data.

Table-A 4 Long list of barriers of technology of extreme events prevention

Main market players	Broad range of categories of barriers	Barriers within the category	Detailed description of the barriers
Government, Ministries, Local Administration	Economic and financial	Lack of access to financial resources	Lack of financing budget
		Lack of entrepreneurial skills to achieve results	Lack of hydro-meteorological experts that have ntrepreneurial knowledge about sources of funding
	Underdevelopment network	Lack of stakeholder involvement in decision-making	Lack of stakeholder consultations
	Institutional and organizational capacity	Limited institutional capacity	Lack of interest in the existing institutions
	Human potential	Lack of qualified staff	Lack of decryption service, maintenance and forecasting pecialists
	Information and awareness	Lack of awareness	Lack of awareness about the benefits of technology
Companies, farmers, population who are interested in developing and improving the warning system of extreme hydrological phenomena	Economic and financial	Lack of access to financial resources	Lack of access to credit
	Institutional and organizational capacity	Limited institutional capacity	Lack of interest or capacity in existing institutions
	Human potential	Lack of qualified staff	Lack of specialists in the interpretation of information
	Social, cultural and behavioral	Lack of confidence in the new technologies; Consumer preferences and social biases;	Ignorance of the product, lack of awareness
	Information and awareness	Lack of information	Inadequate dissemination of information to users of the echnology.

Table A-5 Identified barriers and measures to technology transfer in the Agriculture Sector

Sectors	**Agriculture Sector**			
Barriers	**Technologies**			**Measures**
	No-till	**Crop production diversification**	**Transhumant and pasture-stall sheep keeping**	
Policy, legal and regulatory	Imperfect legal and regulatory framework; Policy intermittency and uncertainty.	Imperfect legislative and regulatory framework	Imperfect legislative and regulatory framework	Improvement of the: legal framework, land quality monitoring, management and monitoring by the authorities for the quality of pastures;the development of pasture management plans for livestock and schemes of cattle overlanding Strengthen and support the process of unification of small farms
Economic/financial	Lack of full access to financial resources; the high cost of capital; inadequate financial rewards and incentives. .	Shortage of investment capital; lack of funding for the development of seed production; poor rural infrastructure, long distances;	Lack of investment capital, financial funds, grants; excessive fragmentation of land/small farm size; poor rural infrastructure, shortage of pasture, poor logistics, long-distances.	Creation of an agricultural bank with low interest rates, a fund for grants for climate friendly technologies. Reduction of tax when investing farmers doing environmental farm practices, customs duties for climate technologies. Development and implementation of a system of economic incentives for agricultural enterprises using climate friendly technologies
Market failure, imperfection	Unsatisfactory market structure; imperfect sources of increasing revenues; ..	Lack of market prices for the environmental benefits of improving the work on sustainable farming practices	Lack of market prices for the environmental benefits of improving the work on sustainable farming practices; poor rural infrastructure, shortage of pastures, poor logistics, long distances;excessive fragmentation of of land plots / Small farm size	Improving the market structure, logistics, services; ensure effective coordination between the main players in the chain of technology;: a farmer with seed farms, owners of the mineral and organic fertilizers, breeding farms and etc.
Network failures	Poor interaction between the constituents, preferring new technology	Lack of coordination among the various interest groups	Lack of coordination among the various interest groups	Organization and support for regional and national networks of groups interested in promoting climate-friendly technologies, creation of associations for the relationship between farmers and the political parties to lobby for

				sustainable agricultural production systems
Institional capacity	Limited **institional capacity**	Lack of knowledge of the relevant local government authorities and the local population about the need to have high-quality seeds and organic matter in the soil to support the quality and potential of agriculture	Lack of information; knowledge of the relevant local government authorities and the local population about the need to have quality pasture to support pastures potential	Strengthening the foundations of human potential of the agricultural sector; conducting seminars, trainings; promoting and updating of programs providing training on sustainable management of agriculture
Information and awareness	Inadequate awareness.	Inadequate awareness.	Lack of information; knowledge the relevant local government authorities and the local population about the need to have quality pasture to support grassland potential	Strengthening the media interest in the promotion of climate-friendly technologies with the participation of research organizations, experts, manufacturers of agricultural machinery, the positive influence of climate
Water sector				
Barriers	**Drip irrigation technology**	**Technology of extreme events prevention**	**Measures**	
Economic/financial	Limited access to financial resources for the acquisition of equipment; limited market for equipment acquisition	High investment costs; lack of budget, no special support mechanism for the promotion of technology	Credit policy should be conducted in the interests of technology adoption; issuance of government subsidies should be focused on the implementation of the technology; access of small farmers to financial resources should be increased; the state should assist in regulating or subsidizing technologies	
Resources	Lack of research works	Lack of research works, including model of short-term forecasting runoff and weather forecasting	Promote the exchange of data and research results; Increasing budget for the techniques and support the development and adaptation of methods, research;	
Institional capacity	Need to increase human resource capacity	Lack of specialists to support the automated analysis of programs and processes, interpretation of data storage and data update	• Increasing staff capacities in the field of mathematical research and development programs; • Increasing cooperation with international agencies / private sector research. • Development of public sector staff in the field of mathematical programming and GIS Research.	
Information and awareness	• Low level of awareness of the economic and environmental benefits • Ignorance of new technologies	• Low level of awareness about the economic and environmental benefits; • Ignorance of new technology	• Information campaigns on the current economic and environmental benefits of technology; • Establishment of institutional opportunities for awareness; • Implementation of a campaign of pilot projects	

ANNEX II

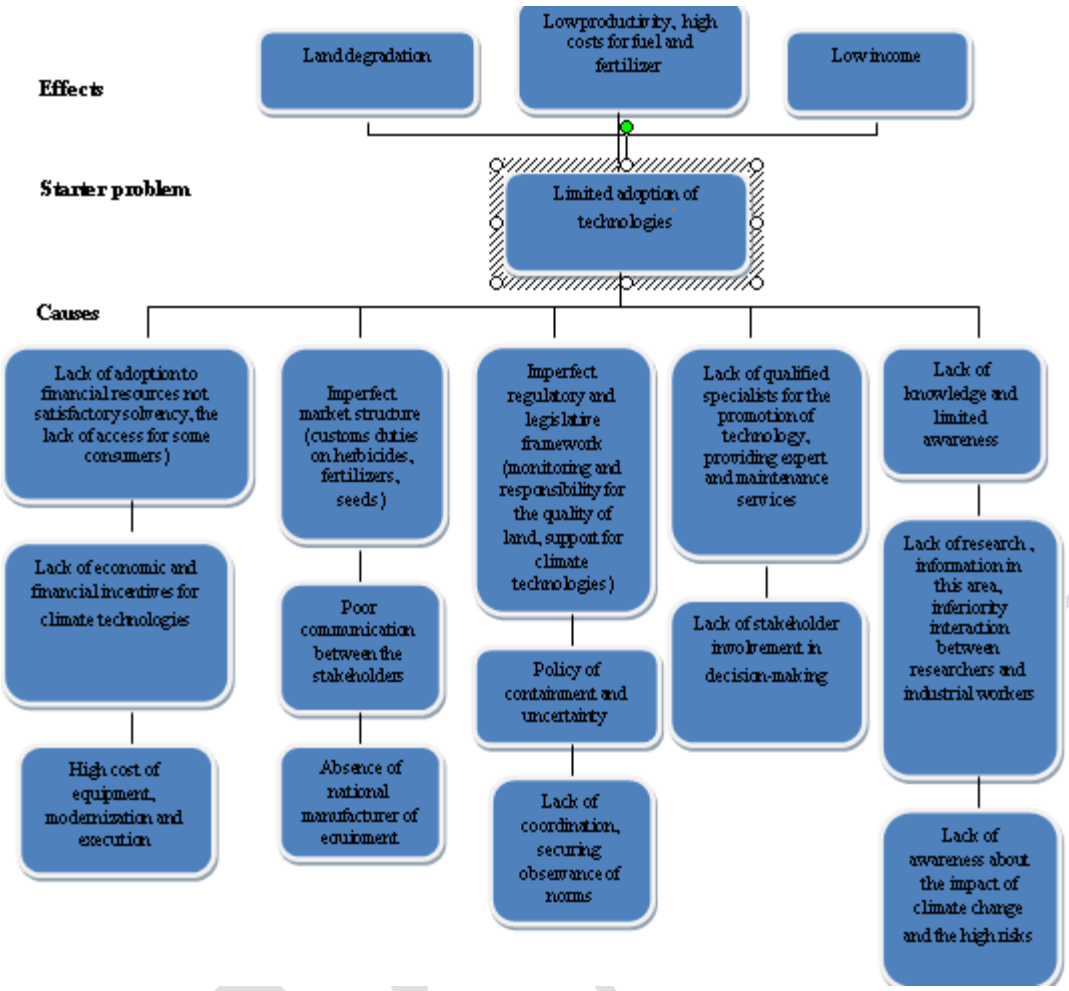

Figure 1.1. Logical Problem Analysis of economic/financial and nonfinancial barriers to the introduction of no till and crop diversification technologies.
Problem tree.

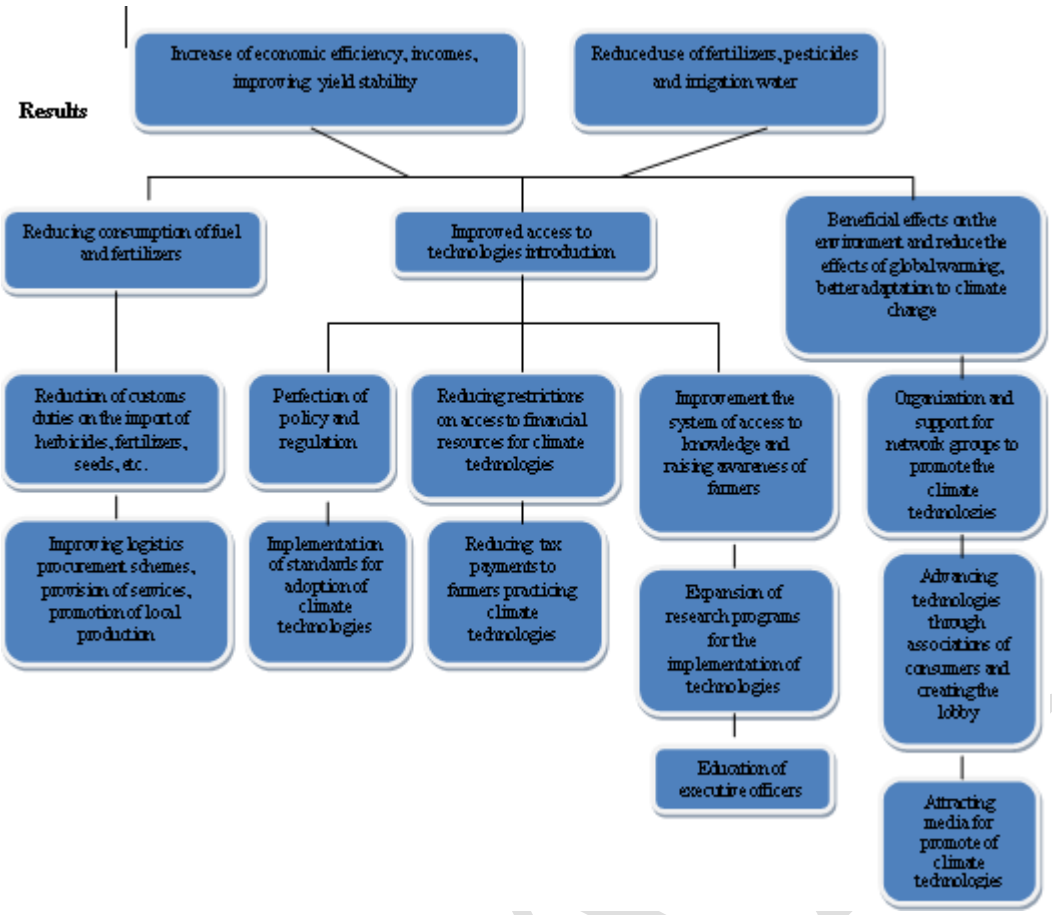

Figure 1.2. Logical Problem Analysis of financial and nonfinancial barriers to the introduction of no till and crop diversification technologies. Tasks tree.

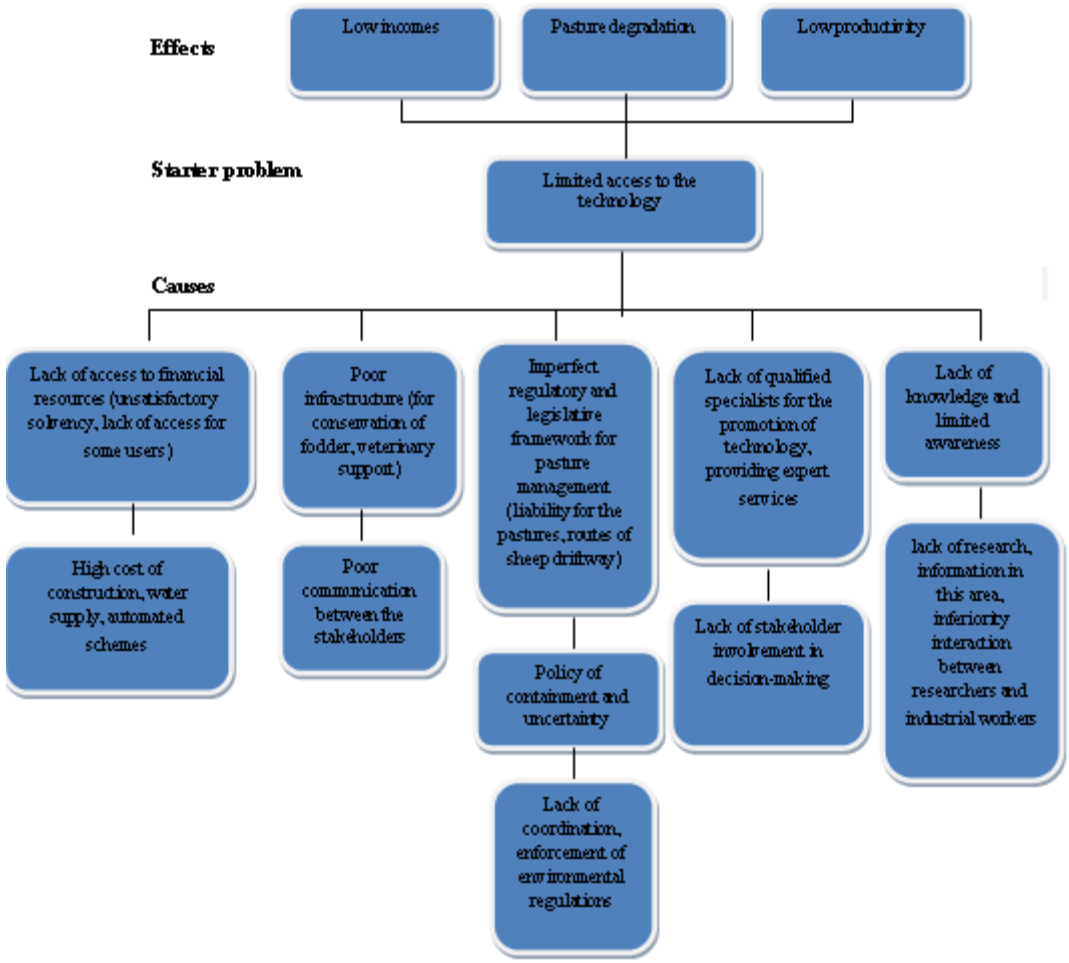

Figure 1.3. Logical Problem Analysis of economic/financial and nonfinancial barriers to the introduction of transhumance system and grazing and stabling system on an industrial basis technologies. Problem tree.

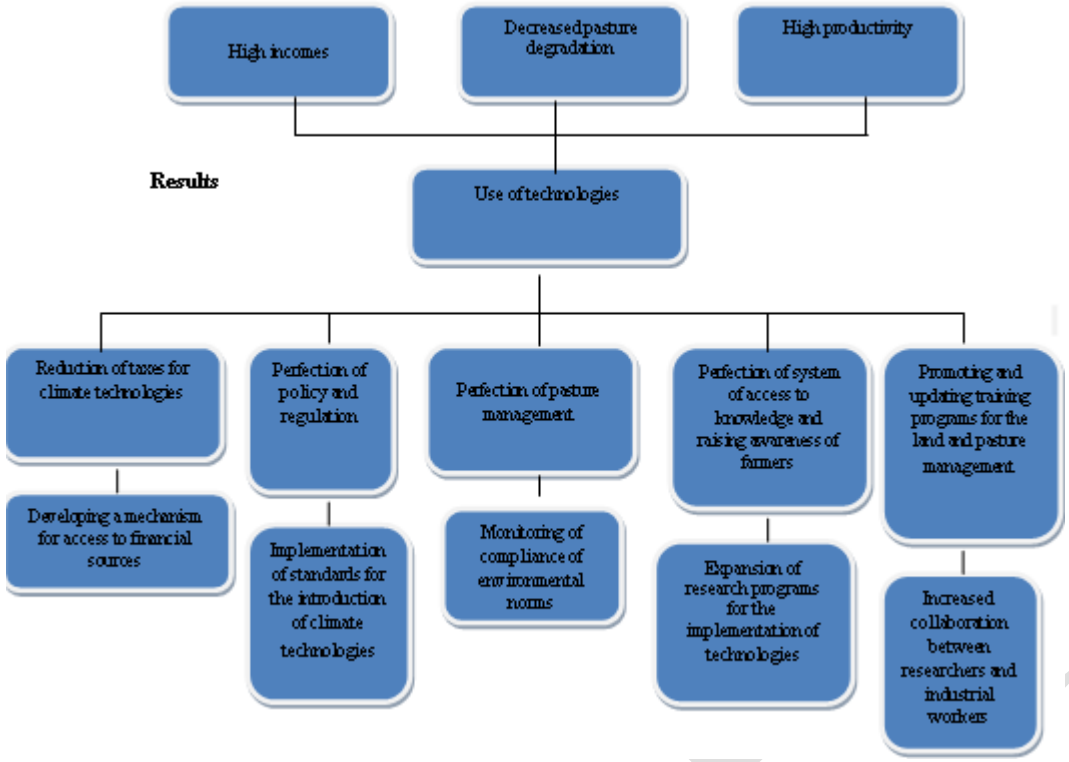

Figure 1.4. Logical Problem Analysis of financial and nonfinancial barriers to the introduction of transhumance system and grazing and stabling system on an industrial basis technologies. Tasks tree.

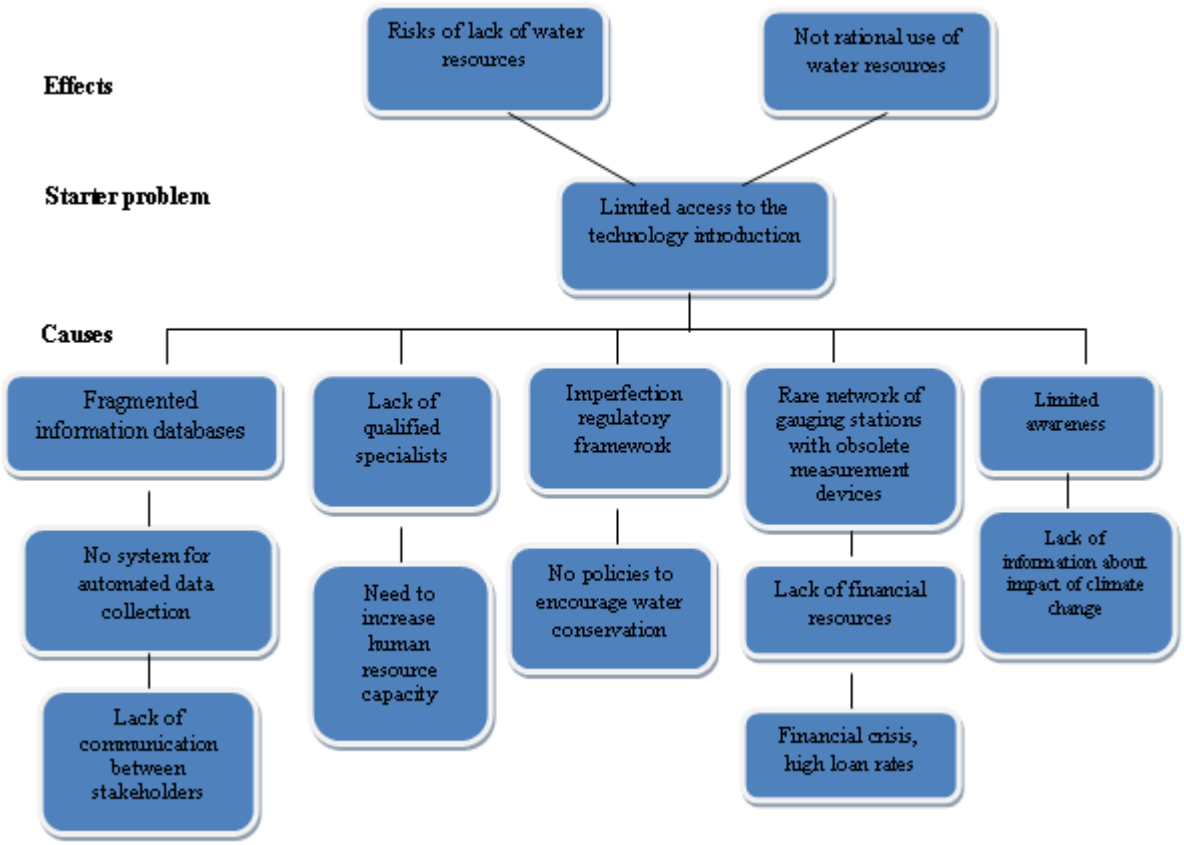

Figure 1.5 Logical Problem Analysis of economic/financial and nonfinancial barriers to the introduction of metering of water for watering and irrigation technology. Problem tree.

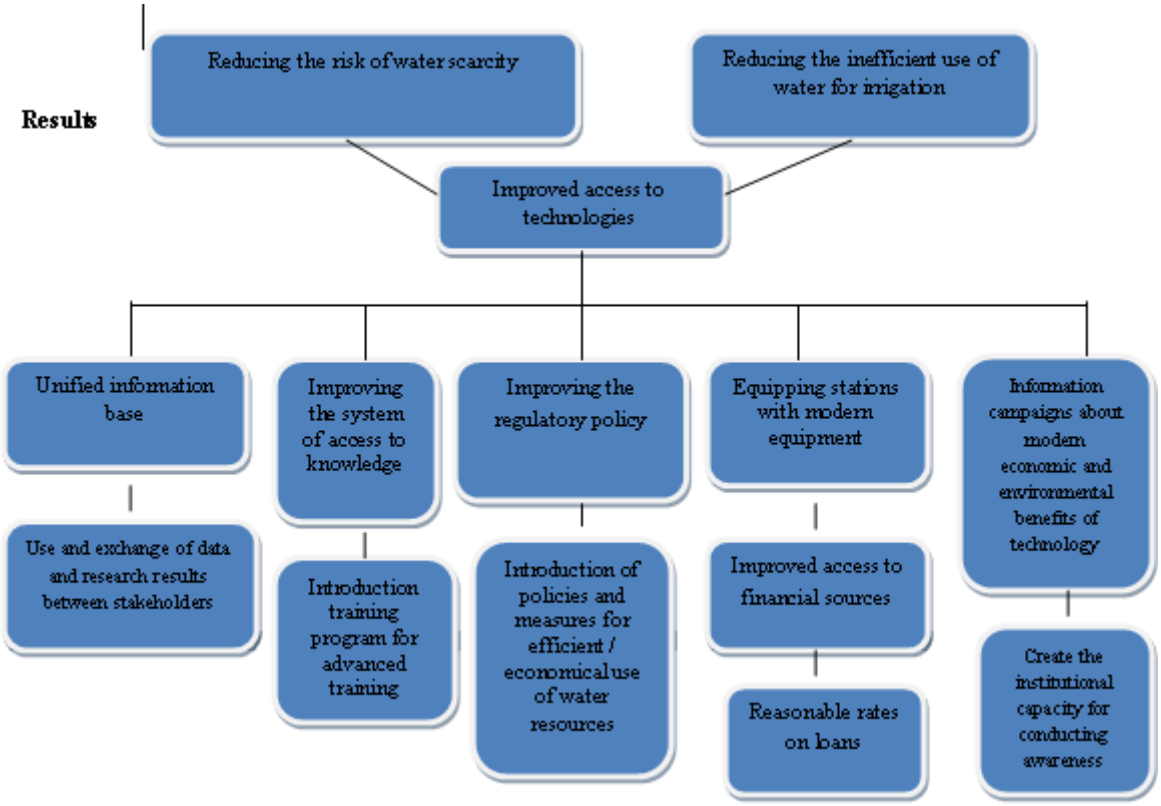

Figure 1.6 Logical Problem Analysis of financial and nonfinancial barriers to the introduction of metering of water for watering and irrigation technology. Tasks tree.

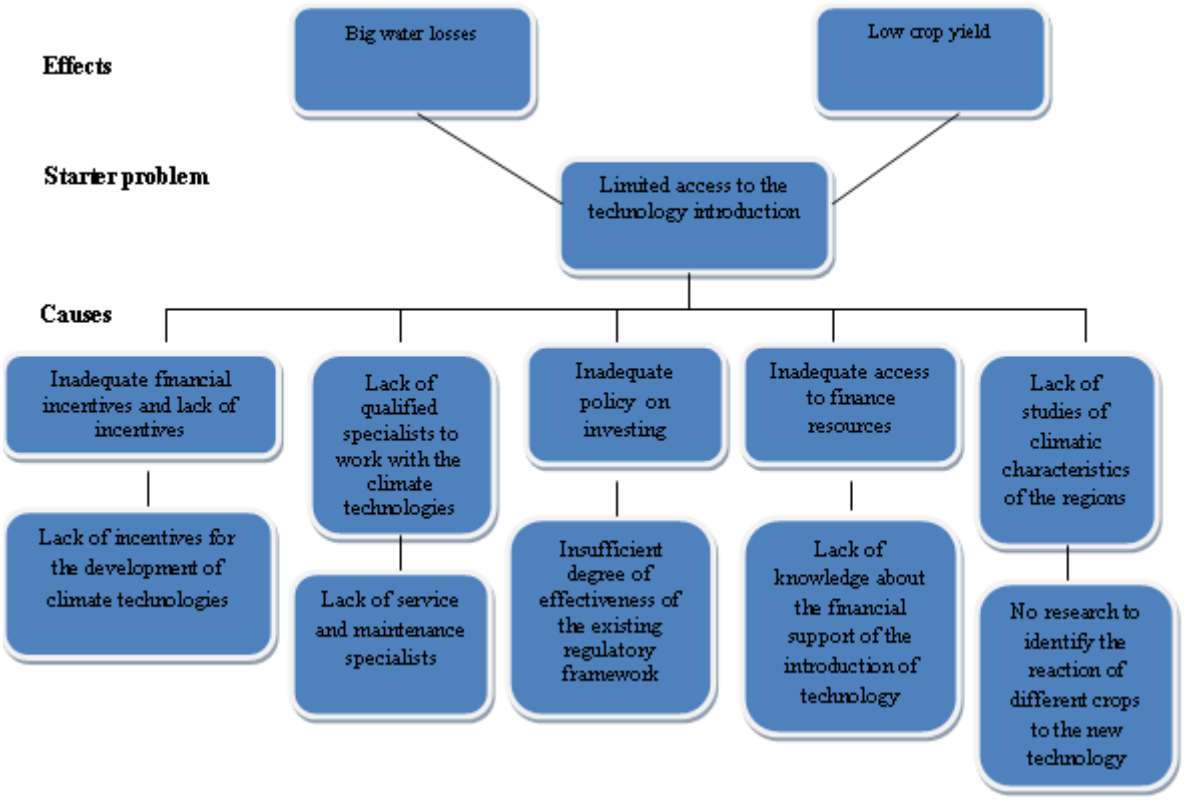

Figure 1.7 **Logical Problem Analysis of economic/financial and nonfinancial barriers to the introduction of drip irrigation technology. Problem tree.**

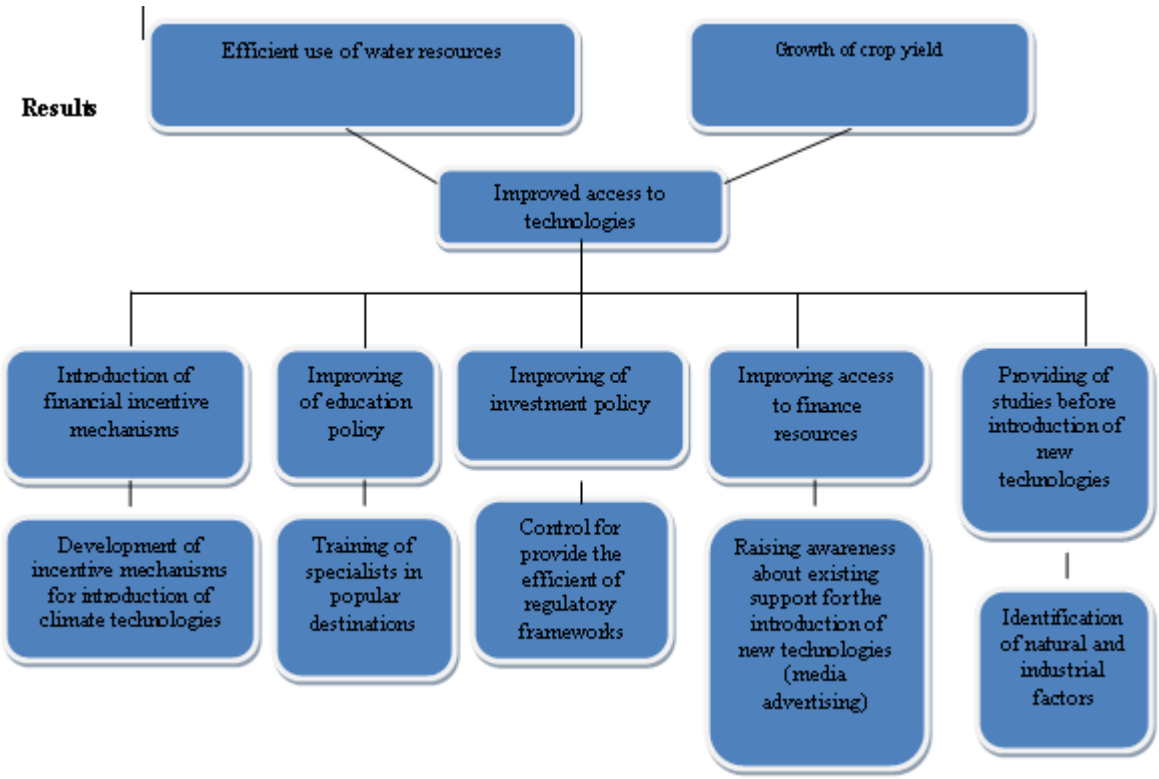

Figure 1.8 Logical Problem Analysis of financial and nonfinancial barriers to the introduction of drip irrigation technology. Tasks tree.

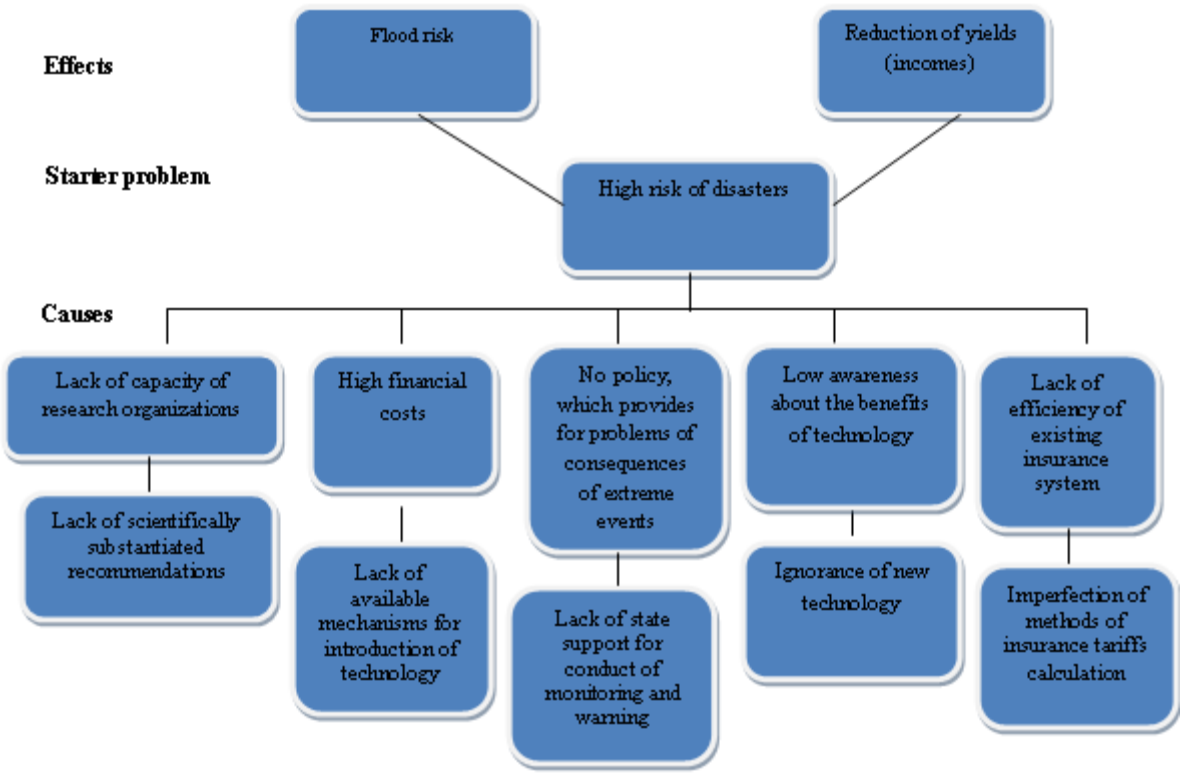

Figure 1.9 **Logical Problem Analysis of economic/financial and nonfinancial barriers to the introduction of technology of extreme events prevention. Problem tree.**

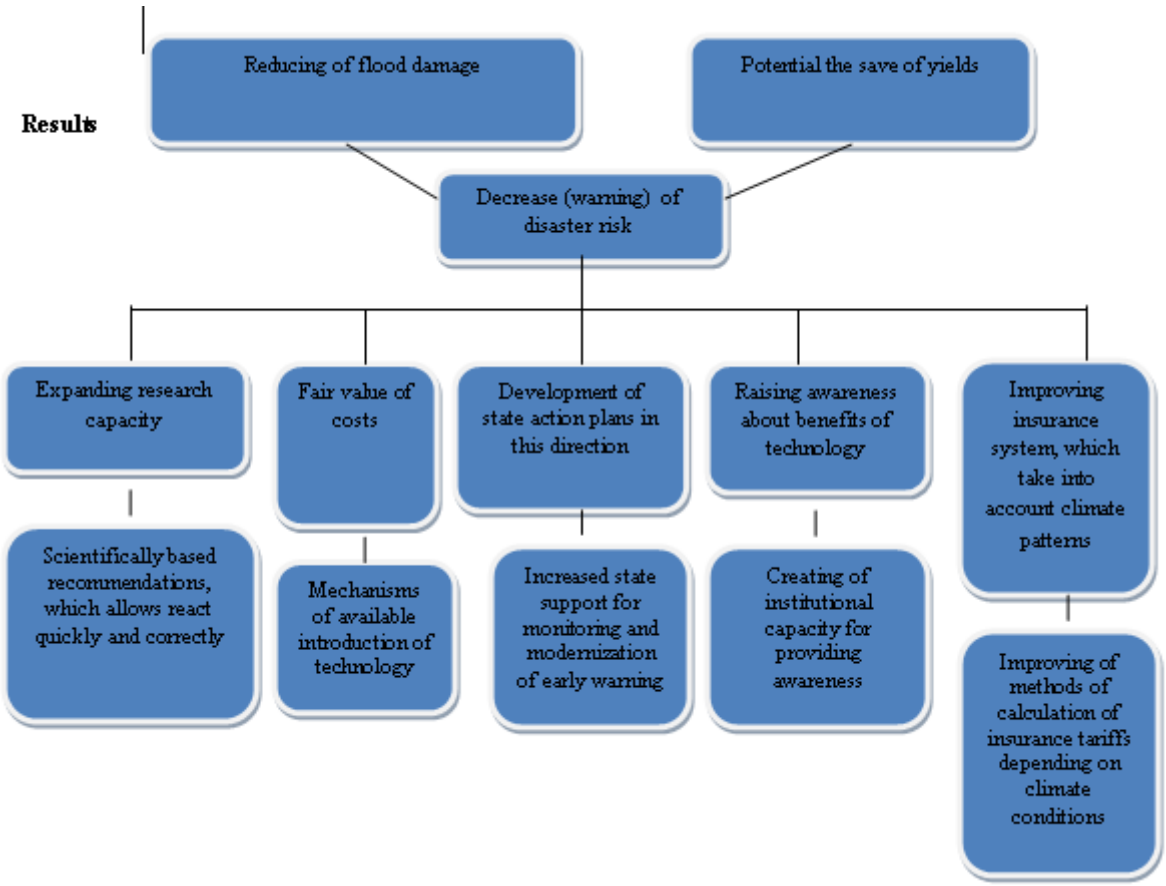

Figure 1.10 **Logical Problem Analysis of financial and nonfinancial barriers to the introduction of technology of extreme events prevention. Tasks tree.**

ANNEX III

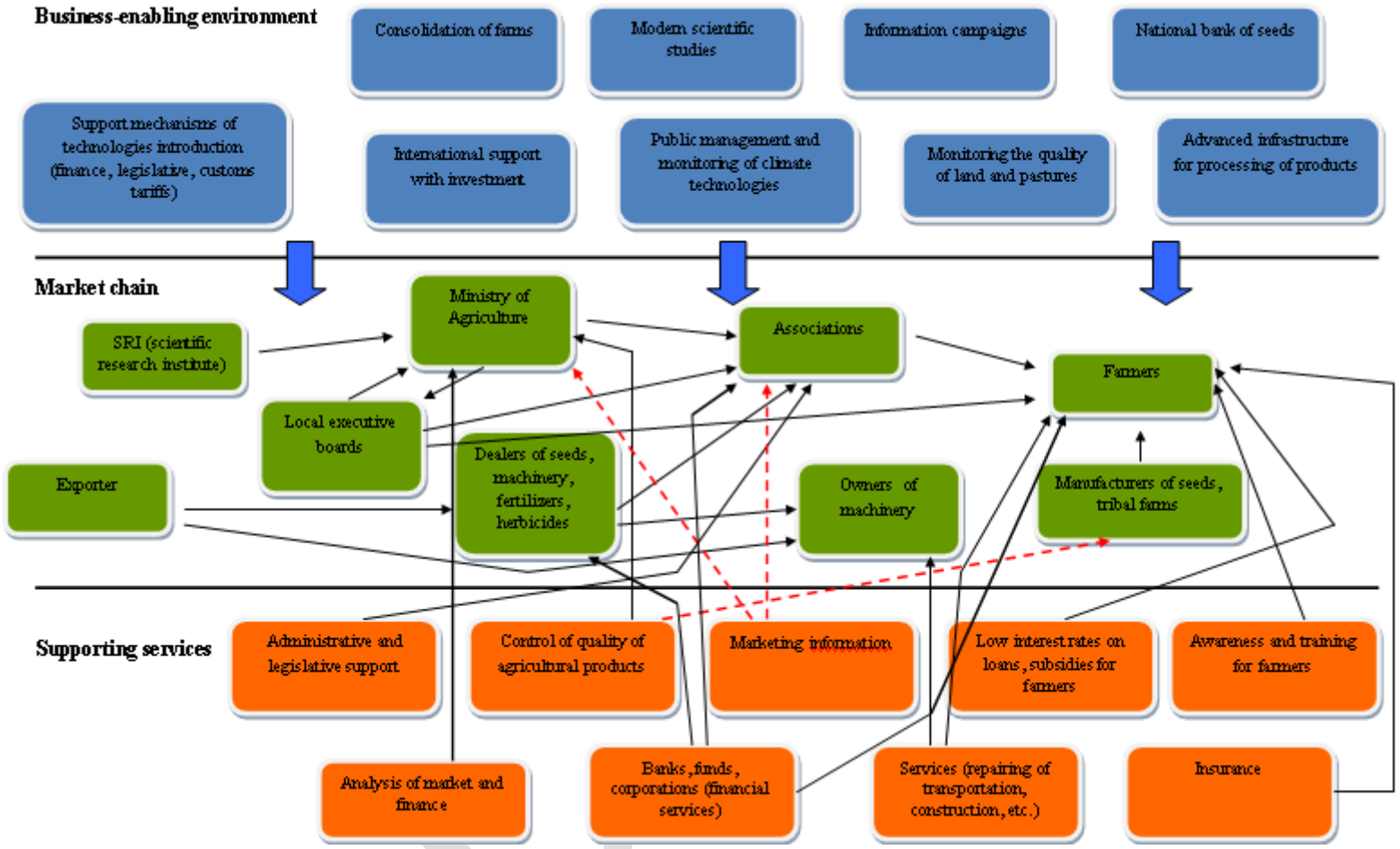

Figure 1.11 Market mapping for technologies of agriculture and water (drip irrigation) sectors

ANNEX IV

List of stakeholders

	Name/Surname	Field of expertise / position	Contact information
1.	**Gulmira Sergazina**	Director of Department of climate change, Ministry of Energy of the RK	+7 7172 740258
2.	**Dias Donenbayev**	Deputy director of Department of green economy, Ministry of Energy of the RK	+7 7172 740077
3.	**Ainur Sospanova**	Deputy director of Department of green economy, Ministry of Energy of the RK	
4.	**Irina Yesserkepova**	Director of Department of cadastre, register and inventory of GHG, JSC "Zhasyl damu", Ministry of Energy of the RK	+7 7272 255625
5.	Saulet Sakenov	Manager of Seventh National Communication of the RK under UNFCCC	+7 7172 901669 saulet.sakenov@undp.org
6.	Syrym Nurgaliev	Manager of UNDP project	+7 7172 58 09 39
7.	Erlan Zhumaev	Manager of UNDP project	
8.	Valeriy Syundyukov	Manager-coordinator of the Association "Kazakhstan Su Arnasy"	8701 5445945
9.	Kanat Baigarin	Senior Manager of the Directorate of Science Project, Nazarbayev University	Kasybayeva A. +7 7172 706154
10.	**Almas Shyntemirov**	Senior Manager of the Directorate of Science Project, Nazarbayev University	Kasybayeva A. +7 7172 706154
11.	**Valentina Kryukova**	Director of PF "Climate Change Coordination Centre"	+7 7172 519804
12.	**Aigul Kusainova**	Specialist of PF "Climate Change Coordination Centre"	

List of experts

	Name/Surname	Field of expertise / position	Contact information
1.	Saken Baisholanov	Consultant of the World Bank for Agriculture	8701 785 01 40
2.	Zheksenbay Kaskarbayev, c.a.s	Director of Shortandy SRI of grain farm named aft.Barayev	+7 71631 230 32 / 230 29
3.	Kanat Akshalov	Shortandy SRI of grain farm named aft.Barayev	8701 3112816
4.	Kazhymurat Musynov, Professor	Head of the Agronomy Department S.Seifullin Kazakh Agro Technical University (Astana)	8701 1316751
5.	Nurlan Serekpayev, Professor	Dean of the Agronomy Faculty of S.Seifullin Kazakh Agro Technical University (Astana)	+7 7172 397807 8701 439 25 51
6.	Murat Karabayev, Professor	CIMMYT International center of improvement of wheat and corn	+7 7172 343713 8701 216 77 21
7.	Lubov Lebed, c.g.s.	JSC "Zhasyl damu"	+7 7272 2558414

8.	**Valentina Kryukova**	Director of PF “Climate Change Coordination Centre”	+7 7172 519804
9.			
10.	Aigul Kusainova	Specialist of PF “Climate Change Coordination Centre”	+7 7172 238650
11.	Damezhan Kartpayeva	Specialist of PF “Climate Change Coordination Centre”	+7 7172 280177
12.	Yuri Blinov	Coordinator of expert group	8701 530 18 78
13.	Valeriy Torubara	Expert	8701 4267133
14.	Lidiyu Nikifirova	Lead of team, Kazgidromet	
15.	Pskhan Kozhakhmetob	Chief, Kazgidromet	

ANNEX V

1. Factsheet for the Strategic Development Plan of the Republic of Kazakhstan till 2020

Program	**Strategic Development Plan of the Republic of Kazakhstan till 2020**
Date of entering into force	Decree of the President of the Republic of Kazakhstan dated 1 February 2010 #922
Date of completion	2020
Sector	All sectors including agriculture and water sector
Country	Kazakhstan
Year of issuing	2010
Political status	In force
Responsible supervisor	Government of the Republic of Kazakhstan
Reason for development	Message of the President of the country to the people of Kazakhstan 1997
Goal of the program	The five key areas will be of priority for the activity of the state in the nearest decade: 1) preparation to post-crisis development; 2) securing of sustainable economy growth through acceleration of diversification by means of industrialization and infrastructure development; 3) investments in the future - improvement of the competitiveness of human capital to achieve sustainable economic growth, prosperity and social well-being for Kazakhstan people; 4) securing qualitative social and housing-communal services for the population; 5) strengthening of accord between the nationalities, improvement of safety and stability of international relations.
Reference	http://adilet.zan.kz/rus/docs/U100000922_
Description	The Program envisages: **By 2020** – internal and foreign investments in non-raw material economy sectors (processing industry, processing of agricultural products, services) will increase not less than by 30 %, the share of direct foreign investments (DFI) in the GDP will increase in relation to ten percent points; the share of small and medium-sized business (SMB) in the GDP will increase by 7-10 %; the investment sources will be diversified (10 main investor-countries with a share of each country equal to 5 % and over); Kazakhstan will enter into the number of 50 countries with best indicators in relation to the World Bank's rating on " Doing Business"; Kazakhstan will be within the number of the first one third of the countries in relation to "Transparency International" rating on the index on corruption perception; **By 2015 –** the indicators of Kazakhstan related to "Doing Business" rating of the World Bank () will be improved on seven positions compared to 2011, the operation costs related to business registration and running (obtaining of permissions, licenses, certificates; accreditation; consultations), including time and costs will be reduced by 30 % compared to 2011; **By 2011** – the methods on regulatory impact analysis (RIA) will be developed to design and adopt new regulatory legal acts, the indicators of Kazakhstan related to "Doing Business" rating of the World Bank will be improved on seven positions compared to 2008, the indicators on the environment for business development in the Business Environment and Enterprise Performance Survey (BEEPS) of the European Bank for Reconstruction and Development and the World Bank will be improved, the operation costs related to business registration and running (obtaining of permissions, licenses, certificates; accreditation; consultations), including time and costs will be reduced by 30 %.

2. Factsheet for the "Kazakhstan-2050" Development Strategy of Kazakhstan

Program	**State-of-the-nation address of the President of the Republic of Kazakhstan "Kazakhstan's way-2050: A common goal, common interests, common future"**
Date of entering into force	State-of-the-nation address of the President of the Republic of Kazakhstan of January 17, 2014
Date of completion	2050
Sector	All sectors, including agriculture and water management
Country	Kazakhstan
Year of issuing	2014
Political status	In force
Responsible supervisor	Government of the Republic of Kazakhstan
Reason for development	State-of-the-nation address of the President of the Republic of Kazakhstan of 1997
Goal of the program	By 2050 to create a society of prosperity based on a strong state, developed economy and universal labor opportunities.
Reference	http://adilet.zan.kz/rus/docs/K1400002014
Description	1. It is important to adjust and strengthen the trend of innovative industrialization. 2. It is important to provide transition to innovative rails of agro-industrial complex. 3. Creation of a knowledge-based economy – it is first and foremost increase of the capacity of Kazakhstan science. 4. It is necessary to ensure dynamic development of the infrastructure triad – agglomerations, transport, energy. 5. Development of small and medium-sized businesses – it is the main tol of industrial and social modernization of Kazakhstan in the XXI century. 6. Our way to the future is connected to the creation of new opportunities for the disclosure of the potential of Kazakhstan. 7. Improving the performance of state institutions.

3. Factsheet for the State program of infrastructure development "Nurly Zhol" for 2015-2019

Program	**State program of infrastructure development "Nurly Zhol" for 2015-2019**
Date of entering into force	Decree of the President of the Republic of Kazakhstan to the people of Kazakhstan of April 6, 2015, No. 1030
Date of completion	2019
Sector	All sectors, including agriculture and water management
Country	Kazakhstan
Year of issuing	2015
Political status	In force
Main developer	Ministry of National Economy of the Repulic of Kazakhstan
Reason for development	State-of-the-nation address of the President
Goal of the program	Forming a single economic market by integrating macro-regions of the country based on building an effective infrastructure on the hub principle for long-term economic growth of Kazakhstan, as well as the implementation of anti-crisis measures to support specific sectors of the economy in the conditions of conjuncture deterioration on external markets.
Reference	http://adilet.zan.kz/rus/docs/U1500001030
Description	Tasks: 1) creation of an efficient transport and logistics infrastructure on the radial principle; 2) development of industrial and tourism infrastructure; 3) strengthening energy infrastructure within the Unified Energy System; 4) modernization (reconstruction and construction) of infrastructure of housing and public utilities and heat, water supply and sanitation systems; 5) increase of the affordability of housing for citizens; 6) development of education infrastructure; 7) improving competitiveness of businesses; 8) support of domestic mechanical engineering; 9) export support; 10) increase of competitiveness of AIC; 11) provision of infrastructure projects of Business Roadmap-2020; 12) securing quality of products through development of laboratory base; 13) provision of knowledge of the Kazakhstan territory with the evaluation of forecast resources.

4. Factsheet for the Program on Argo-Industrial Complex Development in the Republic of Kazakhstan for 2013 – 2020 "Agro business – 2020"

Program	**Program on Argo-Industrial Complex Development in the Republic of Kazakhstan for 2013 - 2020**
Date of entering into force	Resolution of the Government of the Republic of Kazakhstan dated 18 February 2013 #121
Date of completion	2020
Sector	Agriculture
Country	Kazakhstan
Year of issuing	2013
Implementation status	In force
Main developer/responsible executor	Ministry of Agriculture of the Republic of Kazakhstan
Reason for development	State-of-the-nation address of the Head of State of December 14, 2012 "Kazakhstan-2050" Strategy: new political course of the established state"
Goal and objectives of the program	Creating conditions for increasing competitiveness of agro-industrial complex entities of the Republic of Kazakhstan
Reference	http://adilet.zan.kz/rus/docs/P1300000151
Description	Tasks: 1. Financial recovery of AIC entities. 2. Increasing economic affordability of goods, works and services for the AIC entities: 1) increasing economic affordability of goods and services in crop production; 2) increasing physical accessibility of services for storage of grain; 3) increasing economic affordability of water for AP; 4) increasing economic affordability of goods, works and services in animal husbandry and aquaculture; 5) increasing economic affordability of goods, works and services for production of deep processing of agricultural raw products; 6) increasing economic affordability of financial services; 7) increasing the availability of goods, works and services within the implementation of priority investment projects; 8) increasing economic affordability of educational services, results of agrarian science and consulting services. 3. Development of state support systems of AIC entities: 1) development of phytosanitary security; 2) development of veterinary safety system. 4. Improving efficiency of state regulation systems of AIC: 1) improving efficiency of agrochemical service of agriculture; 2) development of information management systems of AIC entities; 3) improving efficiency of state variety trials of crops; 4) development provision of public services system for AIC entities; 4-1) increasing efficiency of monitoring and evaluation of irrigated lands; 5) development of technical regulation system in agriculture; 6) improving efficiency of state control and supervision in the AIC; 7) creating conditions for development of production and turnover of organic agricultural products; 8) development of agricultural cooperatives; 9) development of international cooperation in the field of AIC.

5. Factsheet for the Concept of Republic of Kazakhstan on transition to "green economy"

Program	**Concept on transition of the Republic of Kazakhstan to "green economy"**
Date of entering into force	Decree of the President of the Republic of Kazakhstan of May 30, 2013, No. 577
Date of completion	2020
Sector	All
Country	Kazakhstan
Year of issuing	2013
Political status	In force
Main developer	Ministry of Environment and Water Resources of the Republic of Kazakhstan
Reason for development	1. The problem of outdated and uncompetitive infrastructure; 2. The need to implement less costly ways to produce electricity compared with traditional sources; 3. Objectives of Strategy-2050
Goal of the program	1) in the power industry: the share of alternative and renewable electric power is expected to reach 50% by 2050; 2) energy efficiency has a task to reduce the energy intensity of GDP by 10% by 2015 and by 25% by 2020 compared to baseline of 2008; 3) water resources has a task to solve the problems of provision of drinking water to the population by 2020 and ensuring water to agriculture by 2040; 4) agriculture has a task to raise productivity of agricultural land by 1.5 times by 2020
Reference	http://adilet.zan.kz/rus/docs/U1300000577
Description	Priorities: 1) reduction in the intensity of useing basic resources, including water and land; 2) improvement of underdeveloped and aging infrastructure, particularly in the electricity industry; 3) increasing the welfare of the population and reduction of environmental pollution; 4) increase of national security by reducing dependence on water resources of neighboring countries.

6. Factsheet of the Law "On state regulation of the agro-industrial complex and rural territories development"

Law	**On state regulation of the agro-industrial complex and rural territories development**
Date of entering into force	Law of the Republic of Kazakhstan of July 8, 2005, No. 66
Date of completion	Effective
Sector	Agro-industrial sector and rural territories
Country	Kazakhstan
Year of issuing	2005
Political status	In force
Main developer	Minister of Agriculture of the Republic of Kazakhstan Казахстан
Reason for development	Signing of the law by the President of RK on July 8, 2005
Goal of the law	Determination of legal, organizational, economic and social foundations of the state regulation of development of AIC and rural areas in the Republic of Kazakhstan 1. The goals of state regulation of development of AIC and rural areas are: 1) development of social and engineering infrastructure in rural areas and provision of rural population with favorable living conditions; 2) ensuring food security of the state; 3) ensuring sustainable economic and social development of agriculture and rural areas; 4) creation of economic conditions for production of competitive agricultural products and processed products. 2. State regulation of development of AIC and rural areas is based on the principles of: 1) priority of development of AIC and rural areas with the potential for economic growth; 2) compliance with international agreements on agriculture, sanitary and phytosanitary standards; 3) transparency of the activities undertaken by the state; 4) target in provision of government support measures; 5) development of competitive advantages of domestic agricultural production; 6) protection of the domestic market from unfair competition; 7) division of powers between levels of state management; 8) environmental safety of activities of AIC and population living in rural areas; 9) interaction with public associations, associations (unions) of entrepreneurs; 10) efficiency of state regulation; 11) ensuring the required annual volume of state support development of AIC and rural areas; 12) development of optimum forms of interaction of AIC entities.
Reference	http://adilet.zan.kz/rus/docs/Z050000066
Description	The law contains 4 parts. The first part includes the basic concepts used in the Law, and also describes the objectives and principles of the state development of AIC and rural areas. The second part describes the competence of the state bodies and local self-government bodies in the field of state regulation of development of AIC and rural areas. The third part is devoted to state regulation of development of AIC and rural areas, which is carried out by means of: 1) crediting development in the field of AIC and rural areas; 2) subsidizing of AIC; 3) conduct of purchasing and commodity interventions; 3-1) purchase of agricultural products at a guaranteed purchase price; 4) establishment of specialized organizations; 5) regulation of exports and imports of AIC; 6) technical equipment of AIC; 7) information and marketing support of AIC; 8) scientific, regulatory and methodological support and training of AIC personnel; 9) investment in the development of social and engineering infrastructure of rural areas; 10) organization of optimal rural settlement;

	11) provision of veterinary-sanitary and phytosanitary safety; 11-1) financing costs for monitoring and evaluation of irrigated lands; 12) application of measures of tax, fiscal, customs and tariffs, technical regulations and other measures in accordance with the legislative acts of the Republic of Kazakhstan. The fourth part includes the issues of international cooperation, responsibility for violation of the Kazakhstan legislation and final provisions.

7) **Factsheet on crediting of the agricultural sector**

Regulation of the Government	**"On crediting of the agricultural sector"** of January 25, 2001, No. 137
Date of entering into force	2001
Date of completion	Effective
Sector	Agriculture
Country	Kazakhstan
Year of issuing	2001
Political status	In force
Main developer	Ministry of Agriculture of the Republic of Kazakhstan
Reason for development	Program for development of agro-industrial complex in the Republic of Kazakhstan for 2013-2020 "Agrobusiness-2020"
Goal of the regulation	Providing affordability and increasing efficiency of use of financial resources by rural producers.
Reference	http://adilet.zan.kz/rus/docs/P010000137_
Description	The pilot project is being implemented in two stages. First stage: establishment of a specialized financial institution – Agricultural Credit Corporation – Closed Joint-Stock Company. The RK Government provides Corporation with loans at a zero rate of remuneration (interest) for a period of five years. The Corporation operates under license of the National Bank of the Republic of Kazakhstan for conducting loan transactions and provides loans exclusively to rural credit partnerships. The second stage of the project provides for the creation of a network of regional financial institutions – rural credit partnerships. The Ministry of Agriculture of the Republic of Kazakhstan, akims of regions and the Corporation carry out the organizational work for the creation of rural credit partnerships. Creation of rural credit partnerships is carried out in the regions with the effective conduct of production and/or processing of agricultural products, cost-effective, economically viable sectors of the agro-industrial complex. Rural credit partnership (Partnership) operates in accordance with the current legislation of the Republic of Kazakhstan and the regulatory acts of the National Bank of the Republic of Kazakhstan. Ministry of Agriculture of the Republic of Kazakhstan in the development of the Corporation's internal documents, provides for the following requirements: 1) to potential participants in the Partnership (agricultural producers): - making contribution by a potential member of the Partnership to the authorized capital of the Partnership solely by money. For legal entities – within the limits of own funds; for individuals – at the expense of the net income; - availability of a period of activity in the production and/or processing of agricultural products for at least three years at the potential participants of the Partnership at the time of formation of the Partnership; - competently executed documents on available real estate; - stability of production and financial activities; - implementation of agricultural production, which must be at least 50 percent of their products; - processing and sale of agricultural products; 2) the proportion of agricultural producers should be at least 50 percent of the authorized capital of the Partnership, and their number – at least 20 members; 3) the minimum size of the authorized capital of the Partnership should be no less than 3 000 000 (three million) tenge; 4) the minimum payment contribution of the participant is established in the amount of 100 MCI. Participation in the management of the Partnership shall be in proportion to the contribution to the authorized capital of the Partnership. The Corporation participates in the authorized capital of created Partnerships at the expense of its own authorized capital. At that, the Corporation's share in the authorized capital of the Partnership at the initial stage should be at least 35% with a gradual reduction of its share in the existing Partnerships, through the sale of shares or its part to other members of the Partnership or re-entering it. The Corporation participates in the management of the Partnership in accordance with the legislation.

8) **Factsheet on the issues of agro-industrial sector support with the participation of specialized organizations**

Regulation of the Government	**"On certain issues of support of agro-industrial complex with the participation of specialized organizations"** of July 7, 2006, No. 645
Date of entering into force	2006
Date of completion	Current
Sector	Agriculture
Country	Kazakhstan
Year of issuing	2006
Political status	Valid
Main developer	Ministry of Agriculture of the Republic of Kazakhstan
Reason for development	Law of the Republic of Kazakhstan on July 8, 2005 "On state regulation of development of agriculture and rural areas"
Goal of the regulation	Determines the order of support to agricultural sector with the participation of specialized organizations, such as: 1) "National Company "Food Contract Corporation" Joint-Stock Company; 2) "KazAgroFinance" Joint-Stock Company; 3) "Agrarian Credit Corporation" Joint-Stock Company; 4) "Fund for Financial Support of Agriculture" Joint-Stock Company; 5) "KazAgroProduct" Joint-Stock Company; 6) "Kazagromarketing" Joint-Stock Company; 7) "KazAgroGarant" Joint-Stock Company; 8) "KazAgroInnovation" Joint-Stock Company.
Reference	http://adilet.zan.kz/rus/docs/P060000645_
Description	Ministry of Agriculture of the Republic of Kazakhstan Kazakhstan supports agro-industrial complex with the participation of specialized organizations in accordance with the applicable legislation in the following order: 1) determines the need for resources allocated from the national budget to support the agricultural sector; 2) makes a budget request and receives funds allocated from the republican budget; 3) at the expense of funds allocated from the republican budget, pays the authorized capital of Joint-Stock Company "National Holding "KazAgro" and "KazAgroInnovation" Joint-Stock Company, arranges budget loans for them, carries out public procurement from specialized organizations; 4) carries out corporate management of the Holding and "KazAgroInnovation" JSC.

9) **Factsheet of the law "On Credit Society"**

Law	"On Credit Society" of March 28, 2003, No. 400
Date of entering into force	2003
Date of completion	Current
Sector	Finances, activities of organizations of different legal forms
Country	Kazakhstan
Year of issuing	2003
Political status	Valid
Main developer	Ministry of Agriculture of the Republic of Kazakhstan
Reason for development	State-of-the-nation address of December 14, 2012 "Kazakhstan-2050" Strategy: new political course of the established state"
Goal of the law	Determination of the legal status, order of establishment, reorganization and liquidation, as well as regulating the activities of credit societies.
Reference	http://adilet.zan.kz/rus/docs/Z030000400_

10) Factsheet for the State program on water resources management of Kazakhstan

Program	**State program on water resources management of Kazakhstan**
Date of entering into force	Decree of the President of the Republic of Kazakhstan dated 4 April 2014 №786
Date of completion	2020
Sector	Water sector
Country	Kazakhstan
Year of issuing	2014
Implementation status	In force
Main developer/responsible executor	Ministry of environment protection and water resources of the Republic of Kazakhstan
Reason for development	State-of-the-nation address of the Head of State of December 14, 2012 "Kazakhstan-2050" Strategy: new political course of the established state, approved by Decree of the President of the Republic of Kazakhstan dated December 18, 2012 №449.
Goal and objectives of the program	Ensuring water security of the Republic of Kazakhstan by improving of efficiency of water management.
Reference	http://adilet.zan.kz/rus/docs/U1400000786

ANNEX VI

Table 6.1 Economic effectiveness of wheat grain production at costs per 1 ha in grain-steam 4-ple crop rotation depending on tillage systems in 2010

Tillage system	Produced per 1 ha of crop rotation			Direct costs per 1 ha of crop production				Net cost of grain ton, USD
	Grain, tons	Gross output, USD	Income, USD	Per. - h	USD, total	POL, %	Herbicides, %	
Traditional	2,4	411	228	5,4	184	31,90	25,8	76
Minimum	2,4	411	222	5,1	189	19,79	39,7	79
Zero	2,5	427	249	4,8	178	7,77	51,2	71

Source: Article of Aksagov T.M., Saving tillage technologies as a way to reduce net cost of wheat grain of Omsk 18 variety production

Economic and financial analysis of drip irrigation technology in the territory of 5.5 ha apple orchard

Table 6.2 Initial data for cost-benefit analysis

	Total, KZT
Planting material	6 187 500
Equipment – drip irrigation system	1 100 000
Preparatory work (mechanisms)	91 025
Fertilizers and chemicals for preparatory works	139 524
Fertilizer and irrigation water	657 360
Salary and deductions	2 648 223
Current fertilizer application	44 137
Hiring of labor	1 430 000
Other expenses	866 267
Total investment costs	**13 164 036**

Table 6.3 Costs for purchase of planting stock

Price of one apple plant, KZT	450
Average cost for planting of one planting stock	100
Consumption rate per 1 ha. scheme 4x1, planting stocks / ha	2 500
Purchase of planting material per 1 ha	1 375 000
Purchase of planting material**, for 5,5 га**	**7 562 500**

Table 6.4 Costs for drip irrigation system

Name	**Price, KZT**
Water treatment and filtration system	1 100 000
Polishing filtration and automatization system	
Electrical supply of site of land	
HDPE pipe Ø 50 mm	
Drip tube Vered 16	
Pump GP 250 A	
Mechanical works	

Table 6.5 Costs of the preparatory work for 1 ha

Agrotechnical works	16 550
Costs for soil enrichment	25 368
Total preparatory costs for 1 ha garden	41 918
Total preparatory costs for 5,5 ha garden	**230 549**

Table 6.6 Costs for irrigation water

Irrigation norm, m3/ha	4 800
Irrigated area, ha	5,5
Total demand, m3	26 400
Price, KZT/thous. m3	800
Costs for 1 watering, KZT	21 120
Number of waterings in 1 year	10
Total costs for 1 year	**211 200**
Total costs for 3 years	**633 600**

Table 6.7 Costs for fertilizers

Fertilizers	Unit	Number	Price, KZT	Sum, KZT in year	Total for 3 years, KZT
Ammophos	kg	1100	58	64 856	194 568
Ammonia nitrate	kg	1650	32	32 256	96 768
Superphosphate	kg	10	60	600	1 800
Insecticide BI-58	l	1,5	1 000	1 500	4 500
Herbicide Uragan-forte	l	1,5	2 200	2 200	2 200
Total, KZT				**99 212**	**299 836**

Table 6.8 Costs for personnel

Position	Staffing position	Monthly salary, KZT	Yearly salary, KZT
Director	1	40 000	480 000
Agronomist	1	30 000	360 000
Gardeners-operators	2	20 000	240 000
Total	**4**		**1 080 000**

Table 6.9 Report on profits and loss for 1 operational year, KZT

Name of article	1 year	2 year	3 year	4 year	5 year
Proceeds from the apples realization	0	0	**6 600 000**	**6 600 000**	**6 600 000**
Planting material	7 562 500	0	0	0	0
Gross profit	**-7562500**	**0**	**6 600 000**	**6 600 000**	**6 600 000**

Total operational costs	**1 093 070**	**987 645**	**1 533 693**	**1 533 693**	**1 533 693**
Works of mechanisms	124 025	24 750	24 750	24 750	24 750
Irrigation water	21 120	21 120	21 120	21 120	21 120
Fertilizer	139 528	143 378	143 378	143 378	143 378
Salary	600 000	600 000	1 080 000	1 080 000	1 080 000
Deductions from salary	115 896	115 896	181 944	181 944	181 944
Hiring of labour	40 000	30 000	30 000	30 000	30 000
Other expenses	52 501	52 501	52 501	52 501	52 501
Operational profit/loss	**-8655570**	**-987 645**	**5 066 307**	**5 066 307**	**5 066 307**
Corporate tax	0	0	148 465	148 465	148 465
Net profit/loss for period	**-8 655 570**	**-987 645**	**4 917 842**	**4 917 842**	**4 873 838**
Loss of previous periods	0	-8 655570	-9 643 215	-4 725 373	192 469
Accumulated profit/loss	**-8 655 570**	**-9 643215**	**-4 725 373**	**192 469**	**5 066 307**

Table 6.10 Economic effectiveness of the use of drip irrigation system

Revenue part	Unit	Total of 3 year, thous.USD dollars
Harvest area	ha	5,5
Harvest per ha	**t**	12
Amount of harvest in year	**t**	66
Price per ton	USD doll.	294
Proceeds from the sales of apples	USD doll.	19, 411

Source: http://dkz.mzsr.gov.kz/ru/node/680, Dorozhnaya karta zanyatosti-2020.