Ministry of Natural Resources, Ecology and Technical Supervision
Kyrgyz Republic

Barriers Analysis and Enabling Framework Report

Part I
Technologies Needs Assessment for Climate Change Adaptation

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Technology Needs Assessment (TNA) for Adaptation
Barriers Analysis and Enabling Framework Report for Climate change Adaptation in the Agriculture and Water Resource Sectors

National TNA Project Coordinator:
Mr. Azamat Temirkulov, Deputy Minister of Natural Resources and Technical Supervision of the Kyrgyz Republic, NDE for CTCN.

Contributing experts:
Mr. Aleksandr Temirbekov, Agriculture Sector Adaptation, Team Leader
Ms. Ekaterina Sakhvaeva, Water Resources Sector Adaptation

UNEP Copenhagen Climate Centre TNA Coordination:
Mr. James Haselip
Mr. Paul Riemann

International PNA consultants:
Ms. Ala Druta, Republic of Moldova.
Ms. Jiska de Groot, South Africa.

Table of contents

List of illustrations

List of tables

List of Abbreviations

CCF	Climate Finance Centre at MNRET
CTCN	UN Climate Technologies Centre and Network of UNFCCC
DI	Drip irrigation
DOAD	Department for Organic Agriculture Development under the MOA
DDWSS	Department for Drinking Water Supply and Sanitation
EEPS	Energy Efficient Pumping Stations
ERSDWSS	Energy and resource-saving drinking water supply systems
FAO	Food and Agriculture Organization of the United Nations
FOM	Federation of Organic Movement
GCF	Green Climate Fund
GDP	Gross domestic product
GoK	Government of Kyrgyzstan
HRE	Hydroreclamation Expedition of the WRS
HPP	Hydropower plants
IFAD	International Fund for Agricultural Development
KNAU	Kyrgyz National Agrarian University
KRIIR	Kyrgyz Research Institute for Irrigation
LAP	Logical Problem Analysis
LSG	Local Self- Governments
MSC	Ministry of Economy and Commerce
MNRETS	Ministry of Natural Resources, Ecology and Technical Supervision of the Kyrgyz Republic
MOA	Ministry of Agriculture
NAP	National Adaptation Plan
NAPU	National Association of Pasture Users
NDC	Nationally Determined Contribution to the Paris Agreement
NLA	Normative Legal Act
NSC	National Statistic Committee
OA	Organic Agriculture
PC	Pasture Committee (executive body of PUA)
PMP	Pasture Management Plans
PPP	Public Private Partnership
PUA	Pasture Users Association
RCADWC	Rural Community Association of Drinking Water Consumers
RAS	Rural Advisory Service
SNIP	Building Codes
SPM	Sustainable pasture management
SSI	Subsoil irrigation
SWG	Sectoral working group
TAP	Technology Action Plan
TFS	Technology Fact Sheets
TNA	Technology Needs Assessment
TSR	Technical Safety Rules
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNEP CCC	UNEP Copenhagen Climate Centre
UNFCCC	United Nations Framework Convention on Climate Change

WRS	Water Resource Service
WSS	Water supply and sanitation
WUA	Water Users Associations

Executive Summary

This is the second report of the Technology Needs Assessment Project on the climate resilient technologies transfer to Kyrgyzstan. The first report was devoted to the identification and selection of priority technologies for the adaptation to climate change in the agriculture and water resources sectors. For the agriculture sector, the following adaptation technologies have been prioritized: (i) Sustainable Pasture Management (SPM) in the context of climate change; (ii) Organic Agriculture (OA); and (iii) Drip Irrigation (DI). The following technologies were selected as priority technologies for adaptation of the water sector: (i) Energy- and resource-saving drinking water supply systems from surface water sources using local materials (ERSDWSS); (ii) Energy-efficient pumping stations for irrigation (EEPS); (iii) Subsoil irrigation based on the closed drainage by subsoil irrigation method (SSI).

There are varieties of barriers to the deployment and diffusion of these technologies that hinder the transfer and promotion of these priority adaptation technologies in Kyrgyzstan. The purpose of this report is to present a Barriers Analysis and Enabling Frameworks for the promotion of selected climate resilient technologies. Barriers identification in this sense is the process of identifying the causes that hamper technology transfer. This analysis also includes identifying any missing measures that could support the promotion of technologies.

The project activities were implemented by the Climate Finance Centre (CFC) under the Ministry of Natural Resources, Ecology and Supervision (MNRETS) in close cooperation with the Ministry of Agriculture (MOA) and its Water Resources Service (WRS), research and educational institutions, businesses, non-governmental organizations and international development partners. The sectoral analysis of barriers and enabling frames was carried out by the project team of experts and Sectoral Working Groups on Agriculture and Water Sector, established at the beginning of the project, including all the stakeholders.

As a first step in the barrier analysis process, a desk study of policy papers and other relevant documents was undertaken to identify the main reasons why a technology is not currently widely adopted and why neither the private nor the public sectors are investing in it significant funds.

The priority Technologies Fact Sheets have been reviewed by the Sectoral Working Groups (SWGs) and classified as various categories goods, for which private enterprises, government agencies, research institutes, community organizations, peasant farmers, their associations and others are potential consumers.

The Barriers' Analysis was carried out in steps, starting with the analysis of sectoral policies, programs and action plans in the light of the transfer of climate resilient technologies and support to resolve climate challenges in the Agriculture and Water sectors. During the analysis of barriers, policy documents, regulations of targeted sectors, research papers, technical reports of the relevant international development projects, other available information were studied, the main reasons hindering the introduction and dissemination of technologies selected at the previous stage being identified. For this, an appropriate questionnaire was compiled and a corresponding survey among the members of the SWGs was conducted, based on its results a long list of barriers was compiles.

In the next step, the SWG participants were again asked to evaluate and rank barriers in order of importance, followed by an online discussion with SWG members, which resulted in a list of key barriers.

Barriers to priority technology deployment and diffusion were identified in two categories:

i) Economic and Financial barriers; and
ii) Non-financial

To understand the main problems in the sector, a Logical Problem Analysis (LPA) was used, during which logical cause-and-effect relationships of interrelated elements and external factors were identified. Based on the results of a logical analysis, a Problem Tree was formed for each technology, which was used to understand the cause-and-effect relationships of barriers and their interrelations.

The next step in assessing barriers and enabling frameworks was to identify measures to facilitate technology transfer as actions that could be taken to improve technology transfer. The process of identifying and describing measures to overcome barriers was also carried out using a survey of members of the SWGs based on a LPA.

Findings about the causality of barriers to technology transfer open up opportunities for interventions and realizing the economic and social potential of selected technologies. Through a logical analysis of the proposed actions for each priority technology, an Objectives Tree was constructed that helped to visualize the objectives for improving technology transfer. The proposed measures, in accordance with their economic profile and achievable effect, were discussed and agreed with the members of a respective SWG.

The implementation of each of the priority technology is associated with the actions of several regulations that affect the implementation of the technology. Brief information about this is presented in the section for each technology. In addition, the implementation of technologies is associated with financial and economic conditions. Financial and non-financial terms are also described for each technology. The market analysis for each technology was carried out using a "market mapping" approach. This approach helped to visualize the commercial and institutional environment for each of the technology market. The whole system was considered in the context of its three main components:

- Enabling business environment.
- Market players and connections, and
- Service providers.

The results of the LPA are presented in the corresponding texts of the Chapter 1 for Agriculture and Chapter 2 for Water sector, and the mapping of technology markets is presented in Annex I A for Agriculture and I B for the Water sector. The list of stakeholders involved into the analysis and their contacts is presented in Annex II for both Agriculture and Water Sectors.

The summary of identified barriers and measures to overcome them for the deployment and diffusion of priority climate-resistant technologies in the sectors of Agriculture and Water resources are presented in tab. 0.1 and 0.2 below.

Table 0.1. Identified barriers and measures to overcome them for the deployment and diffusion of the adaptation technologies in Agriculture Sector

Agriculture					
Sustainable Pasture Management (SPM)		***Organic Agriculture (OA)***		***Drip Irrigation (DI)***	
Identified Barriers	**Proposed measures**	**Identified Barriers**	**Proposed measures**	**Identified Barriers**	**Proposed measures**
Economic and Financial					
Lack of investment in sustainable pasture ecosystems	Development of a state program to preserve the fertility of natural pasture systems	Lack of investment in OA expansion	Investments for the development of OA through the new state program for OA aimed at creating a favourable environment for OA and subsidizing OA producers.	The high cost of DI equipment	Building our own plant for the production of DI systems is expected to reduce the cost of DI systems.
	Mobilization of international resources for the implementation of projects for the restoration of natural pasture systems		Using state reserve lands, it was proposed to support the initiatives of private owners using the mechanism of "public-private partnership" to create large land areas of the OA and new "organic aimaks"		Development of the development of the land market, which involves changing the legislation on land pledges for obtaining bank loans by farmers.
			Mobilization of international financial resources for the implementation of projects for the development of the capacity of the OA and financial support for farmers practicing OA.		In addition, it was proposed to mobilize international financial resources for the implementation of projects for the development of the capacity of DI and financial support for farmers.
Limited access to credit and necessary agricultural inputs for SPM	Continuation and expansion of the state agricultural financing program for pasture users	Limited access of OA producers to loans on acceptable terms	Access to credit resources will be improved through the land market development strategy, which involves changing the legislation on land collateral for obtaining bank loans.	Lack of concessional funding for farmers who need DI systems	It is proposed to attract investments for the development of DI and improve access to cheap loans through the development of an addendum to the state program “Financing of Agriculture”, aimed at supporting farmers who are going to install DI systems.
	Reducing interest rates on loans for pasture users			The energy dependence of some DI systems on the availability of electricity for water supply, which increases operating costs.	Where possible, the need for electricity for pumps should be removed by inclined DI systems using the terrain of the sites or solved by increasing investment in the creation of DI.
Decreasing productivity of pastures and livestock	Livestock regulation in grazing	Lack of equity capital for OA start-ups	Continuation and expansion of the state program "Financing of Agriculture" for lending at preferential interest to agricultural producers, highlighting them in		
	Reducing the number of unproductive animals and the transition to breeding				

Agriculture					
Sustainable Pasture Management (SPM)		*Organic Agriculture (OA)*		*Drip Irrigation (DI)*	
Identified Barriers	**Proposed measures**	**Identified Barriers**	**Proposed measures**	**Identified Barriers**	**Proposed measures**
	more productive breeds of livestock		a separate category of beneficiaries		
	Creation of cultural pastures in every community				
Non-financial					
Political, legal and regulatory					
Lack of state policy for pasture development	Development and adoption of the State program for the development and conservation of pasture lands	Lack and absence of a strategic policy document for the development of the OA	Development and adoption of the State Program for the development of agricultural crops with clearly formulated political goals and objectives for creating a favourable environment, allocating new areas for agricultural crops, as well as subsidizing agricultural producers.	Lack of DI development policy	Development of a strategy for improving water efficiency and water saving in irrigation, including DI.
Gaps in normative legal acts regulating the management and use of pastures	Adoption of legal acts on sowing degraded pastures	Gaps in technical regulations	Adoption/introduction of amendments to the legal documents on the requirements for the production process of OA, the criteria and procedure for certification of organic products of OA and the support of OA in general.	Gaps in technical regulatory documents on DI	Development of technical regulatory documents for the promotion of water efficient technologies, including DI systems. Such technical documents defining the use order, irrigation water quality requirements, use and loss norms would help the wider development of Di.
Institutional					
Uncertainty in the institutional organization of community-based pasture management	Strengthening the role and institutional status of PSUs and pasture committees at the legislative level	Lack of certification system and uncertainty with voluntary certification of OA products	Improving the transparency of the system of voluntary certification of organic products and finalizing the national standard in terms of implementation procedures using scientific developments and research results.	Lack of advisory and repair service	Integration into the list of today's RASs of the entire range of services for advisory assistance to farmers on field survey - calculation of the technical specification of equipment - places of purchase - training in use.
	Special support for pastoral communities during migration to distant pastures for integration into the early warning system for natural disasters.		Harmonize national and international standards for OA production.		As well as the development of DI service centres for the supply of spare parts and consumables and the repair of equipment based on existing private campaigns in the field.

Agriculture					
Sustainable Pasture Management (SPM)		*Organic Agriculture (OA)*		*Drip Irrigation (DI)*	
Identified Barriers	**Proposed measures**	**Identified Barriers**	**Proposed measures**	**Identified Barriers**	**Proposed measures**
	Establishment of the State Pasture Service for irrigation and reclamation construction in pastures, including pasture infrastructure		Equip laboratories and accredit the national organization to IFOAM.		
Market					
Lack of high-quality and affordable seed material of productive breeds of animals and pasture grasses	Revision and strengthening of the legal framework for seed production (regulations on seed and breeding farms) strengthening the link between science and production	Lack of organic seed and planting material	As part of the development process of seed and flame farms, launched by the state, to establish seed farms oriented to the OA market for the production of high-quality organic seeds and planting material to expand the areas of OA.	Lack of a production base for the manufacture of high-quality DI systems and spare parts	Construction of a plant for the production of DI systems, i.e. corresponding production base for DI, therefore, this is a real measure that will reduce the dependence of the Kyrgyz Republic on the import of components and spare parts.
	Strengthening the network of semkhozes (seed farms) for the production and propagation of seeds of pasture grasses and breeding farms to increase the breeding herd	Lack of quality control of imported seed material	Strengthen control over the import into the territory of the republic of GMO-containing seeds, the use of which is contrary to organic methods of agricultural production is constantly growing. Introduce customs duties on such materials.	Lack of a supply chain of quality spare parts in all regions	The creation of service centres for DI and a network of sales of spare parts covering all regions will make it possible to overcome this barrier.
		Difficulties in marketing OA products	Expand marketing services and promotion of healthy eating based on organic products, make regular advertising campaigns, fairs of organic products already voluntarily certified in the Kyrgyz Republic to develop a catalogue of OA products and manufacturers and place it on Internet resources and social networks. Expand the local organic trade network.		
Human management skills					
Lack of pasture improvement practices (pasture rotation, reseeding, irrigation, afforestation, etc.)	Creation of seed funds for growing seeds of natural	Lack of knowledge and practical skills among eco-	As measures to overcome this barrier, the process of increasing the institutional and individual potential, carried out by the	Lack of knowledge and practical skills of agricultural business entities on	Increasing the capacity of RAS users and DI service centres to increase the culture of operation and

Agriculture					
Sustainable Pasture Management (SPM)		*Organic Agriculture (OA)*		*Drip Irrigation (DI)*	
Identified Barriers	**Proposed measures**	**Identified Barriers**	**Proposed measures**	**Identified Barriers**	**Proposed measures**
	pasture grasses and reseeding seeds of natural pasture grasses	nomic entities of agriculture for the production of organic products	FOD "BIO.KG" and the PF "Bio Service" within the framework of the mobilized resources of international projects, will be expanded, taking into account the development of farmers' skills in marketing and financial management. number of major barriers. In addition, educational and methodological materials on OSH will be developed to connect to the process of capacity building of the RAS. Training modules on OA will be integrated into the curriculum of KNAU.	the proper operation of DI systems	knowledge of the rules and regularity of maintenance is also proposed to conduct regular information campaigns on the best DI practices.
	Creation of artificial glaciers to solve water supply issues	Insufficient use of biological plant protection products and organic fertilizers by economic entities of agricultural enterprises,	To overcome this barrier, the production of organic fertilizers and biological plant protection products will be expanded in all regions of the country and information and training campaigns will be held on the rules and norms for their use.	Lack of technical expertise to install and maintain a drip irrigation system	Special trainings and programs to expand the technical expertise and professional development of professionals will be developed and conducted regularly.
	The use of electric fences for pasture rotation				
	Pasture irrigation				
	Creation of afforestation on pastures				
	Improvement of pasture infrastructure				
Low PC capacity for SPM and limited knowledge of current PLM tools	Improving the technical capacity of pasture committees on modern tools for climate change resilience SPM				
	Development of improved long-term pasture management plans and an annual pasture use plan (including a pasture turnover mechanism)				
	Development of an electronic application for live-				

Agriculture					
Sustainable Pasture Management (SPM)		*Organic Agriculture (OA)*		*Drip Irrigation (DI)*	
Identified Barriers	**Proposed measures**	**Identified Barriers**	**Proposed measures**	**Identified Barriers**	**Proposed measures**
	stock breeders with databases on the state of pastures				
Lack of a unified system of permanent monitoring of the state of pastures and data	Annual evaluation of pasture productivity, maintenance of databases by years (PC)				
	Development of a unified monitoring system and databases at all levels of management				
	Carrying out land management of pastures with the transfer of data from the PUA and PC				
Social					
Lack of integration of gender equality aspects in pasture management systems	Developing tailored programs and exceeding the capacity of national and local stakeholders on gender equality in rural development, livestock and SPM	Significant not identified	Not defined	Significant not identified	Not defined
	Integrating gender into local development planning and long-term pasture management plans				
	Carrying out information events for women and youth of local communities about modern technologies of Agriculture and SPM				
Barriers to Networking					
Weak cooperation and coordination of stakeholders at the local level	Strengthen the relationship between the aiyl okmotu (seluprava), forestries, WUAs and pasture committees on the management and use of pasture re-	Weak coordination and support of stakeholders at the state level for the development of the CA.	In order to strengthen, coordinate and involve local state administrations, local governments, as well as research institutions and business communi-	Significant not identified	Not defined

Agriculture					
Sustainable Pasture Management (SPM)		*Organic Agriculture (OA)*		*Drip Irrigation (DI)*	
Identified Barriers	**Proposed measures**	**Identified Barriers**	**Proposed measures**	**Identified Barriers**	**Proposed measures**
	sources through the implementation of joint projects and holding coordination meetings. Monitoring the activities of PUAs and PCs to identify PSAs and PCs requiring state support and development of relevant projects/applications.		ties in the process of development of the OA from the implementation of the tasks of organic agricultural production, meetings will be held regularly meeting of the Coordinating Council for the Development of Organic Agricultural Production under the Government of the Kyrgyz Republic. The DOA will become the working secretariat of the council and will prepare materials to accelerate the expansion of the DOA as a competitive advantage of the Kyrgyz Republic in the region and monitor the implementation of the decisions taken by the council.		
Information and awareness barriers					
Lack of seasonal agrometeorological forecasts for pasture users and communities	Increase the technical capacity of Kyrgyzhydromet to develop seasonal agrometeorological forecasts and disseminate through channels available to local self-governments, PUAs and farmers	Insufficient scientific capacity for advisory support on OA.	The subject of OA will be included in the Plans of scientific work of the relevant institutions to develop appropriate recommendations on the best practices of OA, as well as to form a scientific basis for the harmonization of national and international standards of OSH. The process of developing teaching aids for educational institutions and practical guides, training materials and visual materials on agricultural technology and agroecology for the training of advisory services and farmers will be intensified. The Organic Aimak initiative will continue.	Low awareness and awareness of the benefits and importance of developing DI as a water efficient technology.	Development of communication products and information campaigns on water efficient technologies in the media and social networks, especially at the local level, with the presentation of quantitative data on the benefits of using DI, especially for new perennial plantations.

Agriculture					
Sustainable Pasture Management (SPM)		*Organic Agriculture (OA)*		*Drip Irrigation (DI)*	
Identified Barriers	**Proposed measures**	**Identified Barriers**	**Proposed measures**	**Identified Barriers**	**Proposed measures**
Lack of scientific research and data on climate impacts on pastures and animals	Strengthening scientific potential through exchanges and conferences, including international ones, as well as strengthening the regulatory framework of scientific institutions	Low awareness and awareness of the OA, its benefits and the importance of development in the KR	To address these issues, a number of communication products will be developed and a number of information and promotional events will be held to promote OA products using the media, Internet resources and social networks. On the basis of the FOD "BIO.KG" an online community of practices will be created, where farmers and entrepreneurs themselves will discuss the problems of introducing OA practices.	Lack of information about modern high-tech DI systems	Creation of trade and information platforms, preparation of information products, and holding promotions on high-tech DI systems.
Lack of climate awareness and adaptive knowledge of government officials, local authorities and users on sustainable pasture management	Publish popular materials on the impact of climate change on pastures and climate-resilient adaptive pasture management				
	Develop training programs and increase the capacity of LSGs on climate-resilient pasture management				
	Develop area-specific training programs and build the capacity of farmers for climate-resilient pasture management				
	Develop training programs on SPM in the context of climate change for universities				
Lack of information on modern technologies for SPM	Develop and publish popular information packs on climate resilient SPM practices	Lack of information on current OA technologies	The complex nature of the OA technology, integrating a whole set of techniques and approaches of agricultural production based on agroecology, will also receive wide information support both from the scientific and educational institutions of NGOs, and from business - manufacturers, importers and dealers of the corresponding equipment for OA.		
Others: Environmental					
Continued pasture degradation	Development and maintenance of a cadastre for	Decreased soil fertility	This barrier will be overcome by the development of schemes	Lack of clean water sources	Kyrgyzstan has a significant number of mothballed wells that are

Agriculture					
Sustainable Pasture Management (SPM)		*Organic Agriculture (OA)*		*Drip Irrigation (DI)*	
Identified Barriers	**Proposed measures**	**Identified Barriers**	**Proposed measures**	**Identified Barriers**	**Proposed measures**
	monitoring degraded lands and ensuring access for PUAs		for soil fertilization with organo-mineral fertilizers based on individual fields. For this, the Republican Soil-Agrochemical Station will be involved, which will conduct surveys of all agricultural lands intended for agricultural land.		now being rehabilitated by the communities themselves. It is proposed to continue this practice in order to expand the use of DI. In addition, as a cheap measure, it is possible to provide for the creation of sedimentation tanks for turbid water.
	Development, publication and dissemination of materials to combat land degradation				
	Development of Land Degradation Guidelines and regular capacity building courses for PUAs and pasture users				
	Development/revision and approval in the PMP of sections on grazing rotation by plots in the Pasture Management Plans.				
Growing vulnerability of livestock and pasture ecosystems to adverse impacts of climate hazards	Strengthening the work of veterinary services and the range of veterinary preparations.				
	Development of mechanisms and implementation of climate risk insurance				
		Others: Small scale of current production farms			
		Small-scale farm production OA	Currently, the Ministry of Agriculture is developing a concept for the development of the land market, where one of the directions has already been announced is the consolidation of agricultural land. As expected, as a result of its implementation, a number of farms with large land plots will appear, where it will become possible to carry out zero tillage and organize crop rotation.		

Table 0.2. Identified barriers and measures to overcome them for the deployment and diffusion of the adaptation technologies in the Water Resources Sector

Water Resources					
Energy- and resource-saving drinking water supply systems from surface water sources using local materials (ERSDWSS)		***Energy-efficient pumping stations for irrigation (EEPS)***		***Subsoil irrigation based on the closed drainage by sub-soil irrigation method (SSI***	
Identified Barriers	**Suggested measures**	**Identified Barriers**	**Suggested measures**	**Identified Barriers**	**Suggested measures**
Economic and Financial					
Lack of financial resources: donor and national investment	Improving investment policy Increasing the capacity of SAACU, DDWSS to prepare project applications to various funds	Lack of financial resources: donor and national investment	Carrying out policy, contributing to the attraction of financial resources for energy-saving electric units	Lack of financial resources: donor and national investment	Attracting investments, increasing the volume of allocation of financial resources from the Republic of Belarus
Low tariffs of drinking water suppliers	Adoption of tariffs for the supply of drinking water adequate to the costs incurred for the operation of systems and taking into account inflation and development opportunities as well as payment method population Explanatory work with LSG bodies, the population Capacity Building of Local Kenesh Members	Lack of economic analysis works of pumping stations.	Capacity building by conducting training for service personnel	The high cost of purchasing, installing a set of equipment and its operation	Forming a policy that promotes the development of local producers for the development of drip irrigation: providing incentives for the supply of imported equipment
Existing old debts of a number of municipal enterprises and organizations of drinking water supply and sanitation	Carry out phased write-offs of financial debts of WSS service providers accumulated from previous state-owned enterprises				
Insufficient level of accounting at enterprises and organizations of drinking water supply and sanitation	Improving the financial literacy of accountants, economists Training to work with the accounting 1 C Program in the field				
Non-financial					
Political, legal and regulatory					
Absence of a sectoral normative legal act on the regulation of tariffs in the sector of domestic and drinking water supply and sanitation.	Refinement and adoption of an industry-specific NLA on tariff regulation	Lack of financial resources: donor and national investment	Despite the measures taken by the GoK, due to a lack of financial resources, there is still a problem in providing irrigation	The absence of the State program on economical and rational management of water resources	Development and adoption of the State Program for the economical and rational use of water resources in connection with climate change

Water Resources					
Energy- and resource-saving drinking water supply systems from surface water sources using local materials (ERSDWSS)		*Energy-efficient pumping stations for irrigation (EEPS)*		*Subsoil irrigation based on the closed drainage by subsoil irrigation method (SSI*	
Identified Barriers	**Suggested measures**	**Identified Barriers**	**Suggested measures**	**Identified Barriers**	**Suggested measures**
			water, there are no opportunities to modernize pumping stations with new electric units		
Most of the DWSS systems, after restoration and new construction, were transferred to the ownership of RCADWC, which are unstable	Studying the results of the implementation of the pilot project in the a / a of the Naryn region PKM No. 713 dated 12/26/2022	Lack of economic analysis of work researcher	It leads to the inability to evaluate the performance of the p.s.	The regulatory legal framework of the sector does not provide for incentives for the use of efficient irrigation technologies	Introducing amendments and additions to the regulatory legal acts regarding the provision of benefits when using efficient irrigation technologies
Lack of a license to develop deposits of salt, quartz sand	Introducing an amendment to the Law "On Subsoil" in Article 35. P. 3.	Lack of incentives aimed at saving electricity	Doesn't help reduce power consumption		
Absence of the Act on the allocation of land for the construction of micro-hydro power plants	Development of a regulation on the allocation of water fund lands for micro hydroelectric power plants for the DWSS sector	Lack of economic analysis of worker searcher	It leads to the inability to evaluate the performance of the pumping stations.		
Outdated building codes and maintenance standards	Conducting an analysis existing SNIP for their renewal				
The regulatory legal framework for the drinking water supply and sanitation sector is outdated	Analysis and evaluation of legal acts in the field of DWSS				
Institutional					
Insufficient number and qualification of personnel in the SAACU system	Pursuing a unified comprehensive policy and improving the coordination of actions of state bodies and local self-governments	Lack of qualified engineering and management personnel, as well as locksmiths, electricians	Organization of permanent courses to improve the potential of mechanics, electricians at the regional level.	Lack of studies on the areas of possible application of this technology	Conducting research on the possibilities of using this technology in the Republic with the development of recommendations
Unresolved institutional issues. Frequent reorganization of the industry	Pursuing a unified comprehensive policy and increasing the coordination of actions of state bodies and local self-governments		Analysis of the prospects of creating a Marketing Service under the Ministry of Agriculture of the Ministry of Agriculture		
	To study the issue of the feasibility of creating the Republican State Enterprise "Kyrgyztazasuu" for DWSS				
Market					

Water Resources					
Energy- and resource-saving drinking water supply systems from surface water sources using local materials (ERSDWSS)		***Energy-efficient pumping stations for irrigation (EEPS)***		***Subsoil irrigation based on the closed drainage by subsoil irrigation method (SSI***	
Identified Barriers	**Suggested measures**	**Identified Barriers**	**Suggested measures**	**Identified Barriers**	**Suggested measures**
Lack of local manufacturers for the production of electrolysis plants for the production of sodium hypochlorite	Establishment of a policy that promotes the development of local manufacturers of electrolysis plants	Lack of local manufacturers for the production of electric pumps	Market Research for Energy Efficient Pumps in order to acquire the most reliable in operation	Lack of local manufacturers for the production of polyethylene pipes and flexible nylon hoses	Formation of policies that promote the development of local producers
Lack of local manufacturers of solar panels for mini hydropower plants	Formation of policies that promote the development of local manufacturers of solar panels				Implementation of sustainable public-private partnership business models (outsourcing)
	Implementation of sustainable business models through the implementation of the Public-Private Partnership (outsourcing) model				
Human skills					
Lack of qualified engineering and management personnel, as well as locksmiths, plumbers and welders.	Implementation of the Vocational education Program and the Roadmap for its implementation	Low qualification of service personnel, the Central Office of the Water Resources Service and in the field	Organization of permanent courses to increase the potential of mechanics, electricians at the regional level	Lack of qualified personnel for design and maintenance	Increasing the capacity of universities in the field of irrigation and HME, WRS, MOA
Lack of teachers and insufficient qualifications of teachers for the design, operation of systems	Increasing the capacity of colleges, universities in the field of air defense				
Lack of benefits for admission to universities for the specialty water supply and sanitation, high school exams passing score for applicants	Lowering the school exams score threshold for admission to a university in the direction of DWSS				
Network					
Conservative thinking of designers, managers	Informing about good practices and examples	Conservative thinking of managers.	Preference is given to brands of pumping units installed earlier	Not identified	No identified
	Studying and informing about good practices				
Conservative thinking of designers, managers	Informing about good practices and examples				
Information and awareness					
Lack of knowledge and information about the possibility of obtaining sodium hypochlorite from local salt deposits (in the	Increasing interagency cooperation on the possibilities of developing local deposits for drinking water purification: SAACU, MNRETS, etc.	Lack of knowledge and information about the possibility of reducing	Training of best practices for managers and operators	Lack of positive practices for the application of this Technology	Studying positive practice on re-application of this Technology in the region and raising awareness among farmers in the republic

Water Resources					
Energy- and resource-saving drinking water supply systems from surface water sources using local materials (ERSDWSS)		*Energy-efficient pumping stations for irrigation (EEPS)*		*Subsoil irrigation based on the closed drainage by sub-soil irrigation method (SSI*	
Identified Barriers	**Suggested measures**	**Identified Barriers**	**Suggested measures**	**Identified Barriers**	**Suggested measures**
Jalal-Abad region, in the Kochkor region, etc.),		electrical energy consumption by using energy efficient pumps			
Lack of knowledge and information about the possibility of obtaining the use of solar energy for electricity generation in the DWSS system	Increasing interdepartmental cooperation on the use of solar energy in the DWSS system: SAACU, MEC, MNRETS etc.	The Rules of the technical safety and operations for electrical installations in pumping stations are not followed up as appropriate. In accordance with which, maintenance personnel are obliged to develop and implement organizational and technical measures that should provide for a reduction in the cost of operating pumping stations.	Organization of permanent staff training p.s.: 1. Rules of technical operation 2. Development of organizational and technical measures operation		
	Studying and informing about the positive practices of solar energy production and application in the WWW sector				
Technical					
Lack of production control of water quality in most urban, municipal and rural water supply systems	Creation of a state enterprise for maintenance of air defense systems at the district level.	Lack of positive practices for the application of this Technology	Study of international experience in the application of this technology in order to prepare a pilot project	The need for construction/reconstruction of drainage and water supply systems (collector-drainage), sluice-regulators, etc.	Capacity Building of the Hydro reclamation Expedition of the WRS of the Ministry of Agriculture of the Kyrgyz Republic
	Organization of three production and one mobile laboratory of the Far East and Higher Educational Establishment for the production control of HP in rural areas			The need to carry out work to prevent possible clogging of subsoil humidifiers and perforations with debris, solid deposits	Capacity Building of the Hydro-reclamation Expedition of the SVR of the Ministry of Agriculture of the Kyrgyz Republic
Lack of positive practice of applying this technology in the Kyrgyz Republic	Studying foreign examples and informing for the preparation of pilot projects			High requirements for the size of solid particles - no more than 1.0 mm, water turbidity - no more than 0.05 g / liter	Organization of the monitoring system for solid sediments at sources

Water Resources					
Energy- and resource-saving drinking water supply systems from surface water sources using local materials (ERSDWSS)		***Energy-efficient pumping stations for irrigation (EEPS)***		***Subsoil irrigation based on the closed drainage by sub-soil irrigation method (SSI***	
Identified Barriers	**Suggested measures**	**Identified Barriers**	**Suggested measures**	**Identified Barriers**	**Suggested measures**
Others:					
Non-compliance with the regime of sanitary protection zones of rural water supply sources	Development and implementation of an interdepartmental mechanism for a selective study of the state of sanitary protection zones of sources of centralized DWS Application of articles of the Code of the Kyrgyz Republic On Administrative Law violation dated October 28, 2021 No. 128.	Interruptions in the supply of electrical energy to pumping stations	Consideration of the issue of construction of mini-hydropower plants for the work of pumping stations.	Not identified	Not identified

Introduction

Technology transfer has been a central element of the United Nations Framework Convention on Climate Change since the Rio Conference on Environment and Development in 1992.

Article 4 of the UNFCCC on Commitments of Member States provides the legal basis for all subsequent action on this topic. Art. 4.5 states that "Developed country Parties and other developed Annex II Parties shall take all practical steps to promote, facilitate and finance, as appropriate, the transfer of environmentally sound technologies and know-how to other Parties, especially Parties developing countries, or access to them, so that they can comply with the provisions of the Convention. In this process, developed country Parties support the development and strengthening of their own capabilities and technologies of developing country Parties. Other Parties and organizations in a position to do so, may also assist in facilitating the transfer of such technologies."[1]

At the same time, Art. 4.7 notes that "The extent to which developing country Parties will effectively implement their commitments under the Convention will depend on the effective implementation by developed country Parties of their commitments under the Convention related to financial resources and transfer of technology and will take fully into account that economic and social development and poverty eradication are the first and overriding priorities of the developing country Parties.."

Despite the relatively clear language contained in Art. 4, discussions on technology transfer have been very slow, with developing member countries calling for the full implementation of the provisions of art. 4, while the developed participating countries stressing the need to create an enabling environment in developing countries in order to unleash the full potential of cooperation activities and enable recipient countries to fully benefit from the transfer of environmentally sound technologies. In addition, the discussions looked at other elements such as the definition of "Technology Transfer" and, more importantly, the role of intellectual property law in facilitating or creating barriers to the effective transfer and deployment of climate-related technologies.

The impasse was broken in Marrakesh (7th Conference of the Parties to the Convention (COP), 2001), where the Parties agreed to establish an Expert Group on Technology Transfer and a so-called "Technology Transfer Framework" to stimulate cooperation between stakeholders on assessment of technological needs, technological information, creation of an enabling environment and capacities. The COP requested all Parties to create an enabling environment by removing barriers, promoting environmental regulation, protecting intellectual property rights and supporting technology transfer through export credit agencies or tax credits. Technology transfer activities were also mandated to be facilitated through financial, institutional and methodological activities, as well as project implementation.

The Bali Action Plan for Improving Implementation of the UNFCCC, agreed at COP 13 (2007), reaffirms the central role of technology transfer in the UNFCCC and calls for the first time for "effective mechanisms and strengthened means to remove barriers, and provide financial and other incentives for scaling up the development and transfer of technologies to developing country Parties to facilitate access to affordable, environmentally sound technologies." The Copenhagen Accord (COP 15, 2009) stated the need for a comprehensive "technological framework to accelerate the development and transfer of technologies in support of climate change adaptation and mitigation [...] based on a country-driven approach and [.. .] according to national circumstances and priorities",

COP 16 committed the Technological Mechanism of the convention to address seven main issues:

i) Low R&D and implementation capacity;

[1] https://unfccc.int/resource/ccsites/zimbab/conven/text/art04.htm#:~:text=5.-,The%20developed%20country%20Parties%20and%20other%20developed%20Parties%20included%20in,Parties%2C%20to%20enable%20them%20to

ii) Low level of introduction and dissemination of environmentally sound technologies;
iii) Low levels of public and private investment;
iv) Difficulties with soft/hard technologies for climate change adaptation and mitigation;
v) Inadequate observation systems for and information on climate change;
vi) Weak national innovation systems and technology innovation centres;
vii) Insufficient national technology planning capacity for mitigation and adaptation.

The technological mechanism of the convention today has a political body - the Technology Executive Committee (TEC), and an implementing body - the Climate Technology Centre and Network (CTCN).

At COP 17 (2011) in Durban, guidelines were approved for the selection of the host of the CTCN.

So far, 25 TEC meetings have been held. At the 25th Joint Meeting, TEC and CTCN reviewed the background paper for updating the Technology Needs Assessment (TNA) guidelines prepared by the Implementation Working Group and provided guidance, including an assessment of gaps in existing TNA guidelines, with a focus on the ability of national stakeholders to obtain access to financial resources for conducting TNAs; and the relationship between TNA processes and countries' Nationally Determined Contributions to the Paris Agreement.

Barriers and Enabling Framework Analysis Methodology

As well as for the technology prioritization stage, the analysis of barriers and enabling frameworks is carried out using the relevant Guidelines,[2]developed by UNEP and the Technical University of Denmark, which states that the main task of barrier analysis is to understand the nature of individual barriers and the relationships between them, to determine which barriers are important and which barriers are easier to remove. An adequate understanding of the barriers to the transfer and diffusion of climate technologies is key to creating an appropriate portfolio of measures to overcome them. Barrier analysis is not an exact science and a proper understanding of barriers can often be achieved by applying different approaches, or by combining the most appropriate elements of different approaches. The process that was carried out during this analysis in full compliance with the recommended procedure included the following steps:

1. Organization of the process. At this stage, the same organization of work was used, through meetings of the Sectoral Working Groups (SWGs) already formed at the previous stage of the project and verified online exchanges of information, questionnaires and preliminary results of the analysis. In addition, face-to-face meetings of national project experts with sectoral stakeholders were also held.
2. Identification of all possible barriers through literature review, surveys and brainstorming sessions of the SWG. In the course of the analysis of the literature (the list is given in the "Reference List" section of this report, as well as the online survey of members of the SWG and the general discussion at the third meeting (minutes are attached to the Report), a long list of barriers that prevent the implementation and dissemination of each of the priority technology was compiled.
3. Then, the project experts, together with the members of the SWG, refined the wording and screened the full list of barriers in order to select the most meaningful.
4. The classification of the key selected barriers into a hierarchy by categories was carried out on the basis of a systematic approach to the description and analysis of barriers and the

[2] Nygaard, I. and Hansen, U. (2015). Overcoming Barriers to the Transfer and Diffusion of Climate Technologies: Second edition. UNEP DTU Partnership, Copenhagen. This guide is available at https://tech-action.unepccc.org/wp-content/uploads/sites/2/2021/01/overcoming-barriers-to-the-transfer-and-diffusion-of-climate-technologies-2nd-edition.pdf

definition of measures and enabling frameworks, for each selected technology, which included the following:

a. Definition of preliminary objectives for the introduction and diffusion of technologies on an industry scale;

b. Description of the technologies and adaptive benefits and their categorization as a market or public good, as well their current status.

c. Identification of the most important barriers through interviews and discussions with SWG members, development of the analysis tools, including problems and objectives trees and market mapping and classification of barriers into financial and non-financial.

5. The next step in the process was the elaboration of measures, which was also carried out based on the survey of the members of the SWG proposals of measures to overcome barriers by turning barriers into solutions. The lists of appropriate measures to promote each priority technology was compiled, also identifying links between the various technological barriers in the sector will help to overcome the barriers and create an enabling environment for the development and successful diffusion of the selected technologies.

6. The evaluation of the costs and benefits of the measures to determine their relevance to the policy objectives was carried out by the national experts in close cooperation with the international consultants.

7. At the last stage, by exchanging the final list of measures, online consultations among the SWG members were again held and a set of additional measures was added to the programs.

8. The report thus compiled was sent to the project's international consultants, translated and sent also to the UNEP Copenhagen Climate Centre for comments. All recommendations received were duly integrated into the final report.

1. Agriculture sector

The goal of barrier analysis is to understand the market conditions for each of the selected technologies and to identify barriers to their deployment and diffusion.

The main steps in the barrier analysis were as follows:

1. Identifying all possible barriers by reviewing the literature, conducting interviews and/or brainstorming workshops
2. Formation of a long list of barriers in order to select the most significant
3. Classification of the main selected barriers with the construction of a hierarchy of categories.[3]

As a result of the work carried out on the TNA Report, three technologies were selected in the Water Resources sector as priority ones:

1. Energy and resource-saving drinking water supply systems from surface sources using local materials.
2. Energy efficient pumps for pumping stations of the Kyrgyz Republic"
3. Subsoil irrigation against the background of closed drainage by the method of subsoil irrigation.

This Chapter presents preliminary goals for the transfer and diffusion of prioritised technologies, analysis of the identified barriers. Based on an analysis of the relationship between barriers and possible solutions, some measures are proposed to help eliminate barriers, the resource requirements, strengths and weaknesses of each solution are assessed.

In preparing this section, the expert used the results of work with members of the Sectoral Working Group, guided by the document: "Overcoming Barriers to the Transfer and Diffusion of Climate Technologies"[4], as well as similar completed documents of such countries as Ukraine, Moldova, Azerbaijan, etc.[5]

The main goal of the first phase of the Technology Needs Assessment (TNA) project was to identify technology options in order to reduce Kyrgyzstan's vulnerability to climate change impacts and to ensure sustainable development. In the course of this work on the prioritization of adaptation technologies, the following main steps were taken:

- The organizational structure of the project was defined to involve stakeholders
- The consequences of climate change for the country's development priorities and strategies were determined
- Priority sectors and sub-sectors were identified, selection criteria being duly developed
- A set of technologies were identified as a high priority for climate change adaptation.

Within the first phase of the TNA in Kyrgyzstan, an assessment of technologies for adaptation of agriculture and water management to climate change was carried out. To this end, a broad process of engagement with key stakeholders was organized and two Sectoral Working Groups (SWG) were established, involving representatives from the government, academia, the private sector, farmers' and

[3]Haselip, J., Narkevičiūtė, R., Rogat, J. and Trærup, S. (2019) 'TNA Step by Step- A guidebook for countries conducting a Technology Needs Assessment and Action Plan'. UNEP DTU Partnership. Copenhagen, Denmark. Available at: https://tech-action.unepccc.org/wp-content/uploads/sites/2/2019/04/2019-02-tna-step-by-step-guide.pdf

[4] https://tech-action.unepccc.org/wp-content/uploads/sites/2/2021/01/overcoming-barriers-to-the-transfer-and-diffusion-of-climate-technologies-2nd-edition.pdf

[5]Ukraine Technology Needs Assessment for climate change adaptation barrier analysis and enabling framework. Report 2. June 2020 https://tech-action.unepccc.org/wp-content/uploads/sites/2/2020/06/baef-ukraine-adaptation.pdf

civil society organizations. Working session of the SWG were held to assure the quality of the results of the first stage of the TNA and their compliance with national development priorities and climate policy (NDC, National Communication, BUR).

As part of the TNA process, the following technology priorities were identified (Table 1.1).

Table 1.1. Priority adaptation technologies for the agricultural sector.

Agriculture	
Animal Husbandry	*Crop Farming*
1. Sustainable pasture management in the context of climate change	2. Organic farming
	3. Drip irrigation

The introduction of these technologies will require strengthening the policy framework through the development of supportive policies, laws, regulations and other instruments, as well as building institutional and human capacity to accelerate the adoption of these technologies. To do this, an analysis of existing gaps and barriers was carried out to improve the favourable conditions for their implementation and dissemination. This report is the second product of the TNA project.

In the third phase of the project, the collected recommendations for improving the deployment and dissemination of priority adaptation technologies in the agriculture and water sectors will then be consolidated into a Technology Action Plan (TAP). Then to mobilize financial resources to start its implementation, based on the TAP, the Concepts Notes for the GCF will be developed.

In the following, the barriers and regulatory frameworks for all selected technologies and the respective sub-sector contexts will be described in turn based on the findings of the scoping exercise using the relevant UNEP CCC Guidance.[6]

1.1 Preliminary Targets for Technology Transfer and Diffusion

Agriculture in Kyrgyzstan is the most important sector of the economy of Kyrgyzstan, the development of which is of key importance for the entire economy. In 2020, the share of agriculture, forestry and fisheries in the gross domestic product (GDP) of the Kyrgyz Republic was 13.5%. In the vast majority of regions of the country, this is the leading industry. Agriculture provides the population with basic food, thereby solving the problems of ensuring the food security of the state, the sustainability of the supply of food to the population.

20% of all employed citizens work in agriculture, 66% of the total population of the country lives in rural areas. At the same time, the poverty rate of the rural population in the Kyrgyz Republic in 2020 was 29.3%, which is significantly higher than the poverty rate of the urban population (18.3%).[7]

The existing acute problems and challenges dictate the need to address them in a timely manner, and determine the most effective ways to develop the agro-industrial complex of the Kyrgyz Republic, to create a competitive industry with high profitability that provides the country's population with basic food products. National Development Strategy for 2018-2040 determines that in the field of agriculture, the main policy is to provide the population of the Kyrgyz Republic with quality food and turn

[6] Nygaard, I. and Hansen, U. (2015). Overcoming Barriers to the Transfer and Diffusion of Climate Technologies: Second edition. UNEP DTU Partnership, Copenhagen.

[7] NSC. On the level of poverty in the Kyrgyz Republic in 2021 http://www.stat.kg/media/publicationarchive/9462883c-9dd6-4c33-9a95-2958a38c3ba2.pdf

the industry into a supplier of high-quality, environmentally friendly, organic products to the world and regional markets.[8]

The strategic goal of reforms in the agricultural sector declared there will be to ensure the national food security.[9]At the same time, at the state level, it marks the need to introduce a favourable regime for the import of agricultural technologies and innovations, machinery and mechanized means of production. In the context of climate change, the agricultural sector needs to apply adaptation measures, including the use of climate-resilient technologies.[10]

The basis of agriculture is the irrigated farming. Crop production on irrigated lands is the main consumer of fresh water in the Kyrgyz Republic. Taking into account the global trends associated with climate warming, forecasts of a decrease in fresh water reserves, and the uneven distribution of them across the country, the development of sustainable irrigation is especially important. Taking into account the need to adapt to the consequences of climate change, one of the important adaptation areas is the economical, rational and efficient use of available water resources. For that DI is one of the best solutions.

In order to accelerate the development of the market for organic products in the Kyrgyz Republic, the National Development Programme provides for the establishment of the appropriate legislative regulation and the need to introduce international standards for certification of organic produce. Additionally it provides to foster control over the import of chemical fertilizers, as well as to promote appropriate marketing activities.

The Action Plan of the Cabinet of Ministers of the Kyrgyz Republic[11] for the implementation of the above mentioned programme in Chapter IV "Economic Development Priorities" Section 4.3. "Green Economy Development" subsection "Agriculture and processing" highlights the following tasks and related measures concerning priority adaptation technologies:

1. The launch of the "Organic Products" program, which provides for the updating of the Law of the Kyrgyz Republic "On Organic Agricultural Production" to create appropriate legal conditions, the development of a Program for the Development of Organic Agriculture to create legal, economic and social environment for the development of organic agricultural production, as well as to develop the market for organic products within the country and for the export.
2. Technological modernization of the agro-industrial complex of Kyrgyzstan provides for the introduction of favourable conditions for the supply of agricultural machinery and mechanisms, equipment for drip irrigation systems and greenhouses, as well as the creation of conditions for the development of specialized agro-technical and veterinary service centres for farmers and the development of public-private partnership mechanisms for the development of breeding farms.
3. The task of ensuring the rational use of land resources provides for the introduction of the rotational use of pastures, the conservation of degraded pastures and the appropriate pasturelands monitoring by Pasture Committees, as well as geobotanical and soil surveys of pastures and the approval of a pasture cadastre.

[8] National Development Strategy of the Kyrgyz Republic for 2018-2040. Approved by Decree of the President of the Kyrgyz Republic dated October 31, 2018 UP No. 221.
[9] National Development Program until 2026 Approved by Decree of the President of the Kyrgyz Republic dated October 12, 2021 UP No. 435.
[10] Ibid.
[11] Action plan of the Cabinet of Ministers of the Kyrgyz Republic for the implementation of the National Development Program of the Kyrgyz Republic until 2026.DecreeCabinet of Ministers of the Kyrgyz Republic dated December 25, 2021 No. 352.

4. The task of providing irrigation includes the installation of wells and drip irrigation systems on 3000 hectares.

The Concept of Agricultural Development of the Kyrgyz Republic until 2026[12], defines four priorities for agricultural development, including the following:

1. Agro-industrial integration increasing the competitiveness of the agro-industrial complex, while ensuring food security.
2. Establishment of favourable conditions for the production and sale of agricultural products.
3. Improving the efficiency of land and water use, adapting agricultural production to climate change
4. Improvement of management and innovative development of the agro-industrial complex.

The major areas of agricultural land in Kyrgyzstan are geographically located in zones with an arid climate, while the water resources of Kyrgyzstan are unevenly distributed throughout the country. This requires the creation of a sustainable irrigation system, which, given the mountainous landscape and the high cost to construct and maintain water reservoirs and channels, creates a problem of sustainable financing needs and increases costs of crop farming. It is obvious that scarce public investment in capital construction and a high degradation of irrigation infrastructure (up to 25% of water losses during transportation), in the face of the adverse impacts of climate change, water use efficiency and water conservation come to the forefront as the main adaptation approach.

Therefore, the National Water Strategy until 2040[13] aims to create a sustainable system of water resources management in the Kyrgyz Republic for the benefit of present and future generations and identifies three priority areas for this:

1. protection of water resources from depletion and pollution;
2. rational use of water resources; and
3. reforming the water management system.[14]

Two State Programs represent the goals and objectives of the Water Resources sector: 1) The State Program for the Development of Irrigation of the Kyrgyz Republic for 2017-2026[15] and 2) The Program for the Development of Drinking Water Supply and Sanitation Systems in Settlements of the Kyrgyz Republic until 2026.[16]

The State Program for the Development of Irrigation underlines that in connection with the decrease in fresh water reserves that irrigation construction, the modernization of irrigation infrastructure, the introduction of water-saving technologies are important tools for adapting to global warming, as they solve issues of effective, rational and economical use of existing water resources for the needs of the country.

The Program for the Development of Drinking Water Supply and Sanitation defines the main directions and activities for the sustainable development of drinking water supply and sanitation systems, taking into account measures to minimize environmental impact, proactive response to existing and potential risks in the form of natural disasters and climate change, as well as provides for measures necessary for the appropriate monitoring and evaluation and taking steering action, if necessary. At the same time, it stress that strengthening the fight against climate change and increasing "climate" financing at the global level opens up new opportunities to attract resources in orders to improve the energy efficiency and environmental sustainability of drinking water supply and sanitation systems.

[12] A project developed by the Ministry of Agriculture of the Kyrgyz Republic.
[13] Approved by Decree of the President of the Kyrgyz Republic dated February 10, 2023 No. 23
[14] National Water Strategy until 2040
[15] Decree of the Government of the Kyrgyz Republic dated July 21, 2017 No. 440 was approved
[16] Approved by the Decree of the Government of the Kyrgyz Republic dated June 12, 2020 No. 330

In both programmes, it is noted that the introduction of advanced international technologies and the use of new materials to improve the quality and ensure a long service life of systems are of extreme importance.

Based on the analysis of the above-mentioned regulatory legal and policy documents, we emphasize that all technologies prioritized within the framework of the project contribute to the priority areas for the development of agriculture and water management in the Kyrgyz Republic.

At the same time, we single out the Decree of the President of the Kyrgyz Republic, stressing the need to create a mechanism for cooperation of the industry science and cluster production associations to improve farmers' access to innovation and ensure the deployment of modern technologies, including resource-saving technologies for agriculture.[17]

Thus, the following preliminary targets to promote priority climate adaptation technologies in agriculture were formulated:

1. Transformation of the current intensive grazing practice into the climate resilient SPM to sustain productivity of pastures and livestock;
2. Transition to OA production to support quality nutrition and livelihoods of rural households; and
3. Deploy and diffuse water efficient DI systems in the context of shrinking irrigation water supply during vegetation period.

1.2 Barrier analysis and possible enabling measures for Sustainable Pasture Management Technology (SPM)

1.2.1 Legal framework for pasturelands management

Natural pastures, as one of the categories of agricultural land, are owned by the state and are a type of agricultural land covered with grassy vegetation used as pasture for grazing livestock and for other purposes reflected in the land accounting data.[18]

Normative legal acts of state and local self-government bodies of the Kyrgyz Republic regulating relations in the field of management, improvement and use of pastures, except for pastures of the State Forest Fund, must comply with the requirements of the Land Code of the Kyrgyz Republic, as well as other regulatory legal acts of the Kyrgyz Republic.[19]

The pastures are under the exclusive ownership of the Kyrgyz Republic.[20]Pasturelands are a cornerstone of the nation’s wealth, therefore ensuring their rational and sustainable use is the most important task for the state.

Pasture management reform, which began with the adoption of the 2009 Law on Pastures, was based on three main principles:

1. Ecosystem approach, based on the fact that natural pastures consist of grazing systems that should remain unfragmented and managed using unified mechanisms. This approach led to a shift from a tenancy system, where people could acquire long-term use rights on a first-come, first-served basis, to

[17] Decree of the President of the Kyrgyz Republic "On measures to develop the agro-industrial complex of the Kyrgyz Republic" dated February 8, 2021 UP No. 25
[18] Law of the Kyrgyz Republic "On pastures" dated January 26, 2009 No. 30, Art. 2.
[19] Law of the Kyrgyz Republic "On pastures" dated January 26, 2009 No. 30, Art. 1
[20] Ibid. Art. 3.

a common ownership regime, in which rights to use resources are allocated to all users on an annual basis.

2. Devolution of management to the community level, i.e. from central to local government and resource users to improve management efficiency and provide access for local residents and

3. Introduction of payment for the resource through the establishment of fees for the use of pastures per head of livestock; this principle encourages both sustainable use and fundraising for investment.[21]

1.2.2 Institutional set up for pasturelands management

According to the Law of the Kyrgyz Republic "On Pastures", responsibility and control over the management of state pasture lands, in addition to the right of disposal, is transferred to local governments, which have the right to delegate the authority to manage and use pastures to associations of pasture users of local communities

Pasture Users Associations (PUA) is a public organization in the territory of local a self-government, which represents the interests of pasture users of the corresponding administrative-territorial unit in relation to the use of pastures. PUAs are established as bodies of territorial public self-government and are subject to state registration as legal entities by the judicial authorities.

The Executive Body of PUA is the Jaiyt Committee (Pasture Committee). The Pasture Committee (PC) consists of representatives of pasture users, deputies of the Local Kenesh (Parliament), a representative of the authorized body on environmental and forestry issues, heads of the executive body of local Self-Government. The PC manages the current activities of PUA. The tasks of a PC include:

- development of a community plan for the management and use of pastures;
- development of an annual plan for the use of pastures;
- implementation of the provisions of the community plan for the management and use of pastures and the annual plan for the use of pastures;
- pasture condition monitoring;
- issuance of pasture tickets in accordance with the annual pasture use plan, as well as the conclusion of agreements on the use of pastures for other purposes;
- determining the amount of the fee for the use of pastures with the obligatory approval of its Local Kenesh;
- resolution of disputes relating to the use of pastures, within its authority;
- management of income received from payment for the use of pastures and other resources directed as investments in pasture infrastructure, for their maintenance, management and improvement in accordance with the current legislation of the Kyrgyz Republic.

The use of pastures is carried out in accordance with the community Pasture Management Plan (PMP) and the Annual Grazing Plan (AGP) and is carried out on the basis of pasture tickets.

The representative body of local self-government approves PMP and AGP, as well as reports on their implementation. At the same time, the interference of state bodies and local state administration into the activities of local self-government bodies and pasture user associations on the use of pastures is prohibited.[22]

[21] Sara Robinson. Pasture Management in Central Asia: Results of the First Practical Conference on Promoting Sustainable Pasture Management in Central Asia. GIZ. FLERMONICA. 2015

[22] Law of the Kyrgyz Republic "On pastures" dated January 26, 2009 No. 30, Art.4.

The Ministry of Agriculture of the Kyrgyz Republic is defined by the Government of the Kyrgyz Republic as an authorized state body that implements a policy to regulate the use of pasturelands, which are the exclusive property of the Kyrgyz Republic. In this capacity, its competence includes:

- development of recommendations for the implementation of programs and legislation of the Kyrgyz Republic in the field of pasture use;
- determination of state standards and methods for assessing the monitoring of the state and quality of pastures;
- monitoring the implementation of programs for monitoring the state of pastures;
- development of standard provisions, instructions, rules and other regulatory legal acts, as well as methodological materials on pasture use;
- monitoring the application of community plans for the management and use of pastures by the association of pasture users and annual pasture use plans;
- providing technical and other support to local governments and Jaiyt Committees in the use of pastures;
- monitoring the use of pastures by pasture user associations.

As part of the central office of the Ministry of Agriculture of the Kyrgyz Republic (MOA), pasture management is handled by the Department of Pastures and Livestock Breeding (DPLB). The main purpose of which is the conservation and improvement of pasture ecosystems, their infrastructure, and animal genetic resources to solve the problems of food security of the Kyrgyz Republic. One of the main tasks of DPLB is the organization of sustainable management and effective use of pastures based on the active involvement of local communities.

Another important organization for the sustainable pasture management of the Kyrgyz Republic, a subordinate organization of the Ministry of Agriculture, is the Land Resources Service, which provides functions for the implementation of state policy in the field of land resources and land legal relations, registration of rights to real estate, geodesy and cartography, including ensuring uniformity in the application and observance of land legislation, the formation of a full-fledged geoinformation system for land resources, the implementation of topographic-geodesic, cartographic and land management works. The main task of this service is the implementation of state policy on land management and land legal relations, registration of rights to real estate, effective provision of services for land management, land cadastre, topography, geodesy, cartography, and promoting the development of the land and real estate market. The Land Resources Service is designed to provide the subjects of pasture management with cartographic materials and title documents for pasture use.

As part of the Service, the State Enterprise "State Design Institute for Land Management "Kyrgyzgiprozem" deserves mentioning, since it carries out land inventory and cartography, soil, agrochemical, geobotanical and other survey work, analysis of soil and plant samples, and also develops various projects for soil protection from water and wind erosion, against mudflows, landslides, flooding, waterlogging, drying up, compaction, salinization, pollution and reclamation of disturbed lands.

Another organization relevant for the sustainable pasture management of the Kyrgyz Republic is the Kyrgyz Research Institute of Animal Husbandry and Pastures, among the tasks of which we can single out the conducting scientific research and developing methods and technologies for improving natural pastures, breeding new high-yielding varieties of fodder crops and introducing the achievements of agrarian science into agricultural practice, as far as animal husbandry and fodder production are concerned.

Pasture management is impossible without ensuring the health of grazing livestock. To do this, there is the Veterinary Service under the Ministry of Agriculture of the Kyrgyz Republic, which performs the functions of state supervision and control in the field of veterinary safety and the implementation of state policy in the field of veterinary medicine, animal health, identification and tracking of animals,

ensuring veterinary sanitary and food safety. The purpose of the Service is to ensure the protection of public health from diseases common to humans and animals, epizootic well-being, veterinary, sanitary and food safety.

To represent, protect and promote the interests of pasture users of local communities at the national level, in 2016, several associations of regional associations of pasture users created the Association of Legal Entities "The National Association of Pasture Users "Kyrgyz Zhaiyty", which is a voluntary non-profit organization. To date, all 454 pasture committees of the country are its members.[23]

1.2.3 Pastures as a natural resource for the introduction of SPM

The formation and development of herbaceous communities in meadows and pastures are determined by the influence of soil and weather, relief, altitude, and the interaction of plant species, microorganisms, animals, and humans. All these factors are interrelated and constantly changing due to variations in the species composition and quantitative ratio of different species and groups. Plants on pastures change relatively quickly under the influence of various anthropogenic pressures, which can cause both positive and negative changes.[24]

The livestock and pasture subsectors play a key role in the Kyrgyz economy as they contribute 49% to agricultural GDP and provide vital ecosystem services, food security and nutrition, and contribute to poverty reduction and sustainable development.

Livestock is a key source of livelihood for households in mountainous rural areas of Kyrgyzstan. Rural households produce 98.5% of the country's gross agricultural output and nearly 90% of all livestock production.[25]At the same time, livestock serves not only as a source of income and food, but also as an airbag and a defence mechanism that can be relied upon in case of unexpected shocks and needs. Animal husbandry is especially important in mountainous areas where arable land is limited, the growing season is short and climatic shocks such as frost and drought are frequent. Extensive pasture grazing is the most appropriate form of agriculture in the harsh mountainous conditions of Kyrgyzstan.

Currently, animal productivity is generally low due to inefficient breeding and feeding practices. Large seasonal fluctuations in body weight of animals indicate that animal feeding is aimed more at keeping animals alive, and not at their commercial breeding. Farmers in Kyrgyzstan produce limited quantities of fodder and feed grains, mainly due to a lack of arable land, a lack of quality seeds and mechanization services, and the availability of natural pastures.

Due to the increase in temperature and the impact of other climatic events predicted for the pastures of Kyrgyzstan, pasture degradation is expected to increase due to anthropogenic factors.[26]

The problem of land degradation and desertification is not new for Kyrgyzstan. A country with an arid climate and a high bioclimatic potential, where from ancient times people settled along rivers and developed the surrounding lands for irrigation, used forest and planted gardens in the foothills and mountainous areas, and were fully engaged in seasonal transhumance in high mountain pastures.

The periods of desertification in the region of Central Asia that occurred in historical time as a result of climatic and/or anthropogenic causes are well known to science. Their study shows that in the contrast natural and climatic conditions of Kyrgyzstan, primarily associated with the provision of water

[23] http://www.jayit.kg/ru/
[24] New Perspectives in Forage Crops. 2018/ Atanas Sevov, Chtistina Yancheva and Yanka Kazakova. Sustainable Pasture Management. INTECH.http://dx.doi.org/10.5772/intechopen.72310
[25] GIZ. IFAD. FAO. 2021 Livestock and pasture sub-sector analysis for NDC revision in Kyrgyzstan. With. 9
[26] Ibid p.11.

and fertile soils, sustainable land use can only be ensured with a balanced (not exceeding critical loads) consumption of available resources.[27]

The growth of anthropogenic load in the last century, expressed in the development of new lands for irrigation, additional water intake for industrial and domestic needs, a significant increase in the number of animals and, accordingly, pasture load, all this, against the backdrop of climatic aridity, has led to a decrease and even loss of fertile soils, forests, land degradation, reduction of productive water resources.

Demographic growth also contributed to these phenomena, since it required a constant increase in agricultural production to provide food and, at the same time, an expansion of production to provide employment.

Pasture degradation and climate change lead to a decrease in pasture productivity, grass yields and livestock productivity. Old models of land use in the new conditions are no longer sustainable, which causes a decrease in income and living standards of the population.

In 2021, pastures occupied 9,003.71[28] kilohectares, which accounted for 85% of all agricultural land in Kyrgyzstan and 45% of the entire territory of the country. The area of pastureland is gradually decreasing and in the period 2000-2022, the reduction was 163 ha or 1.8% of the total pasture area.

At the same time, the number of livestock is constantly increasing for all grazing animal species. In 2022, the number of cattle increased by 88.3%, horses by 50.9%, and sheep and goats by 63.5% compared to 2006. Dynamics of change livestock is shown in fig. 1.1.

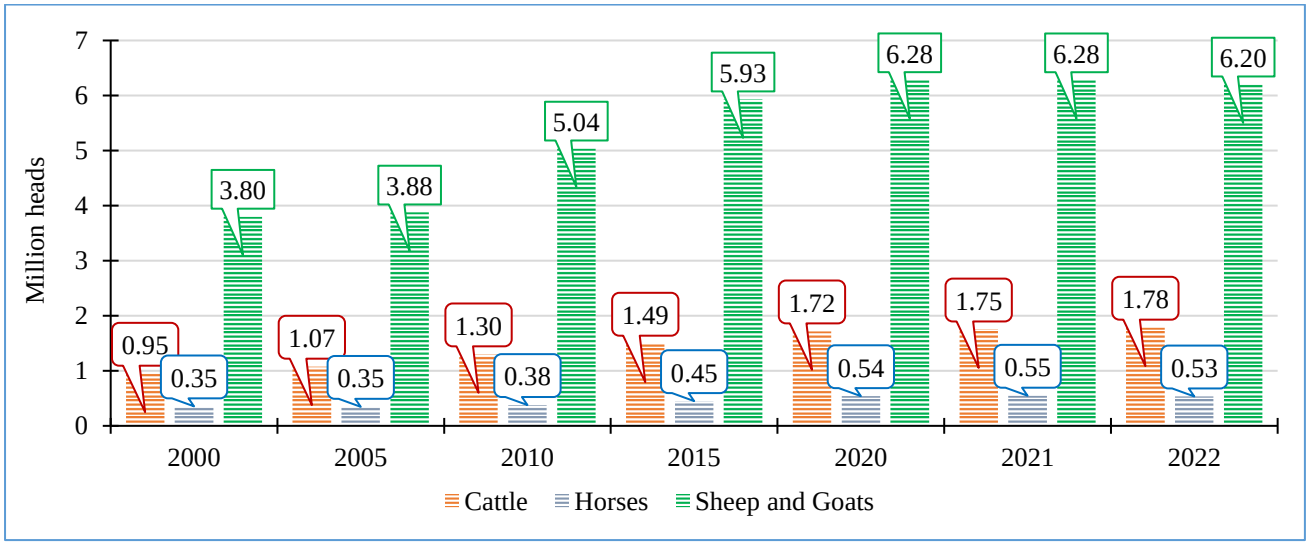


Figure 1.1 Dynamics of the livestock number in the period 2000-2022

The main drivers of livestock growth are low animal productivity, undiversified economy, low financial literacy, and traditional rural stereotypes that view livestock as a source of cash income and a means of accumulating savings.

The pastoral grassland ecosystem is trapped in a vicious cycle of declining productivity: overgrazing and degradation of pastures lead to lower levels of forage availability, which reduces animal vitality

[27] Andreeva Olga, Sebentsov Alexander, Kust German, Kolosov Vladimir. Study. Relationship between land degradation, climate change and migration in Central Asia. © UN Convention to Combat Desertification, 2022 © Institute of Geography of the Russian Academy of Sciences, 2022

[28] The State National Report on the status and use of the land fund of the Kyrgyz Republic as of January 1, 2021, approved by the Order of the Cabinet of Ministers of the Kyrgyz Republic dated May 16, 2022 No. 253-r

and productivity, forcing households to increase the number of animals to compensate for the decline in productivity, which in turn, increases pressure on pastures and leads to their further degradation. The reduction in average weight of an animal sold for meat also confirms that (fig. 1.2).

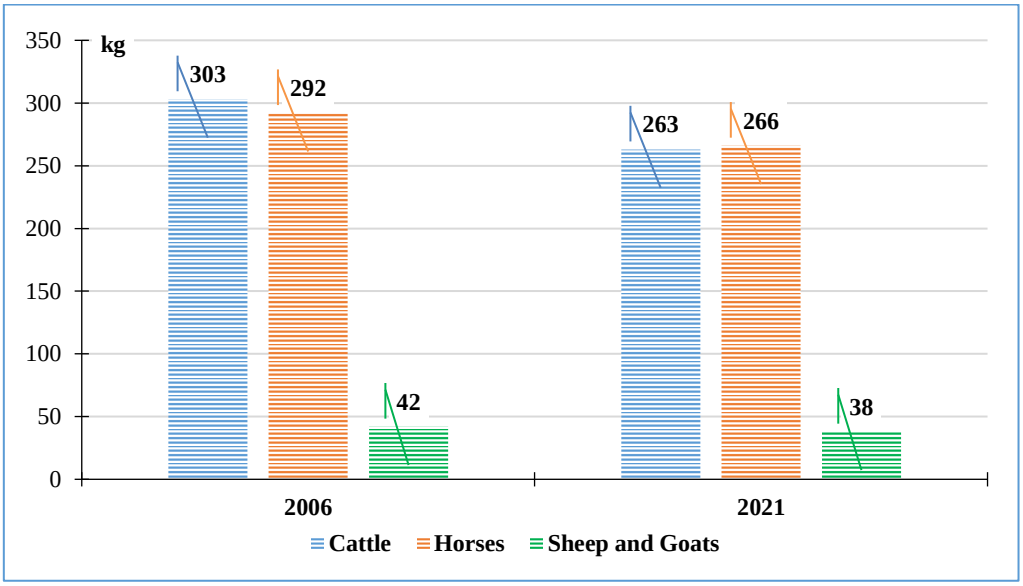


Figure 1.2. Change in the weight of a livestock head sold for meat.

According to the data of the Department of Pastures and Livestock Breeding of the Ministry of Agriculture of the Kyrgyz Republic, in 2016, all pastures of the country were distributed according to the seasons of livestock grazing, depending on the natural and climatic conditions of the regions and the existing practice of pasture use (see Table 1.2).

Table 1.2. Pasture areas by regions and grazing seasons.[29]

No.	Areas	Total pasture area, ha	Spring-autumn	Summer	Winter
1	Batken	590 430	251 997	127 576	210 857
2	Jalal-Abad	1 638 220	1 012 330	418 957	206 933
3	Naryn	2 591 286	707 355	1 157 368	761 563
4	Osh	1 397 651	55 581	975 536	366 534
5	Talassskaya	366 534	373 009	106 603	176 598
6	Issyk-Kul	1 413 301	248 258	839 942	325 101
7	Chuiskaya	762 783	268 309	315 489	178 985
Total		**9 030 890**	**2 916 839**	**3 941 471**	**2 168 690**

At the same time, in 2016 pasture productivity in dry matter mass was 420 kg/ha on spring-autumn pastures, 550 kg/ha on summer pastures, 270 kg/ha on winter pastures, and 1530 kg/ha on hayfields.[30] According to the State Design Institute for Land Management, Kyrgyzgiprozem, in 2016, winter pastures located near settlements, which account for 27% of the country's total pasture area, were in the lead in terms of degradation of 70%. Spring-autumn (or intensive) pastures, which occupy 30% of all pastures in the country, were degraded by 50%, and summer (distant pastures, which make up 43% of the area of all pastures in the country, were degraded by 36%.[31] However, according to the general

[29] Website of the Department of Pastures and Pedigree Livestock of the Ministry of Agriculture of the Kyrgyz Republic and the Agency for Hydrometeorology under the Ministry of Emergency Situations of the Kyrgyz Republic - https://sropasture.kg/info
[30] Ibid.
[31] Ibid.

recognition of the participants in the discussions at the meetings of the SWG, many statistical data on the pastures conditions at the country level are outdated.

The latest studies of pasture conditions using spectral indices based on Landsat satellite images and a digital elevation model conducted by IFAD, taking into account pasture types, grazing periods and altitude, as well as the results of field studies, showed a high level of degradation processes in all pastures. The results of the study in table. 1.3. show that large areas of grassland were moderately or severely degraded during the periods 2000-2004. and 2016-2020.

Table 1.3. Area of seasonal pasture use (ha) and percentage (%) of the total grazing area in this season according to the state of pastures in the period 2016-2020.[32]

Degree of degradation	Winter		spring		Summer		autumn	
	ha	%	ha	%	ha	%	ha	%
severe degradation	420 270	82.3	974 410	33.5	2 529 140	43.2	865 463	29.4
Average degradation	60 374	11.8	1 583 127	54.3	2 924 358	50.0	1 816 875	61.7
Without changes	28 828	5.6	352 074	12.1	394 405	6.7	260 937	8.9
Improvement	1 349	0.3	3 241	0.1	4 368	0.1	2571	0.1
Total	**510 821**	**100**	**2 912 852**	**100**	**5 852 271**	**100**	**2 945 846**	**100**

This study estimates that 94% of pastures (69,971 km^2 in total) have been degraded in at least one season (see Figures 1.3 and 1.4).

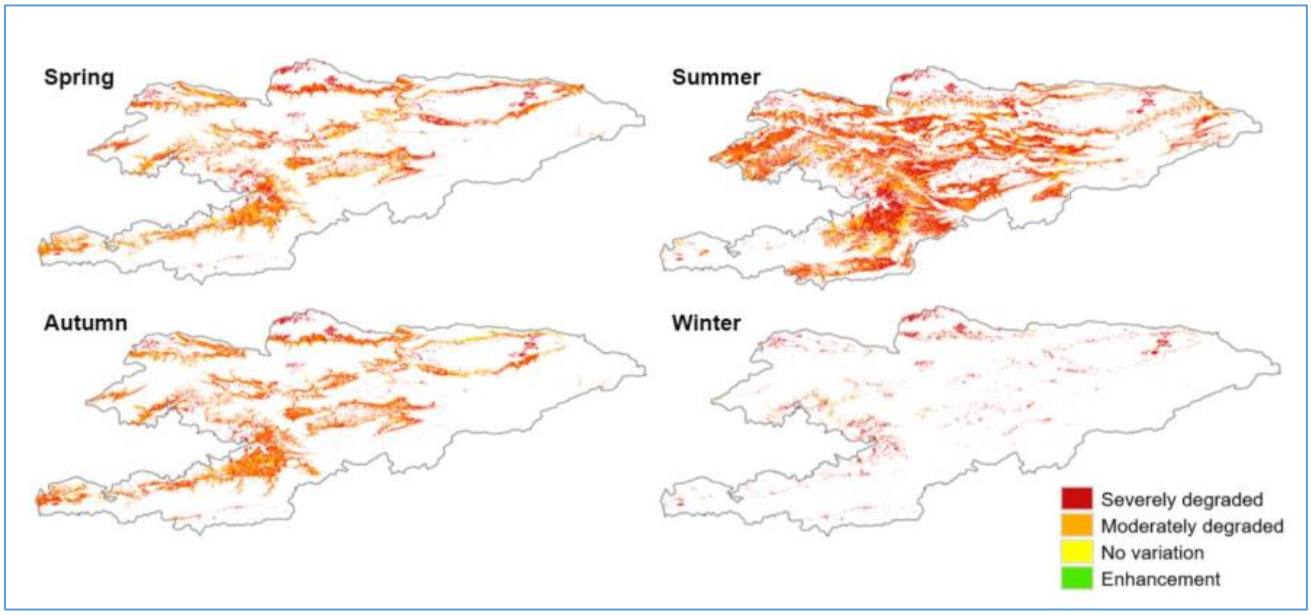


Figure 1.3. Maps of the pasturelands degradation in different seasons of the year.[33]

[32] International Fund for Agricultural Development. 2021. Technical Note: Pasture Conditions Maps.
[33] Ibid.

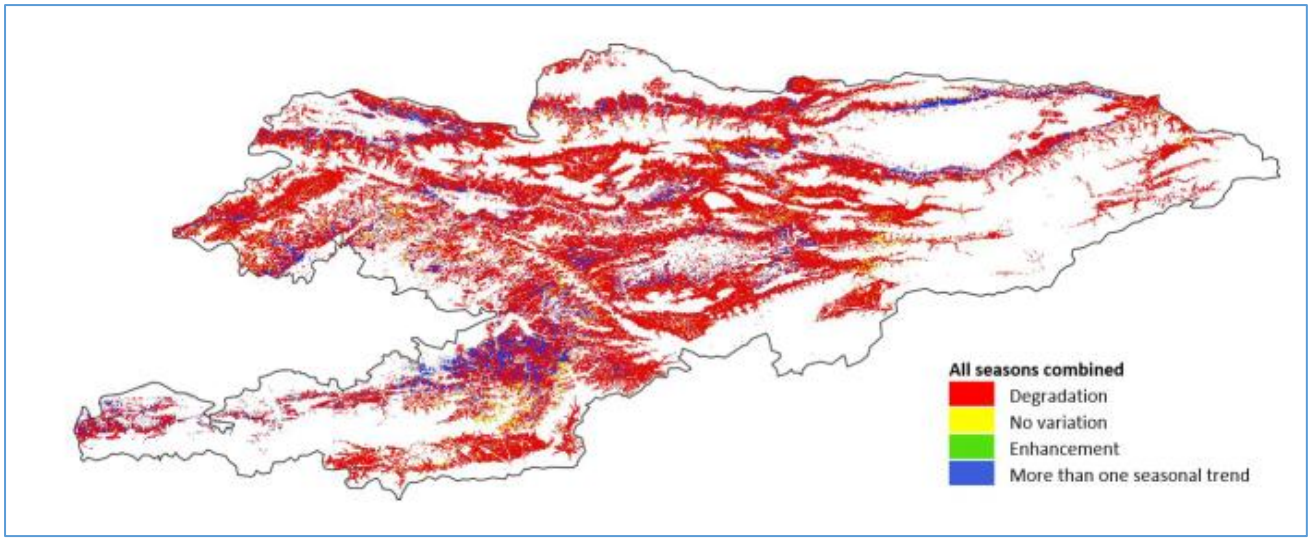


Figure 1.4. Combined map of the state of pastures during four seasons of the year in the compared periods of use in 2000-2004 and in 2014-2020[34]

In connection with climate change in the Kyrgyz Republic, manifestations of three main components of landscape changes are already noted - these are changes in the structure of irrigation-developed lands, changes in the structure of agricultural use of virgin lands in the semi-arid zone and changes in pasture lands both in arid and semi-arid conditions. These changes, in turn, determine the specific manifestations of the three main aspects of social vulnerability: food security, access to water resources (quantity and quality), and human health and well-being. Land degradation and climate change lead to a decrease in land productivity, a drop in crop yields and livestock productivity.

Traditional models of land use in the new conditions are no longer sustainable, which causes a decrease in income and living standards of the population. The critical ecological situation entails an increase in diseases, an increase in mortality, and a decrease in life expectancy. Ultimately, the population is forced to migrate to more prosperous areas. Other social impacts of landscape change include the loss of recreational and tourism areas, and therefore the loss of related incomes and jobs by local communities.

The system of community management of pastures based on old approaches, as practice shows, leads to a "tragedy of the commons", i.e. to the phenomenon described in economics and ecology, when common resources, access to which is not regulated or poorly regulated by formal rules or fees/taxes levied on the basis of individual use, tend to be depleted.

In general, the impacts of climate change on pastures interact with other pressures, leading to (further) degradation of pastures for grazing. This directly threatens the livelihoods and food security of rural communities. In addition, pasture degradation has a negative impact on the ability of soils to sequester and store carbon.

The NDC of Kyrgyzstan, adopted in 2021, aims to increase the adaptive potential of agriculture and strengthen the climate resilience of agriculture, and clearly highlights pastures and livestock among the measures. In addition, the NDC Implementation Plan includes specific measures to improve both the regulatory framework for a common approach to pasture management, pasture management tools and the development of related capacity and awareness of all stakeholders.

The Adaptation Plan for the Agriculture sector currently being developed also includes the measures proposed by the Department of Pastures and Livestock Breeding:

[34] International Fund for Agricultural Development. 2021. Technical Note: Pasture Conditions Maps.

1. Summarizing measures and technologies for adaptation to climate change by including them in the work plans of pasture committees (efficient use of pastures, improvement of pasture infrastructure, reseeding of drought-resistant plant varieties, watering pastures, etc.).
2. Creation and implementation of early warning systems for climate hazards and natural disasters, from local authorities to rural farmers, which will reduce the vulnerability of all segments of the rural population to increasingly frequent extreme weather events (heat, cold, frost, drought, mudflows and floods).
3. Improving knowledge management related to climate change.[35]

The technology "Sustainable pasture management" in the context of climate change involves reducing the vulnerability of the sector to the negative impacts of climate change.

1.2.4 General description of the SPM technology in the context of climate change

Sustainable Pasture Management (SPM) from a market perspective can be categorized as “other non-marketable goods” according to the criteria of the Barrier Assessment Guidelines[36]

SPM is a technology for adapting to climate change in the livestock sector. It helps maintain healthy soils and restore degraded pastures, with many benefits, including sustainable livestock production, reduced rural poverty, and increased resilience to major environmental challenges. Pasture degradation is already occurring to varying degrees and the aim of SPM should be to halt and restore degraded lands, prevent further degradation and ensure the continued health and functioning of pastoral ecosystems.

The livestock production system of the Kyrgyz Republic relies on livestock mobility as a key strategy to reduce risks and systematically manage pastures and water resources. Mobility allows livestock keepers to use the entire landscape, from valleys to high summer pastures, adding value to resources that would not otherwise be used. Mobility also allows them to respond to climate shocks and extreme weather events such as drought, heavy snowfall or rainfall and high winds. Measures that strengthen the pastoral system also strengthen its ability to respond to climate shocks.

Thus, the system of transhumance for pastures, which has developed in the Kyrgyz Republic, allows you to combine natural and economic systems, various seasonal pastures, and is the most important adaptation measure developed by the centuries-old experience of nomads. The natural and climatic conditions and pastures of Kyrgyzstan make it possible to keep livestock on pastures for almost half a year. This is the cheapest way to keep livestock. SPM is the most important technology of this system.

The use of this technology corresponds to the economic, social and environmental priorities of the country's development. They are aimed at ensuring food security, increasing labour productivity and implementing a strategy for diversifying the economy, increasing the weight of the agricultural sector in the economic system. Moreover, since the relevant Pasture User Associations and Pasture Committees are present in all 454 rural communities of Kyrgyzstan, which are home to 66% of the country's population, SPM is undoubtedly the most important technology for maintaining their livelihoods and employment. The technical description of this technology, developed at the first stage of the project, presents the following social and economic benefits of SPM, among which are the following:

- Strengthening the food security of the country, communities, households;
- Increasing the income of pasture users;

[35] https://sropasture.kg/info

[36] Nygaard, I. and Hansen, U. (2015). Overcoming Barriers to the Transfer and Diffusion of Climate Technologies: Second edition. UNEP DTU Partnership, Copenhagen. This guide is available at https://tech-action.unepccc.org/wp-content/uploads/sites/2/2021/01/overcoming-barriers-to-the-transfer-and-diffusion-of-climate-technologies-2nd-edition.pdf

- Improving the livelihoods of the rural population;
- Expansion of employment of the rural population;
- Reducing poverty in rural areas;
- Preservation of cultural traditions of the peoples of Kyrgyzstan;
- Strengthening social sustainability, unity and cooperation of various stakeholders of rural communities.

In addition, the spread of this technology will bring a number of environmental benefits, among which we note the following:

- Ensuring environmental sustainability and ecosystem services of pasture ecosystems;
- Restoration of biological diversity, including plant species;
- Preservation and improvement of soil fertility;
- Increase in biomass and vegetation;
- Increasing the sustainability of water sources (open and ground);
- Disaster Risk Reduction;
- Reducing greenhouse gas emissions.
- Absorption and conservation of carbon stocks in soils.

Discussions highlighted the following among the shortcomings of the introduction and dissemination of SPM technology:

- The technology will require social cohesion and consensus within the community to make consistent decisions that are respected by all pasture users.
- Sufficiently large capital expenditures for modern equipment and agricultural inputs and construction works.
- Low awareness of stakeholders about modern SPM techniques.
- Insufficient capacity of most PUAs and PCs for SPM.
- Lack of training materials on many aspects of pasture management and use and extension services.

From an adaptation point of view, climate resilient pasture management as a combination of Ecosystem-Based Adaptation (EbA)[37], in turn, is an integral part of solutions based on nature. Thus, PSM encompasses, in addition to improving the management of these critical natural resources, also nature-based solutions (NbS) - defined as actions to protect, sustainably manage and restore natural or modified ecosystems to address the challenges facing society while ensuring well-being people and the conservation of biodiversity are critical to sustainable development.[38]The sustainability, cost-effectiveness, and scalability of NbS make them one of the best tools available to deliver the necessary transformational change to address climate change.

The efforts of all stakeholders in Kyrgyzstan, including those with international support, are obviously not enough, because pasture degradation remains a critical obstacle to the sustainable development of livestock while preserving pasture ecosystem services. The ongoing degradation of pastures points to the existence of barriers to an effective technology transfer and dissemination mechanism for SPM. Therefore, it is necessary to respond appropriately to solve the problems associated with the transfer and dissemination of technologies. These barriers are often complex and require a systematic and careful approach to address them.

[37] As defined by the UN Convention on Biodiversity, EbA is "the use of biodiversity and ecosystem services as part of an overall strategy to help people adapt to the adverse effects of climate change". UNEP-WCMC and UNEP, 2019 Ecosystem-based Adaptation Briefing Note Series 1

[38] IUCN (2020). Global Standard for Nature-based Solutions. A user-friendly framework for the verification, design and scaling up of NbS. first edition.

1.2.5 Identification of barriers for the SPM technology in the context of climate change

In order to identify barriers, before the Joint Meeting of the Sectoral Working Groups on Agriculture and Water Resources (held on April 19, 2023), a study was conducted that included several research methodologies: a review of policy documents, technical literature, including publications of international projects, two rounds of an online survey members of the sectoral working groups (the first on collecting barriers and the second on determining the importance of barriers) and direct interviews with various stakeholders. During the consultations, a list of all the major barriers that will have to be faced in the transfer, implementation and dissemination of SPM technology was prepared and discussed. In accordance with the results of discussions by stakeholders, 31 barriers were identified, of which they were ranked as important,

1.2.5.1 Economic and financial barriers

Economic and financial barriers that affect the level of investment in SPM-related activities influence the deployment and diffusion of best practices for sustainable pasture management. The following are the most significant economic and financial factors hindering technology transfer and the diffusion of SPM:

As a result of the analysis of documents, surveys and interviews with stakeholders, the following economic and financial barriers were identified:

- Lack of investment in sustainable pasture ecosystems. The low standard of living of the rural population and the lack of understanding of the economics of land degradation among pasture users, on which the economic opportunities of the Pasture Committees (PCs) of local communities depend, make it impossible to invest in the conservation of soil fertility and pasture grass communities.
- Decreasing pasture productivity caused by another category of barriers, namely the degradation of natural pastures, becomes an obstacle to the introduction of SPM, since the only response to this barrier has been the short-sighted practice of increasing the number of livestock, which further reduces the productivity of pastures. Permissible grazing rates, even fixed by the relevant regulatory legal document, are not observed for a number of reasons that need to be addressed for the introduction of SPM.
- Lack of access to credit and necessary agricultural inputs for SPM. This financial barrier reflects the nature and characteristics of the financial and credit system that has developed in Kyrgyzstan in the conditions of the prevailing small-scale production, a huge number of small peasant farms and the high cost of credit resources. In such circumstances, the state is implementing the "Agricultural Financing" program by investing in lower interest rates for farmers. However, only 2-3% of the country's farmers have enough of these resources.

1.2.5.2 Non-financial barriers

In addition to economic and financial barriers, barriers related to politics, the market, governance, human resources, information and awareness, and the environment were also identified. Among the non-financial barriers, we can single out the following categories:

- *Policy, legal and regulatory barriers:*

- Lack of state policy for pasture development. Despite the importance of pasture management for the ecology, national economy and food security of Kyrgyzstan, the latest strategic document on pastures[39]ended in 2015 and was no longer developed.
- Gaps in normative legal acts regulating the management and use of pastures. Among the gaps in the regulatory framework, we note the existing controversial issues on the boundaries of pasture lands of local communities, the lack of guidelines for assessing pasture productivity, and non-compliance with livestock grazing standards.

- *Institutional*
  - Uncertainty in the institutional organization of community-based pasture management. The weak institutional capacity of most PUAs and PCs is related to the ambiguity of their relationship and integration into the system of local governments, both in terms of accountability and operational activities. The legal status of PUAs and PCs continues to be subject to varying interpretations and controversy, and hinders the introduction and expansion of SPM.
- *Market conditions*
  - Lack of high-quality and affordable seed material of productive breeds of animals and pasture grasses. The available seed material offered by seed and breeding farms does not inspire the confidence of most pasture users in terms of quality, and the material of foreign companies is not affordable.
- *Human management skills*
  - Lack of pasture improvement practice (pasture rotation, reseeding, irrigation, afforestation, etc.).The issue of improving the condition of pastures, judging by the increase in the area of their degradation, is not a priority. All other pasture improvement techniques are implemented only within the framework of international projects.
  - Low PC capacity for SPM and limited knowledge about modern SPM tools. Personnel shortage is clearly present at the PC level, as well as the introduction and dissemination of modern pasture management tools - electronic Pasture Committee, electric shepherd, yield monitoring both on the ground and using GIS technologies. Irrigation of pastures and the creation of protective forest plantations are also demonstrative in nature and are not being introduced into the broad pasture management practice.
  - Lack of a unified system of continuous monitoring of the state of pastures and data.
- *Social*
  - Insufficient integration of gender equality into SPM. Women are underrepresented in pasture management bodies, which means they do not participate in relevant decision-making. There is also a gender gap in professional knowledge in agriculture and pasture management. Access to many technologies for women is also limited, both due to a lack of financial resources and due to the uneven distribution of rural women's time budget.
- *Network*
  - Weak cooperation and coordination of stakeholders at the local level. These barriers are associated with poor interaction between public associations of pasture users and their Pasture Committees with local self-government bodies, which often lead to misunderstandings, disputes and conflict situations. In addition, issues of livestock grazing in the territories of the State Forest Fund also lead to conflicts, since there is no coordination and a unified scheme for pasture use on various categories of land at the local level.
- *Information and awareness barriers:*

[39] Pasture Development Program of the Kyrgyz Republic for 2012-2015. Decree of the Government of the Kyrgyz Republic dated 1 February, 2012 No. 89.

- Lack of seasonal agro-meteorological forecasts for pasture users. Insufficient technical potential of Kyrgyzhydromet and a limited observation network will not allow it to give long-term forecasts, which are especially necessary during the seasonal change in the location of livestock grazing, which maintains risks for pasture users during long-term distant pasture in the mountains.
- Lack of methodologies for assessing the vulnerability of pastures to climate change and developing adaptation measures. This barrier is associated with the lack of systematic observations of the impact of climate change on pastures and the lack of methodological approaches to assessing vulnerability and developing adaptation measures for pastures in tracts.
- Lack of climate awareness and adaptive knowledge of government officials, local authorities and users on sustainable pasture management. Insufficient information about the possible negative impacts of climate change and adaptation measures significantly reduces the adaptive capacity and increases the vulnerability of local communities.
- Lack of information on modern technologies for SPM. Despite some publications, there are no sufficient information resources in the Kyrgyz Republic and little work is being done to raise awareness of stakeholders about sustainable pasture management techniques and modern technologies. Possible for use in SPM.

- *Other barriers: Environmental*
  - Continued pasture degradation. In the course of discussions, many as a barrier that cannot be overcome in modern conditions regard this barrier. However, all participants in the discussions of the project have a clear understanding that this process should at least be stopped and support for the regeneration of pasture ecosystems should be started.

The key barriers identified based on the results of discussions with stakeholders and assessed by their importance are presented in Table. 1.4.

Table 1.4. Key barriers to the introduction and dissemination of SPM.

Categories	barriers	rate
Economic and financial		
1	Lack of investment in sustainable pasture ecosystems	5
2	Limited access to loans and necessary agricultural inputs for SPM	5
3	Decreasing productivity of pastures and livestock	5
Non-financial		
Policy, legal and regulatory		
4	Lack of state policy for pasture development	5
5	Gaps in normative legal acts regulating the management and use of pastures	5
Market conditions		3
6	Lack of high-quality and affordable seed material of productive breeds of animals and pasture grasses	
Institutional		
7	Uncertainty in the institutional organization of community-based pasture management	4
Human management skills		
8	Lack of pasture improvement practices (pasture rotation, reseeding, irrigation, afforestation, etc.)	5
9	Low PC capacity for SPM and limited knowledge of current PLM tools	5
10	Lack of a unified system of permanent monitoring of the state of pastures and data	3
Social		
eleven	Lack of integration of gender equality aspects in pasture management systems	3
Network		
12	Weak cooperation and coordination of stakeholders at the local level	3
Information and awareness		
13	Lack of seasonal agrometeorological forecasts for pasture users and communities	4
14	Lack of scientific research and data on climate impacts on pastures and animals	4

Categories	barriers	rate
15	Lack of climate awareness and adaptive knowledge of government officials, local authorities and users on sustainable pasture management	5
16	Lack of information on modern technologies for SPM	5
Others: Environmental		
17	Continued pasture degradation	5
18	Growing vulnerability of livestock and pasture ecosystems to adverse impacts of climate hazards	5

Logical problem analysis (LPA) of economic, financial and non-financial barriers to the introduction and dissemination of sustainable pasture management technology is presented as a problem tree in Fig. 1.5.

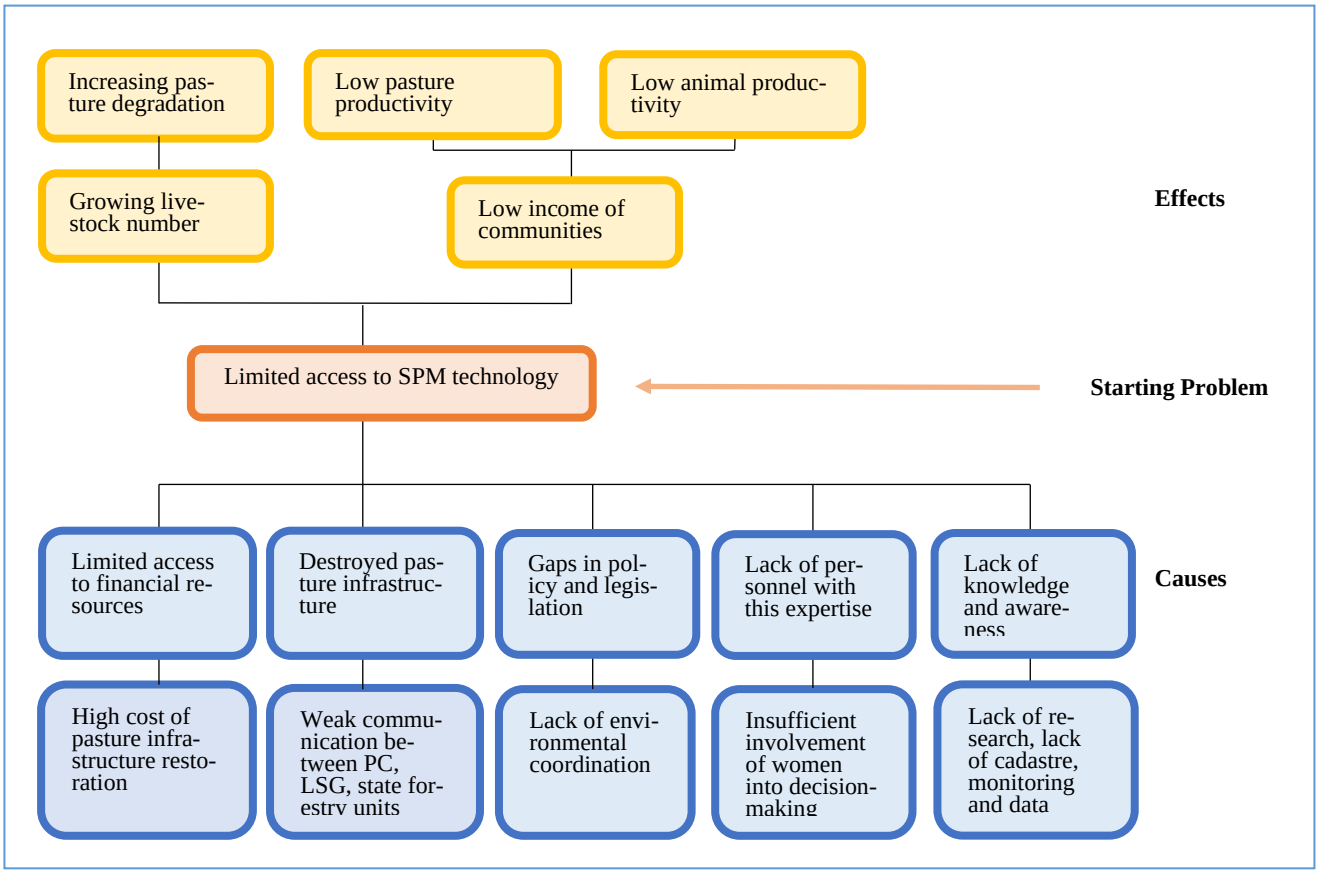


Figure 1.5. LPA of economic, financial and non-financial barriers for SPM

1.2.6 Identified measures to advance the technology

In the course of consultations with stakeholders organized in person and as a result of an online survey, as well as meetings with stakeholders, as well as an analysis of the experience of national and international projects on livestock development and pasture management, the following measures were identified to facilitate the transfer of Sustainable Pasture Management technology and its subsequent distribution in Kyrgyzstan:

1.2.6.1 Economic and financial measures

Enforcement of policy implementation, enforcement of regulations, capacity building and awareness cannot sufficiently guarantee that pasture users will apply appropriate SPM methods unless financial assistance is provided to make them available. For this, the following measures are proposed:

- Development of a state program to preserve the fertility of natural pasture systems, which is supported by budget funding. To introduce advanced SPM methods, develop modern pasture management tools using modern technologies.
- Increasing state funding for scientific research on developments in SPM, as well as the development of training programs for various educational institutions and advanced training of PCs and pasture users.
- Mobilization of international financial resources for the implementation of projects for the restoration of natural pasture systems and modern methods of pasture use.
- Continuation and expansion of the state program "Financing of Agriculture" for lending at preferential interest to pasture users to improve pastures and forage, highlighting them in a separate category of beneficiaries.

In addition, to maintain the economic productivity of grazing livestock, it is proposed:

- Regulation of livestock on grazing, which will increase the regeneration capacity of grass communities through the organization of pasture rotations in communities and restore/increase the yield of grasses on pastures.
- Decreasing the number of underproductive animals and moving towards more productive livestock will reduce pressure and increase the economic value of pastures.
- The creation of cultivated pastures in each community will increase forage availability and reduce the pressure on natural pastures for their regeneration and increase grass stand yields.

1.2.6.2 Non-financial measures

The stakeholder discussions also identified a number of non-financial measures that are important for promoting SPM:

- The following measures have been proposed to create an enabling policy, legal and regulatory framework:
  - Development and adoption of the State program for the development and conservation of pasture farming. Despite the existing legal framework for organizing the management and use of pastures, there is no strategy in Kyrgyzstan with clearly formulated goals and objectives for SPM and the development of transhumance. Delegating pasture management to the community level, along with the advantages, clearly demonstrates the negative consequences associated with the degradation of these common resources and proves the need to develop a state program for the conservation and sustainable use of pastures in the context of climate change.
  - Adoption of a regulatory document on reseeding degraded pastures, obliging PUAs and PCs to carry out reclamation activities will help increase the sustainability of pasture ecosystems and the development of SPM.
- To create a favourable institutional framework for the transfer and expansion of SPM, the following measures have been proposed:
  - The strengthening of the role and institutional status of PUAs and pasture committees at the legislative level is connected with the current practice of inefficient interaction and competition in pasture management between various community-based organizations at the local level.
  - Establishment of the State Pasture Service for Irrigation and Ameliorative Construction in pastures, including pasture infrastructure, was proposed to support PUAs and PCs in the implementation of various civil engineering projects on pasturelands to create favourable conditions for SPM.

- Special support for pasture communities during their migration to remote pastures is primarily related to providing access to communications to use the early warning system for natural disasters

- In order to remove market barriers and expand pasture users' access to high-quality and affordable seed material, the following measures were proposed during the discussions:
  - Revision and strengthening of the legal framework for seed production (regulations on seed and breeding farms) to strengthen the connection between science and production. This is fully in line with the Government's recent efforts to support the development of seed farms through government subsidies to seed farms.[40]
  - Strengthening the network of seed farms for the production and diffusion of seeds of pasture grasses and breeding farms to increase the livestock productivity. This measure is reinforced by the support of the Government of the country to expand the land areas of semkhozes (seed farms) and breeding farms.[41]Both of these measures are expected to saturate the market for quality seed to promote SPM.
- Among the sustainable pasture management practices or techniques, the following measures have been proposed:
  - Creation of *community seed banks* for growing seeds of natural pasture grasses and reseeding with seeds of natural pasture grasses. The practice of creating community seed funds was tested in the framework of the implementation of the IFAD project "Livestock and Market Development" by the Community Development and Investment Agency, who has implemented community seed bank and fodder program [42] and the National Association of Pasture Users of the Kyrgyz Republic, which created 104 community seed funds.[43]
  - The creation of *artificial glaciers* to address water supply issues is a unique method for Kyrgyzstan to adapt to climate change through high-altitude collection and storage of water from a mountain source in the form of a vertically frozen ice tower. This practice has also been tested by the National Pasture Users Association and has been supported by FAO for implementation throughout the country.[44]
  - Another relatively innovative measure is the use of *electric fences* to ensure pasture rotation in SPM. This measure is only gaining popularity in Kyrgyzstan and has a number of limitations, mainly related to the need to provide electricity, although there are also mobile installations.
  - To create cultivated pastures, it was proposed, together with the Water User Associations (WUAs) of the communities, to *install irrigation networks* in suitable areas. This measure will strengthen the forage availability of communities and will help to strengthen cooperation at the local level between WUAs and PUAs and PCs, as well as with local governments. Such joint projects are expected to strengthen networking at the community level in addition to direct economic benefits.
  - Creation of *protective forest plantations* on pastures will have a beneficial ameliorative effect on the pasture area occupied by them and adjacent to them and on animals. Strip, curtain and other plantings increase the productivity of pastures, promote their rational use, and protect animals from summer heat and winter cold, and buildings from snowdrift. With their help, the natural herbage is improved and more favourable conditions

[40] Law of the Kyrgyz Republic "On state subsidies in seed production" dated February 2, 2019 No. 22
[41] Resolution of the Cabinet of Ministers of the Kyrgyz Republic "On amendments to some decisions of the Cabinet of Ministers of the Kyrgyz Republic in the field of regulation of land and legal relations" dated September 9, 2022 No. 494
[42] ARIS website: https://www.aris.kg/index.php?option=com_content&view=article&id=23&Itemid=203&lang=ru
[43] https://kabar.kg/news/sozdany-104-obshchestvennykh-semennykh-fondov-im-zakupleny-semena-iarovogo-iachmenia/
[44] https://www.fao.org/3/cb3752en/cb3752en.pdf

are created for the radical improvement of fodder lands by sowing and reseeding valuable fodder crops, and in some cases (saxaul and other strips) themselves serve as an additional source of fodder. Thanks to the strips, the practical implementation of pasture rotation is facilitated and the capacity of pastures is increased.[45]These measures are also expected to strengthen cooperation between PCs, local leshozes (state owned forest management units) and LSGs.

- Improvement or, rather, rehabilitation of pasture infrastructure, which includes the construction/reconstruction of various structures, bridges, roads, livestock trails, livestock stopping and watering sites, sheep purchases, koshars (stables) and fenced off areas intended for the needs of grazing livestock, seasonal living, relevant facilities shepherds and other real estate necessary for the maintenance and functioning of pastures is today the most important task of the PUA and PC. However, limited economic opportunities do not allow them to solve it in full.
- To increase the technical capacity of pasture committees, a range of training measures on modern tools for climate change resilience SPM were proposed, including database management, electronic Pasture Committee software with extended pasture state databases. For a broad transition to SPM, Pasture Committees are also asked to revise and improve Long-Term Pasture Management Plans and Annual Pasture Plans, including the pasture rotation mechanism.
- The creation of a unified multi-level system of continuous monitoring of the state of pastures is fully in the interests of both the Department of Pastures and Livestock Breeding of the Ministry of Agriculture, and the interests of PUAs and PCs and local governments of communities. To do this, it is proposed to create such a system at the level of the Ministry of Agriculture with the possibility of using PC databases. In addition, in order to fill the PC with relevant data, it was proposed to conduct an annual assessment of pasture productivity. Similar projects have been implemented by NGO CAMP Alatoo in a number of communities and a corresponding methodology has been developed. However, a more systematic survey and complete data collection, of course, are possible only when the institute of Kyrgyzgiprozem conducts land management work in pasture areas with subsequent transfer of data both to the Ministry of Agriculture and local communities.
- The issues of overcoming social barriers in the analysis were mainly related to various aspects of gender equality in SPM. For this, as a broad measure, it was proposed to develop a specialized program and organize capacity building of national and local stakeholders in all communities on gender equality issues in rural development, livestock and SPM. In addition, it was proposed to integrate widely gender issues into local development planning and long-term pasture management plans, as well as conducting information activities for women and youth of local communities about modern technologies for agriculture and SFM.
- *Networking measures* aimed at strengthening cooperation and coordination between aiyl okmotu, forestries, WUAs, PUAs and pasture committees on the management and use of pasture resources, include: preparation and implementation of joint projects (for example, those mentioned above) and holding regular coordination meetings. In addition, in order to support the most vulnerable PUAs and PCs, it was proposed to conduct an analysis of the activities of PUAs and PCs in order to identify PUAs and PCs requiring state support and to develop corresponding project applications.

[45] Orenburg State Agrarian University. 2015 Forestry: Protective forest plantations on pasture lands: types, purpose, placement, cultivation agrotechnics. https://studfile.net/preview/1839860/page:53/

- *Measures of information and awareness.* Among the measures in this category, the following have been proposed:
    - Increase the technical capacity of Kyrgyzhydromet to develop seasonal agrometeorological forecasts and disseminate them through channels accessible to local self-governments, PUAs and farmers;
    - Strengthening scientific potential through exchanges and conferences, including international ones, as well as strengthening the regulatory framework of scientific institutions;
    - Publish popular materials on the impact of climate change on pastures and climate resilient adaptive pasture management;
    - Develop training programs and increase the capacity of LSGs on climate-resilient pasture management;
    - Develop area-specific training programs and build the capacity of farmers for climate-resilient pasture management
    - Develop training programs on SPM in the context of climate change for universities.
- As measures for solving environmental problems associated with pasture degradation at this stage, it was proposed:
    - Develop and special land cadastre for monitoring degraded lands and providing access for PUAs and PCs. In addition, it was proposed to develop and disseminate various communication materials to combat land degradation. For the local level, it was proposed to develop a Land Degradation Guidelines and conduct regular capacity building courses for PCs and pasture users and, most importantly, to introduce sections on grazing rotation by plots into the Pasture Management and Grazing Plans.
    - To reduce the growing vulnerability of livestock and pasture ecosystems to the negative impacts of climate hazards, as measures to increase the resilience of livestock, it was proposed to strengthen the work of the veterinary service and provide an appropriate range of veterinary drugs locally. To reduce the risk of livestock mortality due to drought or extreme frosts, it was proposed to develop a mechanism and introduce insurance for grazing animals.

The results of the LPA on economic, financial and non-financial measures for the introduction and dissemination of SPM are presented in fig. 1.6 as an objective tree.

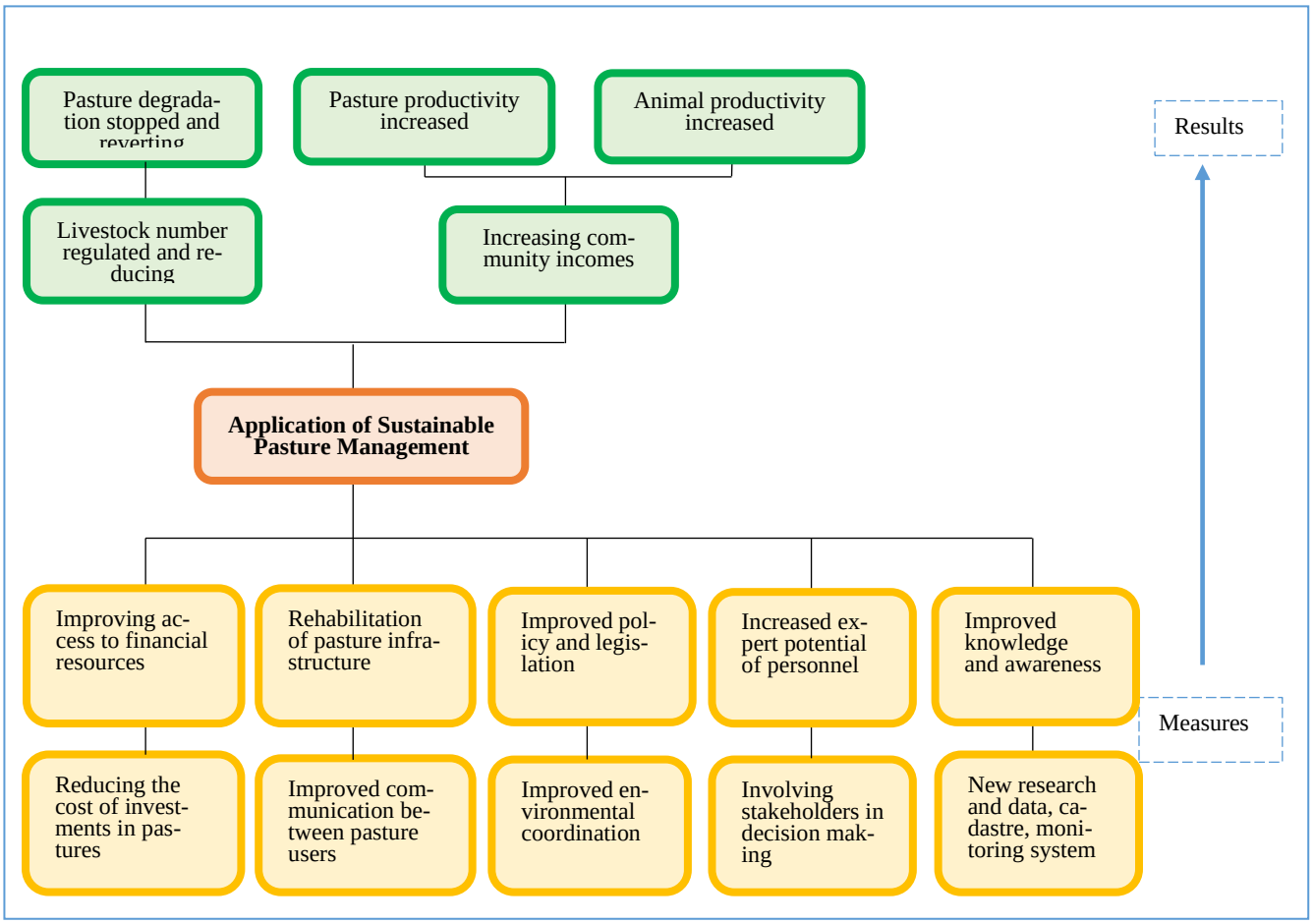


Figure 1.6. LPA objective tree on economic, financial and non-financial measures for the deployment and diffusion of SPM.

Tab. 1.5. below presents a set of barriers hindering the development of SPM technology and related measures that will remove barriers to the promotion and widespread use of SPM technology in the context of climate change in all regions of Kyrgyzstan.

Table 1.5. A List of barriers and measures to promote SPM by category.

Categories	Barriers	No.	Measures
Economic and financial			
1	Lack of investment in sustainable pasture ecosystems	1	Development of a state program to preserve the fertility of natural pasture systems
		2	Mobilization of international resources for the implementation of projects for the restoration of natural pasture systems
2	Limited access to credit and necessary agricultural inputs for PFM	3	Continuation and expansion of the state agricultural financing program for pasture users
		4	Reducing interest rates on loans for pasture users
3	Decreasing productivity of pastures and livestock	5	Livestock regulation in grazing
		6	Reducing the number of unproductive animals and the transition to breeding more productive breeds of livestock
		7	Creation of cultural pastures in every community
Non-financial			
Policy, legal and regulatory			
4	Lack of state policy for pasture development	8	Development and adoption of the State program for the development and conservation of pasture lands
5	Gaps in normative legal acts regulating the management and use of pastures	9	Adoption of legal acts on sowing degraded pastures
Institutional			
6	Uncertainty in the institutional organization of community-based pasture management	10	Strengthening the role and institutional status of PSUs and pasture committees at the legislative level
		11	Special support for pastoral communities during migration to distant pastures for integration into the early warning system for natural disasters.
		12	Establishment of the State Pasture Service for irrigation and reclamation construction in pastures, including pasture infrastructure
Market conditions			
7	Lack of high-quality and affordable seed material of productive breeds of animals and pasture grasses	13	Revision and strengthening of the legal framework for seed production (regulations on seed and breeding farms) strengthening the link between science and production
		14	Strengthening the network of semkhozes (seed farms)for the production and propagation of seeds of pasture grasses and breeding farms to increase the breeding herd
Human management skills			
8	Lack of pasture improvement practices (pasture rotation, re-seeding, irrigation, afforestation, etc.)	15	Creation of seed funds for growing seeds of natural pasture grasses and sowing seeds of natural pasture grasses
		16	Creation of artificial glaciers to solve water supply issues
		17	The use of electric fences for pasture rotation
		18	Pasture irrigation
		19	Creation of afforestation on pastures
		20	Improvement of pasture infrastructure
9	Low PC capacity for SPM and limited knowledge of current SPM tools	21	Improving the technical capacity of pasture committees on modern tools for climate change resilience SPM

Categories	Barriers	No.	Measures
		22	Development of improved long-term pasture management plans and an annual pasture use plan (including a pasture turnover mechanism)
		23	Development of an electronic application for livestock breeders with databases on the state of pastures
10	Lack of a unified system of permanent monitoring of the state of pastures and data	24	Annual evaluation of pasture productivity, maintenance of databases by years (PC)
		25	Development of a unified monitoring system and databases at all levels of management
		26	Carrying out land management of pastures with the transfer of data from the PUA and PC
Social			
11	Lack of integration of gender equality aspects in pasture management systems	27	Developing tailored programs and exceeding the capacity of national and local stakeholders on gender equality in rural development, livestock and SPM
		28	Integrating gender into local development planning and long-term pasture management plans
		29	Carrying out information events for women and youth of local communities about modern technologies of AG and SPM
Network			
12	Weak cooperation and coordination of stakeholders at the local level	thirty	Strengthen the relationship between the aiyl okmotu (LSG), forestries, WUAs and pasture committees on the management and use of pasture resources through the implementation of joint projects and holding coordination meetings.
		31	Monitoring the activities of PSUs and PCs to identify PSUs and PCs requiring state support and development of relevant projects/applications.
Information and awareness			
13	Lack of seasonal agrometeorological forecasts for pasture users and communities	32	Increase the technical capacity of Kyrgyzhydromet to develop seasonal agrometeorological forecasts and disseminate through channels available to local self-governments, PUAs and farmers
14	Lack of scientific research and data on climate impacts on pastures and animals	33	Strengthening scientific potential through exchanges and conferences, including international ones, as well as strengthening the regulatory framework of scientific institutions
15	Lack of climate awareness and adaptive knowledge of government officials, local authorities and users on sustainable pasture management	34	Publish popular materials on the impact of climate change on pastures and climate-resilient adaptive pasture management
		35	Develop training programs and increase the capacity of LSGs on climate-resilient pasture management
		36	Develop area-specific training programs and build the capacity of farmers for climate-resilient pasture management
		37	Develop training programs on SPM in the context of climate change for universities
16	Lack of information on modern technologies for SPM	38	Develop and publish popular information packs on climate resilient SPM practices
Others: Environmental			
17	Continued pasture degradation	39	Development and maintenance of a cadastre for monitoring degraded lands and ensuring access for PUUs
		40	Development, publication and dissemination of materials to combat land degradation
		41	Development of Land Degradation Guidelines and regular capacity building courses for PUUs and pasture users
		42	Development/revision and approval by LSG the sections on the rotation of grazing plots in the Pasture Management Plans.
18	Growing vulnerability of livestock and pasture ecosystems to adverse impacts of climate hazards	43	Strengthening the work of veterinary services and the range of veterinary preparations.
		44	Development of mechanisms and implementation of climate risk insurance

1.3 Barrier Analysis and Possible Enabling Measures for the Organic Agriculture Technology

Organic agriculture (OA) is based on the concept of sustainable development, which is built into existing ecosystems not disturbing their harmonious functioning. It preserves nature and provides the population with quality food. Globally OA is based on the principles of the International Federation Organic Agriculture Movement (IFOAM). They reflect the opportunities that organic agriculture can bring to the world and a vision of ways to improve agriculture on a global scale.

These principles apply to agriculture in a broad sense, and include the methods by which people take care of land, water, plants and animals for the production, processing and distribution of food and other goods. They concern the pathways in which people interact with natural landscapes that are connected to each other and protect the heritage of future generations. These include:

1. The Principle of Health, according to which OA should maintain and improve the health of the soil, plant, animal, human and planet as a single and indivisible whole. This principle shows that the health of individuals and society cannot exist apart from the health of ecosystems - healthy soils grow healthy plants that support the health of animals and people. According to this principle, the use of fertilizers, pesticides, animal veterinary drugs and food additives, which may have an adverse effect on health, should be avoided.
2. The Principle of Ecology, according to which OA should be based on the principles of the existence of natural ecosystems and natural cycles, working, coexisting with them and supporting them. This principle "roots" organic agriculture among living ecosystems. It argues that production is based on ecological processes and recycling. The principles of organic farming, grazing and the use of wild natural systems, in order to obtain a crop, must comply with natural cycles and balances. These cycles are universal, but they also vary by location, so the management of OA must be adapted to local conditions, environments, cultures and scales.
3. The Principle of Fairness, determines that the OA should be built on relationships that guarantee fairness, taking into account the general environment and life opportunities. Fairness is characterized by objectivity, respect, correctness and economic attitude, common to the whole world, both in relations between people and with other living beings. Natural resources that are used in production and consumption should be considered from the standpoint of social and environmental justice, taking into account the interests of future generations.
4. The Principle of Care says that the management of the OA must be proactive and responsible in order to protect the health and well-being of present and future generations and the environment. OA, from this point of view, is a living and dynamic system that responds to internal and external needs and conditions. Those who use OA methods can improve efficiency and productivity without compromising health and well-being. This principle states that precaution and responsibility are key components in the choice of management methods, development, and acceptable technologies in organic agriculture.

Currently, two organizations from Kyrgyzstan are members of IFOAM: the Federation of Organic Movement "BIO.KG" in Bishkek and the Public Foundation "Bio Service" in Jalal-Abad.

1.3.1 Legal basis for the development of the OA in the Kyrgyz Republic

Preserving environmental friendliness and focusing on organic production is today designated as a strategic priority for the development of agriculture in Kyrgyzstan. In order to accelerate the development of the market for organic products in the Kyrgyz Republic, appropriate legislative regulation will

be developed and adopted, international standards for certification of organic products will be introduced, strict control over the import of chemical fertilizers will be ensured, and appropriate marketing activities will be carried out. The legal basis for this has recently been laid by Law of the Kyrgyz Republic "On organic agricultural production in the Kyrgyz Republic".[46] However, in the opinion of the manufacturers of the OA, it has not yet been launched, since there are no necessary regulatory documents for the practical implementation of its provisions. Thus, according to the law, the state must provide support for producers of organic agricultural products in the following main areas:

1) information, consulting and methodological support for economic entities engaged in organic agricultural production;

2) assistance in the promotion of organic products on the world market of agricultural products;

3) support in conducting research work in the field of organic agricultural production;

4) ensuring access to programs of state preferential lending to agricultural production;

5) organization of training of rural producers in the skills of organic agricultural production;

6) scientific and methodological development of technologies for organic agricultural production, adaptation of international methods, technologies in relation to the conditions of the Kyrgyz Republic;

7) creation of conditions for the reproduction of soil fertility and rational use of land resources;

8) ensuring sustainable development of agricultural production and rural areas;

9) organization of obtaining an international certificate for the export of products of producers of organic agricultural products to the international market.[47]

However, in reality, this does not happen, and the support is provided within the frames and at the expense of various international projects. Even despite the fact that OA is declared a priority for the development of the agro-industrial complex.

Thus, the National Development Strategy of the Kyrgyz Republic for 2018-2040 notes that in the field of agriculture, the main policy is to provide the population of the Kyrgyz Republic with high-quality food and turn the industry into a supplier of high-quality environmentally friendly, organic products to the global and regional markets.[48]

The National Development Program of the Kyrgyz Republic until 2026 also says that the strategic priority for the development of agriculture should be to maintain environmental friendliness and focus on organic production. In order to accelerate the development of the market for organic products in the Kyrgyz Republic, appropriate legislative regulation will be developed and adopted, international standards for certification of organic products will be introduced, strict control over the import of chemical fertilizers will be ensured, and appropriate marketing activities will be carried out. The program "Organic products" will be launched.[49]

The developed Concept for the development of the OA production in the Kyrgyz Republic for 2017-2022[50] defined the goal of development of agricultural sector in the Kyrgyz Republic aimed at creating favourable conditions for the development of agricultural sector by improving regulatory legal acts and taking other measures that contribute to the sustainable development of the agricultural sector of the economy, increasing the competitiveness of organic products. The priority areas of organic agricultural production include the following:

- creation of favourable conditions for the development of organic agriculture in the republic through the improvement of regulatory legal acts;

[46] Law of the Kyrgyz Republic dated May 18, 2019 No. 65
[47] Art. 11 of the Law.
[48] Approved by Decree of the President of the Kyrgyz Republic dated October 31, 2018 UE No. 221
[49] Approved by Decree of the President of the Kyrgyz Republic dated October 12, 2021 No. 435
[50] Approved by the Decree of the Government of the Kyrgyz Republic dated August 2, 2017 No. 459

- empowerment, awareness and access of the population to knowledge about organic agricultural production;
- creation of favourable economic conditions for organic agricultural production and development of the value chain;
- building confidence and a system of guarantees for the development of organic agricultural production.

Discussions of stakeholders held during the project concluded that the goal stated in the Concept has not yet been achieved. That document is currently being evaluated and a new policy document on OA is being developed.

1.3.2 Institutional set up for the promotion of OA in the Kyrgyz Republic

In 2019, in order to take effective measures aimed at creating favourable conditions for the development of organic agricultural production in Kyrgyzstan, the Coordinating Council for the Development of Organic Agricultural Production under the Government of the Kyrgyz Republic, chaired by the First Prime Minister was established. The main tasks of the Coordinating Council are:

- development of proposals and recommendations for improving the regulatory legal framework in the field of organic agricultural production;
- preparation of proposals for the provision of state support aimed at stimulating domestic producers of organic products by providing the opportunity to participate in integration processes and access to new international markets for organic products.[51]

The development of the OA, including the development of a policy and a system of voluntary certification of products of the OA, as well as the implementation of the functions of sectoral policy, regulation, coordination, monitoring, control and supervision, as well as the provision of services and support, are included in the functionality of the Ministry of Agriculture of the Kyrgyz Republic.[52]

The Department for OA Development (DOAD) under MOA, which is an authorized body in the field of organic agricultural production, is carrying out activities to develop organic agriculture, increase the production of environmentally friendly agricultural products and to use advanced agrobio -technologies and organic agriculture technologies in the Kyrgyz Republic.[53] Among the functions of the sectoral policy of the DOAD are the following:

- development of draft regulatory legal acts in the field of organic agricultural production and submission to the Ministry for consideration;
- implementation of state programs and activities for the development of organic agricultural production and agrobiotechnologies;
- establishing, together with scientific institutions, priority areas of scientific research in the field of organic agriculture and agrobiotechnologies;
- development and submission to the Ministry of draft state strategic programs and measures to improve legislation in the field of organic agriculture in the Kyrgyz Republic;
- development of innovative agrobiotechnologies for the development of organic agriculture;
- development of a national standard, rules for the production, transportation and storage of organic agricultural products;

[51] Decree of the Government of the Kyrgyz Republic dated August 2, 2019 No. 398
[52] Regulations on the Ministry of Agriculture, approved by the Resolution of the Cabinet of Ministers of the Kyrgyz Republic dated March 9, 2021 No. 83.
[53] Regulations on the Department of the OSH, approved by the resolution of the Cabinet of Ministers of the Kyrgyz Republic dated August 6, 2021 No. 116

- development and use of biological products and entomophages, as well as organic biofertilizers;
- development of rules for maintaining a register of producers of organic products;
- development of a certification system for organic agricultural products;
- development of rules for packaging, labelling, import, export and sale of organic products;

In 2012, the Federation of Organic Movement "BIO-KG" was established in Kyrgyzstan as a national "umbrella" organization, consolidating the efforts of all participants interested in the promotion and development of the OSH of the Kyrgyz Republic. Promoting the principles of the OSH, since 2013 the Federation has been implementing the initiative to create an "Organic Aimaks (rural communities)". Conceptually Organic Aimak is a Kyrgyz model of integrated sustainable development of rural communities, combining the historical experience of nomadic culture and progressive achievements of modern technologies and agro-ecological approaches in farming and rural development. The Federation provides farmers with a wide range of services, providing links between farmers and the government, science, international projects and among themselves.

Scientific support for the implementation and dissemination of OA technology is carried out by several organizations: the Research Institute of Farming, the Kyrgyz National Agrarian University and the National Academy of Sciences. However, as noted during the discussion, the stakeholders of the sector of research stated that the subject of OA are not yet elaborated enough, and the methods for OA are just on the stage of probation, the best practices are being collected, analysed and systematized.

For many years Rural Advisory Services (RAS) deal with the translation of the research analysis conclusions into guiding papers for farmers, thus, covering all regions of the Kyrgyz Republic. By developing and publishing manuals, guidelines, posters and other materials, RAS provides farmers with advisory and educational services, as well as providing training in agricultural skills and best practices. Increasing the knowledge and skills of OA agro techniques will be the focus of RAS in the coming years.

Local Self-Governments and Rural Councils are also important players in the development of the OA, making decisions on a range of local issues, including the management of local water and land resources.

Despite the alleged presence of almost all the components for scaling up and promoting OA, the practical implementation of the OA production is still hampered by a wide set barriers.

1.3.3 General description of the "Organic Agriculture" technology

The technology of "Organic agriculture" from the point of view of the market can be classified as "market good" according to the criteria of the Guidelines for the assessment of barriers,[54]developed by UNEP and the Denmark Technical University.

OA is carried out on the basis of the standards of the International Federation of the Movement of Organic Agriculture (IFOAM), monitoring natural resources use, as well as control of the maximum concentration limit of harmful substances in products. Compliance with regulations and strict control occurs at all stages of the production process.

Organic agriculture products are grown without the use of agrochemicals, pesticides, mineral fertilizers, genetically modified organisms, antibiotics, and plant growth stimulants. Since these substances pose a danger to human health and threaten the environment. Organic food products are processed by

[54] Nygaard, I. and Hansen, U. (2015). Overcoming Barriers to the Transfer and Diffusion of Climate Technologies: Second edition. UNEP DTU Partnership, Copenhagen. This guide is available at https://tech-action.unepccc.org/wp-content/uploads/sites/2/2021/01/overcoming-barriers-to-the-transfer-and-diffusion-of-climate-technologies-2nd-edition.pdf

biological, mechanical and physical methods in a way that maintains the quality of each ingredient. Organic products are protected from pests and diseases by good production practices that include proper cleaning and hygiene without the use of chemical treatments or irradiation.

In addition, such products are processed without the use of gases, synthetic waxes, and chemical additives to improve taste or extend shelf life. Eco-friendly packaging has a minimal negative impact on the environment.

Therefore, OA is a method of farming in which there is a conscious minimization of the use of synthetic fertilizers, pesticides, plant growth regulators, feed additives. At the same time, all the technological production chain within OA must be environmentally friendly and, wherever possible, use a closed production cycle in OA, providing cultivated plants with elements of organic nutrition. Other techniques of OA include biological methods of protecting plants from pests and weeds, crop rotations, organic fertilizers (manure, composts, stubble residues, green manure, etc.) and various methods of minimal tillage. By implementing OA production well-established national traditions of agricultural production are applied using internal resource resulting in soil fertility increase, biodiversity conservation, and limited pollution.

In recent years, the demand for organic food has been constantly growing in the world. The Kyrgyz Republic is a country in which the natural biodiversity and environment have not yet been disturbed much and are well preserved almost in their virgin form. In connection, the Kyrgyz Republic has all the conditions for the production of environmentally friendly organic food. The government of the country has set the task to enter the internal and external markets with organic agricultural products that have special taste qualities, which have no analogues on the world market.

The first experience of the organic agricultural production has been gaining momentum. However, the number of farmers involved in the transition to OA is constantly changing, due to the lack of effective support from the state and weak marketing of organic products.

Today, organic farms are represented by three large agricultural cooperatives, 12 Organic Aimaks, uniting 23 villages. In 2021, there were 1.56 thousand farmers, who had a local organic quality certificate. These farms grow organic products on 7,000 hectares of organic land.[55] According to the Ministry of Agriculture in the Kyrgyz Republic, there are now 32 thousand hectares for growing organic products.[56]The dynamics of development of the OA in Kyrgyzstan is shown in Figure 1.7.

[55] https://www.akchabar.kg/ru/news/v-kyrgyzstane-ni-u-odnogo-fermera-net-mezhdunarodnogo-organicheskogo-sertifikata/

[56] https://www.akchabar.kg/ru/news/v-kyrgyzstane-ploshad-vyrashivaniya-organicheskoj-produkcii-dostigla-32-tysyach-ga/

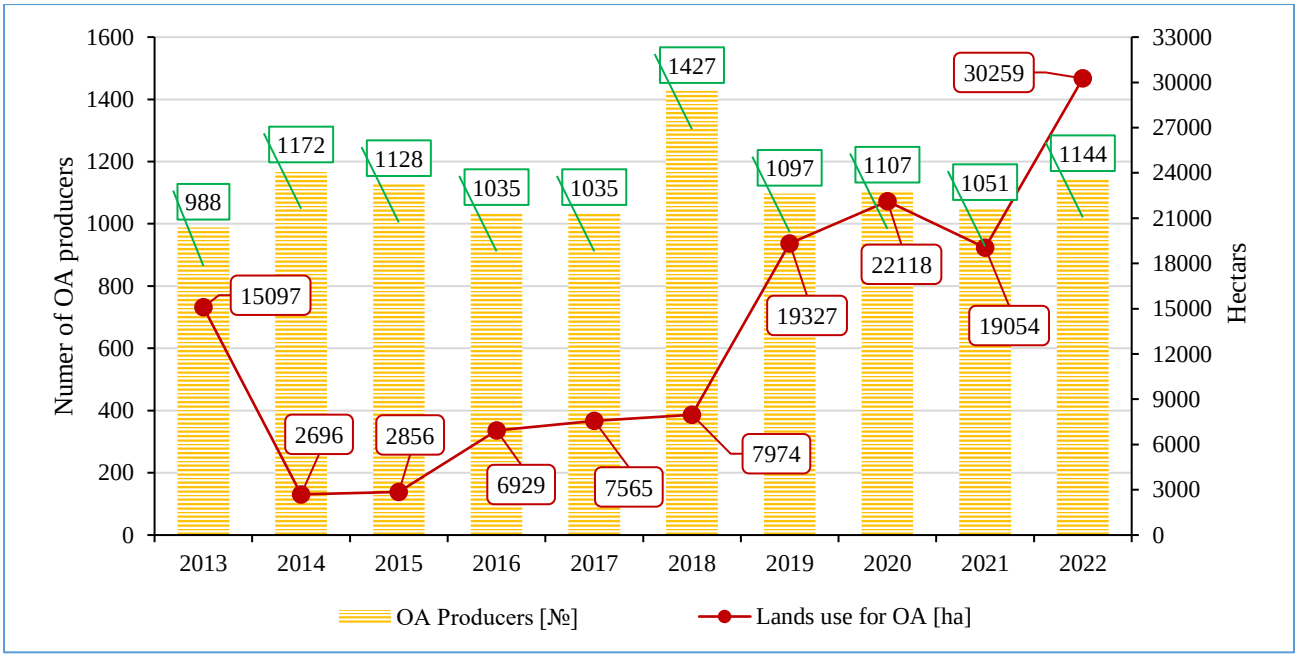


Figure 1.7. Dynamics of the number of farmers and the area of agricultural land used for agricultural purposes.[57]

The main organic products in the republic are cotton, chickpeas, beans, apricots, medicinal herbs, prunes, walnuts, and potatoes. In the Kyrgyz Republic, projects are being implemented to develop the OA with the support of international development partners (KOICA and FAO).

During the discussions, a number of socio-economic benefits of this technology were highlighted:

- savings on expensive synthetic fertilizers and fuel for deep mechanical tillage;
- more intensive use of land resources;
- improving the quality of nutrition, taste and nutritional value of products;
- guaranteed quality and product certification;
- utilization and composting of organic animal waste for fertilizing fields;
- avoidance of hazardous chemicals;
- employment opportunities for rural women;

In addition, the introduction of OA has clear environmental benefits over conventional agriculture, which include:

- improvement of soil quality;
- reduction of pollution of soils and surface and ground waters;
- conservation of biodiversity;
- conservation of the stock and increase in carbon absorption by soils;
- reduction of direct and indirect nitrous oxide (N2O) emissions from managed soils.

However, the development of organic agricultural production in Kyrgyzstan is hindered by a number of barriers.

[57] FiBL & IFOAM – Organics International (2022): The World of Organic Agriculture. Frick and Bonn. https://www.organic-world.net/yearbook.html

1.3.4 Identification of Barriers for Organic Agriculture Technology

In order to identify barriers, before the Joint Meeting of the SWG on Agriculture and Water Resources, a study was conducted that included several research methods: a review of political documents, technical literature, including publications of international projects, two rounds of an online survey of members of sectoral working groups (the first one was to collect barriers and second on the definition of the importance of barriers) and direct interviews with various stakeholders. During the consultations, a list of all the major barriers that will have to be faced in the transfer, implementation and dissemination of OA technology was prepared and discussed. Based on the outcomes of stakeholder discussions, 28 barriers were identified and ranked as important as seventeen key barriers to advancing OA.

1.3.4.1 Economic and financial barriers

Based on the analysis of the regulatory framework for technical reports of international projects, on the results of online surveys of the members of the Task Force and on discussions with stakeholders, the following barriers of this category can be identified that impede the spread of OA technology in the Kyrgyz Republic:

1. Lack of investment in OA from both domestic banking capital, foreign investors, as well as weak financial support from international development partners. OA has not yet become an attractive area for investment by financial institutions due to the lack of a financial contribution from the state, the lack of quality assurance tools and the underdevelopment of the domestic market for OA products.
2. Lack of own capital for economic entities of the OA, starting organic agricultural production. The low level of production potential of small scale OA farmers, limited by their own land resources, as well as low awareness of the health benefits of OA products, which does not allow for the expansion of the marketing of OA products, prevent OA business entities from generating income sufficient to expand production.
3. Limited access of OA producers to credit facilities on acceptable terms. This financial barrier reflects the nature, characteristics of the financial and credit system in Kyrgyzstan in the context of the prevailing small-scale production, a huge number of small peasant farms, the underdevelopment of the land market and the high cost of credit resources. In such circumstances, the state is implementing the "Agricultural Financing" program by investing in lower interest rates for farmers. However, only 2-3% of the country's farmers have enough of these resources. This barrier is evidenced by OA statistics and the ever-changing number of OA farmers forced to return to normal agricultural production.

1.3.4.2 Non-financial barriers

In addition to economic and financial barriers, stakeholder discussions, surveys, and face-to-face meetings led to the formulation of a number of non-financial barriers, including the following:

- *Political legal and regulatory*
    - Lack of a government strategy and regulatory documents for OA. The term of the OA Development Concept has expired and, according to the majority of stakeholders, the goal of the strategy is still relevant and needs to increase state support for the expansion of the OA. The country lacks a number of important regulatory documents on the criteria for evaluation and certification of OA products.
- *Institutional*

- Lack of a certification system for organic products. This barrier is associated with the absence in the Kyrgyz Republic of scientifically based assessment criteria, analysis methods and certification procedures, enshrined in regulatory legal acts, as well as the lack of accredited laboratories that are properly equipped. The currently used voluntary certification system has so far angered many farmers, who blame it for lack of transparency. In addition, the Eco/Bio logo on local food products has not yet been recognized and does not inspire consumer confidence in local markets. At the same time, a number of business structures involved in the processing of organic raw materials and the production of products for export complain about the high cost of foreign certificates. In 2021, Kyrgyzstan introduced the national standard KMS 1361:202 corresponding to the interstate standard GOST 33980-2016 "Products of organic production: Rules for production, processing, labelling and sale (CAC / GL 32-1999, NEQ)", also adopted in Russia and Tajikistan. However, the implementation of its requirements is still far from desirable due to the lack of capacity and appropriate quality control infrastructure. The negative side of this innovation is that in the context of the already existing and working Halal standard, today in the Kyrgyz Republic there is a simultaneous introduction into practice of other standards, among which we single out HACCP and Global GAP. Given the existence of basic IFOAM standards, all this only increases the misunderstanding of the value of the OA standardization system, especially among farmers.

- *Market conditions*
  - Lack of organic seed and planting material in the republic. Since the seed farms available in the Kyrgyz Republic today are not focused on the OA market, which has not yet become widespread, high-quality organic seeds and planting material are mainly imported, which increases the cost of organic products and reduces its competitiveness in the food market as a whole. This is largely due to the next barrier;
  - Uncontrolled import into the territory of the republic of seeds produced using genetically modified organisms (GMOs) and synthetic substances,the use of which is contrary to organic methods of agricultural production is constantly growing. Their lower prices are in many ways a deterrent to switching to OA;
  - Difficulties with marketing. Lack of proper marketing and public understanding of the difference in quality between OA products and conventional agricultural products does not allow the resulting products to be sold at a decent price. In addition, the lack of a logistics and marketing network for OA products, which involves significant investment, also makes it difficult to sell quality OA products.
- *Human management skills*
  - Lack of knowledge and practical skills among economic entities of agriculture for the production of organic products. This barrier is also evidenced by OA statistics and the ever-changing number of OA farmers. And, if the gaps in technical knowledge are currently partially filled with information and trainings conducted by the FOM “BIO.KG” and the PF “Bio Service” as part of the mobilized resources of international projects, then the skills of most farmers in marketing and financial management are still among main barriers. This is largely due to the next barrier of awareness and awareness.
  - Insufficient use by economic entities of organic production of biological plant protection products and organic fertilizers. This is due to the lack of information, scientific potential and the lack of production capacities in the Kyrgyz Republic for the widespread use of biological preparations, as well as the lack of local production

of organic fertilizers, although there are more than enough raw materials for its production.

- *Network*
    - Weak coordination of the process of development of the OA by the state,exclusion or non-participation of local state administrations, local governments, as well as research institutions and business communities from the implementation of the tasks of organic agricultural production. The practice of implementing the first stage of the concept for the development of OA in the Kyrgyz Republic has shown that the efforts of civil society organizations and enthusiastic farmers are clearly not enough to promote OA in the Kyrgyz Republic. The absence of a new strategic document for the development of OA does not contribute in any way to the mobilization of state bodies to expand the practice of OA. This is also facilitated by poor awareness of the state policy for the development of the OA as a competitive advantage for the country in the Central Asian region and for entering international markets.
- *Information and awareness*
    - Insufficient scientific capacity to provide advisory support to the OA. Despite the existence of some scientific potential, the conducted and ongoing research on the best practices of OA does not yet allow to form a scientific basis for expanding the use of OA that meets international standards. The process of developing teaching aids for educational institutions and practical guides, training materials and visual materials on agricultural technology and agroecology for training advisory services and farmers is still at an early stage and has not produced significant results.
    - Low awareness and awareness of the OA, its benefits and the importance of development in the KR among government organizations, academia, the private sector, NGOs and agricultural producers / farmers is expressed in the underdevelopment of the market and low prices for OA products, lack of demand, unwillingness of retail chains to accept organic products for sale, lack of high consumer demand for OA products.
    - Lack of information on current OA best practices. This refers to the lack of communication and dissemination of information and wholesale between the producers of agricultural crops, as well as the fact that the complex nature of the technology of agricultural crops integrates a whole set of techniques and approaches of agricultural production based on agroecology.
- *Others: Small scale production of OA.*
    - Small-scale, small-scale farm production of OA products. As a result of the agrarian land reform after the collapse of the Soviet Union, all agricultural land, except for pastures, was distributed in the form of land shares to rural residents working in the agricultural sector. During the restructuring of 516 collective farms, state farms and other agricultural enterprises[58], and the formation of multi-structural ownership of land, the transfer of arable land to private ownership has become a key step in the socio-economic transformation of the country. The introduction of private ownership of land, which began first with the introduction of the right of long-term use, then the right of perpetual use, finally ended with the right of ownership with the transfer of state lands to private individuals. In Kyrgyzstan, the amount of arable land per person in 2010 was 0.24 ha/person, and in 2020 it was 0.2 ha/person. At the same time, it is obvious that in the context of population growth, this value will

[58] Kalmanbetova G.T. Formation and development of diversity in the agricultural sector of the economy (on the materials of the Kyrgyz Republic). –B., 2006

obviously decrease. Today, a significant part of agricultural land suitable for growing agricultural products is concentrated in the private property of individuals and legal entities of the Kyrgyz Republic (farms),[59]. Agricultural land divided among small scale farmers is fragmented, this is one of the main reasons for low productivity and unsustainable use of agricultural land. The continuing upward trend in the number of peasant farms (PFHs), owners and tenants of agricultural land causes this fragmentation. The NCS data on the area of agricultural land in the use of private farms in dynamics are presented in Table 1.6.

Table 1.6. Land owned by peasant (farmer) households in the Kyrgyz Republic, thousand ha[60]

The name of indicators	1992	1997	2007	2017	2018	2019	2020
Agricultural lands	68.4	631.2	945.3	1037.4	1037.1	1038.8	1039.7
Arable land	11.8	476.1	846.7	924.5	924.1	925.5	926.3
Irrigated arable land	9.8	323.9	586.2	635.3	635.6	636.1	636.7
Pastures	54.9	77.0	0.7	0.7	0.7	0.6	0.6
Perennials	0.5	13.4	15.5	19.1	19.2	19.5	19.6
Hayfields	1.1	64.5	74.2	85.1	85.1	85.2	85.3

According to these statistics, with a total number of 349,159 peasant farms in 2020, one farm accounted for: total land - 2.3 ha, including arable land - 2 ha (1.4 ha - irrigated), 0.04 ha of perennial plantations and 0.18 hectares of hayfields. Such fragmentation of agricultural land does not allow the introduction and dissemination of the practice of zero tillage, which is one of the best practices of agricultural land, and small plots and disunity of farmers do not allow the introduction of crop rotation;

- *Others: Ecological*
    - Decreased soil fertility.

The key barriers identified based on the results of discussions with stakeholders and assessed by their importance are presented in Table. 1.7.

Table 1.7. Key barriers to the introduction and dissemination of OA.

Categories	barriers	rate
Economic and financial		
1	Lack of investment in OA expansion	5
2	Lack of equity capital for OA start-ups	5
3	Limited access of OA producers to loans on acceptable terms	5
Non-financial		
Policy legal and regulatory		
4	Lack and absence of a strategic policy document for the development of the OA	5
5	Gaps in technical regulations for OA	5
Institutional		
6	Lack of certification system and uncertainty with voluntary certification of OA products	5
Market conditions		
7	Lack of organic seed and planting material	4
8	Lack of quality control of imported seed material	4
9	Difficulties in marketing OA products	
Human management skills		
10	Lack of knowledge and practical skills among economic entities of agriculture for the production of organic products	4

[59] State institution "Cadastre". Land registration as of January 1, 2021
[60] National Statistical Committee. http://www.stat.kg/ru/opendata/category/181/

Categories	barriers	rate
eleven	Insufficient use of biological plant protection products and organic fertilizers by economic entities of agricultural enterprises,	
Network		
12	Weak coordination and support of stakeholders at the state level for the development of the OA.	4
Information and awareness		
13	Insufficient scientific capacity for advisory support on OA.	4
14	Low awareness and awareness of the OA, its benefits and the importance of development in the KR	3
15	Lack of information on current OA technologies	3
Others: Small scale of current OA producers		
16	Small-scale farm production OA	5
Others: Environmental		
17	Decreased soil fertility	

Logical problem analysis (LPA) of economic, financial and non-financial barriers to the introduction and dissemination of organic agriculture technology is presented as a problem tree for promoting OA in fig. 1.8.

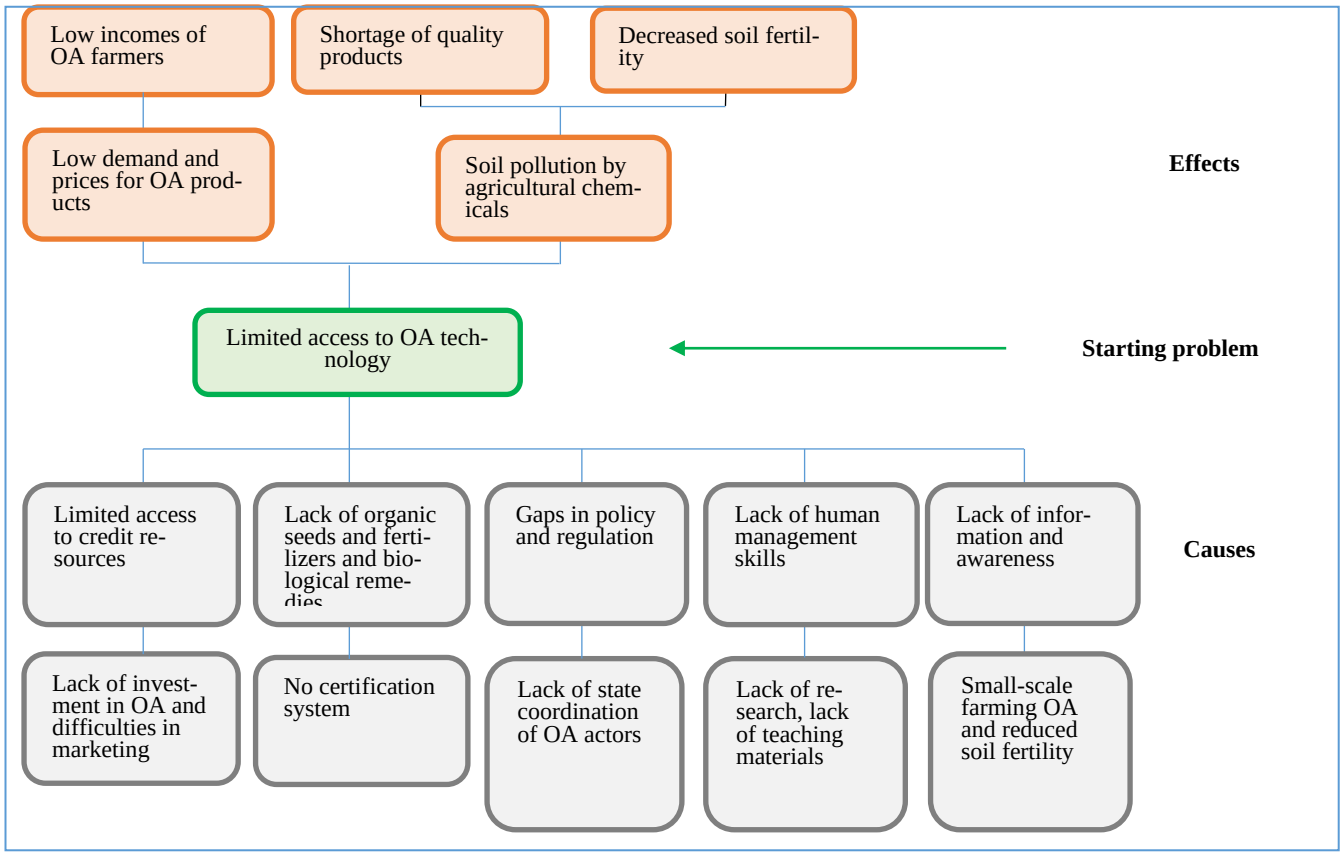


Figure 1.8. LPA problem tree for OA technology.

1.3.5 Identified measures to advance the technology

In the course of consultations with stakeholders organized in person and as a result of an online survey, as well as meetings with stakeholders, as well as based on the analysis of the experience of national and international projects on livestock development and pasture management, the following measures

were identified to facilitate the transfer of technology of Organic Agriculture with its subsequent distribution throughout the territory of Kyrgyzstan.

1.3.5.1 Economic and financial measures

Among the economic and financial measures proposed by the participants in the stakeholder discussions, we highlight the following:

- It is proposed to attract investments for the development of OA through the development of a new state program for OA aimed at developing an enabling environment for OA and subsidizing OA producers. In addition, using state-owned reserve lands, it was proposed to support the initiatives of private owners using the mechanism of "public-private partnership" to create arrays and new "Organic Aimaks"
- In addition, it is proposed to mobilize international financial resources for the implementation of projects for the development of the national systemic, institutional and individual potential of the OA and financial support for farmers practicing OA.
- Continuation and expansion of the state program "Financing of Agriculture" for lending at preferential interest to agricultural producers, highlighting them in a separate category of beneficiaries.
- Another measure related to access to credit resources was proposed to be the development of the land market, which involves changing the legislation on land pledges for obtaining bank loans.

1.3.5.2 Non-financial barrier measures

The stakeholder discussions also identified a number of non-financial measures that are important for advancing OA:

- The following measures have been proposed to create an enabling policy, legal and regulatory framework:
    - Development and adoption of the State Program for the development of the OA. The existing legal framework for the organization of organic movement in Kyrgyzstan needs to be reinforced by political goals and objectives to create an enabling environment, identify and allocate new areas for agricultural production, as well as to subsidize agricultural producers.
    - Adoption/introduction of amendments to the legal documents on the requirements for the production process of OA, the criteria and procedure for certification of organic products of OA and the support of OA in general.
- The following measures are proposed to overcome institutional barriers:
    - Improve the transparent system of voluntary certification of organic products and finalize the national standard in terms of implementation procedures using scientific developments and research results. Harmonize national and international standards for OA production. Equip laboratories and accredit the national organization to IFOAM. This measure will help overcome the barrier of the lack of an organic certification system. .
- The following measures were proposed to improve AO market conditions:
    - As part of the seed and breeding farms development process launched by the state, to establish seed farms oriented to the OA market for the production of high-quality organic seeds and planting material to expand the areas of OA cultivars;
    - To strengthen control over the import into the territory of the republic of GMO-containing seeds, the use of which is contrary to organic methods of OA production, it is proposed to introduce high customs duties on such materials.

- To address issues of improving the marketing of organic products, it is proposed to expand marketing services and promote healthy eating based on organic products, to make regular advertising campaigns, fairs of organic products already voluntarily certified in the Kyrgyz Republic? As well as to develop a catalogue of OA products and manufacturers and place it on the Internet. In addition, it was proposed to expand the network of retail trade for organic products in the regions.

- As a measure to overcome the barrier of lack of knowledge and skills of farmers on the agricultural sector, the process of increasing the institutional and individual capacity, carried out by the FOD "BIO.KG" and the PF "Bio Service" within the framework of the mobilized resources of international projects, will be expanded, taking into account the development of farmers' skills in marketing and financial management still remain among the main barriers. In addition, educational and methodological materials on OA will be developed to connect to the process of capacity building of the RAS. Training modules on OA will be integrated into the curriculum of KNAU.
- Insufficient use by economic entities of organic production of biological plant protection products and organic fertilizers will be addressed by expanding the production of organic fertilizers and biological plant protection products in all regions of the country and information and training campaigns on the rules and norms for their use will be carried out.
- Weak coordination of the process of development of OA by the state will be strengthened by involving local state administrations, local governments, as well as research institutions and business communities in the process of development of OA. On the implementation of the tasks of organic agricultural production, the regular sessions of the Coordinating Council for the Development of Organic Agricultural Production under the Government of the Kyrgyz Republic will be held. At the same time, the DOAD will become the working secretariat of the council and will prepare materials to accelerate the expansion of the OA as a competitive advantage of the Kyrgyz Republic in the region and monitor the implementation of the decisions taken by the council.
- Information and awareness barriers will be addressed by the following:
    - Insufficient scientific capacity for advisory support to the OA will be strengthened by the expansion of the participation of scientific and educational organizations in the development of the OA, and the topics of the OA will be included in the Scientific Work Plans of the relevant institutions to develop appropriate recommendations on the best practices of the OA, as well as allowing the formation of a scientific basis for the harmonization of national and international Oa standards. The process of developing teaching aids for educational institutions and practical guides, training materials and visual materials on agricultural technology and agroecology for the training of advisory services and farmers will be intensified. The Organic Aimak initiative will continue.
    - To address low awareness about OA, a range of communication products will be developed and a series of information and promotional activities will be carried out to promote OA products using the media, Internet resources and social networks.
    - The lack of information about the best modern practices of the OA will be solved by creating on the basis and under the moderation of the FOM "BIO.KG" an online platform "Communities of Practice", which will be run by farmers and entrepreneurs themselves and discuss the problems that they face directly in the implementation of technology. The complex nature of OA technology, which integrates a whole set of techniques and approaches to agricultural production based on agroecology, will also receive wide information support from both scientific and educational institutions, the media, NGOs, and from businesses - manufacturers, importers and dealers of related equipment for OA.

- In order to resolve the problem of small scale production of OA, currently, the Ministry of Agriculture is developing a concept for the development of the land market, where one of the directions has already been announced is the consolidation of agricultural land. As expected, as a result of its implementation, a number of farms with large land plots will appear, where it will become possible to apply zero tillage and organize crop rotation.
- The decrease in soil fertility will be overcome by the development of soil fertilization schemes with organo-mineral fertilizers based on individual fields. For this, the Republican Soil-Agrochemical Station will be involved, which will conduct surveys of all agricultural lands intended for agricultural land.

The results of the LPA on economic, financial and non-financial measures for the introduction and dissemination of OA are presented in Figure 1. 1.9 as an objectives tree.

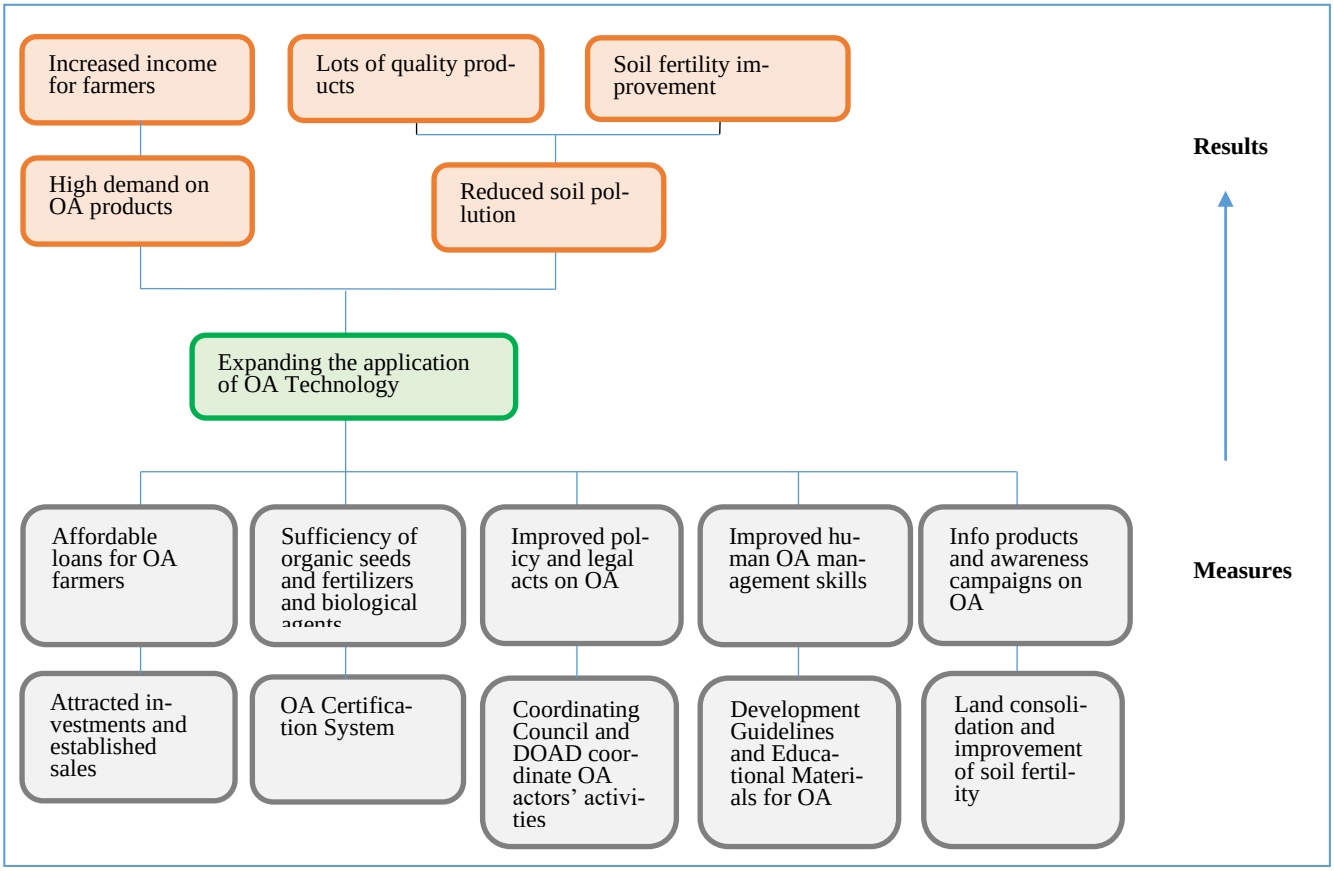


Figure 1.9. LPA objective tree on economic financial and non-financial measures for the deployment and diffusion of OA.

Tab. 1.8. below presents a set of barriers that impede the development of OA technology and related measures that will remove barriers to the promotion and widespread use of OA technology in the context of climate change in all regions of Kyrgyzstan.

Table 1.8. The list of barriers and measures to promote OA by category.

Categories	Barriers	No.	Measures
Economic and financial			
1	Lack of investment in OA expansion	1	Investments for the development of OA through the new state program for OSA aimed at creating a favourable environment for OA and subsidizing OA producers.
		2	Using state reserve lands, it was proposed to support the initiatives of private owners using the mechanism of "public-private partnership" to create large land areas of the OA and new "organic aimaks"
		3	Mobilization of international financial resources for the implementation of projects for the development of the capacity of the OA and financial support for farmers practicing OA.
2	Lack of equity capital for OA start-ups	4	Continuation and expansion of the state program "Financing of Agriculture" for lending at preferential interest to agricultural producers, highlighting them in a separate category of beneficiaries
3	Limited access of OA producers to loans on acceptable terms	5	Access to credit resources will be improved through the land market development strategy, which involves changing the legislation on land collateral for obtaining bank loans.
Non-financial			
Policy, legal and regulatory			
4	Lack and absence of a strategic policy document for the development of the OA	6	Development and adoption of the State Program for the development of agricultural crops with clearly formulated political goals and objectives for creating a favourable environment, allocating new areas for agricultural crops, as well as subsidizing agricultural producers.
5	Gaps in technical regulations on OA	7	Adoption/introduction of amendments to the legal documents on the requirements for the production process of OA, the criteria and procedure for certification of organic products of OA and the support of OA in general.
Institutional			
6	Lack of certification system and uncertainty with voluntary certification of OA products	8	Improving the transparency of the system of voluntary certification of organic products and finalizing the national standard in terms of implementation procedures using scientific developments and research results.
		9	Harmonize national and international standards for OA production.
		10	Equip laboratories and accredit the national organization to IFOAM.
Market conditions			
7	Lack of organic seed and planting material	11	As part of the development process of seed and flame farms, launched by the state, to establish seed farms oriented to the OA market for the production of high-quality organic seeds and planting material to expand the areas of OA
8	Lack of quality control of imported seed material	12	Strengthen control over the import into the territory of the republic of GMO-containing seeds, the use of which is contrary to organic methods of agricultural production is constantly growing. Introduce customs duties on such materials.
9	Difficulties in marketing OA products	13	Expand marketing services and promotion of healthy eating based on organic products, make regular advertising campaigns, fairs of organic products already voluntarily certified in the Kyrgyz Republic. to develop a catalogue of OA products and manufacturers and place it on Internet resources and social networks. Expand the local organic trade network.
Human management skills			

Categories	Barriers	No.	Measures
10	Lack of knowledge and practical skills among economic entities of agriculture for the production of organic products	14	As measures to overcome this barrier, the process of increasing the institutional and individual potential, carried out by the FOD "BIO.KG" and the PF "Bio Service" within the framework of the mobilized resources of international projects, will be expanded, taking into account the development of farmers' skills in marketing and financial management. number of major barriers. In addition, educational and methodological materials on OA will be developed to connect to the process of capacity building of the RAS. Training modules on OA will be integrated into the curriculum of KNAU.
11	Insufficient use of biological plant protection products and organic fertilizers by economic entities of agricultural enterprises,	15	To overcome this barrier, the production of organic fertilizers and biological plant protection products will be expanded in all regions of the country and information and training campaigns will be held on the rules and norms for their use.
Network			
12	Weak coordination and support of stakeholders at the state level for the development of the OA.	16	In order to strengthen, coordinate and involve local state administrations, local governments, as well as research institutions and business communities in the process of development of the OA from the implementation of the tasks of organic agricultural production, meetings will be held regularly Coordinating Council for the Development of Organic Agricultural Production under the Government of the Kyrgyz Republic. The DOAD will become the working secretariat of the council and will prepare materials to accelerate the expansion of the DOAD as a competitive advantage of the Kyrgyz Republic in the region and monitor the implementation of the decisions taken by the council.
Information and awareness			
13	Insufficient scientific capacity for advisory support on OA.	17	The subject of OA will be included in the Plans of scientific work of the relevant institutions to develop appropriate recommendations on the best practices of OA, as well as to form a scientific basis for the harmonization of national and international standards of OA. The process of developing teaching aids for educational institutions and practical guides, training materials and visual materials on agricultural technology and agroecology for the training of advisory services and farmers will be intensified. The Organic Aimak initiative will continue.
14	Low awareness and awareness of the OA, its benefits and the importance of development in the KR	18	To address these issues, a number of communication products will be developed and a number of information and promotional events will be held to promote OA products using the media, Internet resources and social networks. On the basis of the BIO.KG FOM, an online Community of Practice will be created, where farmers and entrepreneurs themselves will discuss the problems of introducing OA practices.
15	Lack of information on current OA technologies	19	The complex nature of the OA technology, integrating a whole set of techniques and approaches of agricultural production based on agroecology, will also receive wide information support both from the scientific and educational institutions of NGOs, and from business - manufacturers, importers and dealers of the corresponding equipment for OA.
Others: Small scale of current production			
16	Small-scale farm production OA	20	Currently, the Ministry of Agriculture is developing a concept for the development of the land market, where one of the directions has already been announced is the consolidation of agricultural land. As expected, as a result of its implementation, a number of farms with large land plots will appear, where it will become possible to carry out zero tillage and organize crop rotation.
Others: Environmental			
17	Decreased soil fertility	21	This barrier will be overcome by the development of schemes for soil fertilization with organic-mineral fertilizers based on individual fields. For this, the Republican Soil-Agrochemical Station will be involved, which will conduct surveys of all agricultural lands intended for agricultural land.

1.4 Barrier Analysis and Possible Enabling Measures for Drip Irrigation

Despite the fact that, at first glance, drip irrigation technology belongs to the water sector, in the discussions of the Sectoral Working Group with the participation of all interested parties, it was decided to accept it for consideration in the "Agriculture" sector. This decision was determined by the natural and climatic conditions of agriculture in the arid and semi-arid zones of the Central Asian region. The country's crop production is completely dependent on irrigation and the issue of efficient use of water resources is especially relevant in the country's agriculture, which consumes about 90% of the total water intake from natural sources.

1.4.1 Legal basis for expanding the use of DI

The legal basis for the use of water resources of the Kyrgyz Republic is laid down in the Water Code of the Kyrgyz Republic,[61]which regulates water relations in the field of use, protection and development of water resources for a guaranteed, sufficient and safe supply of water to the population of the Kyrgyz Republic, environmental protection and ensuring the rational development of the water fund of the republic. The Code defines the management of water resources, presents the principles of their management, determines the competences of state bodies for water management, monitoring, planning and priorities for the use of resources.

National Development Strategy for 2018-2040 in the section "Creating an environment for development" Task 7.19 on sustainable water resources management makes it clear, that technologies for the efficient use of water resources will be widely introduced, which will significantly increase the water use coefficient. [62]

In the National Development Program until 2026 in section 6.2. “Agriculture and processing” noted that, taking into account the need to adapt to the climate change, one of the important areas is the economical, rational and efficient use of available water resources.[63]

More specifically, the course towards the development of DI systems for solving the problem of technological modernization of the agro-industrial complex is noted in the Action Plan of the Cabinet of Ministers of the Kyrgyz Republic for the implementation of the National Development Program of the Kyrgyz Republic until 2026, which refers to the creation of favourable conditions for the supply of agricultural machinery and mechanized means of production to processing industry enterprises, equipment for drip systems irrigation and greenhouses. At the same time, the indicator of the implementation of this measure will be the supply of agricultural machinery and equipment for processing industry systems, drip irrigation and greenhouses in the amount of 426.0 million soms and the renewal of the agricultural technical park.[64] Besides, the expansion of the use of DI technology is also in line with the recently adopted National Water Strategy of the Kyrgyz Republic, which defines as its goal the creation of a sustainable water management system in the Kyrgyz Republic for the benefit of present and future generations. The following priority areas have been identified there:

1. Protection of water resources from depletion and pollution;
2. Rational use of water resources;
3. Reforming the water management system.[65]

[61]dated January 12, 2005 No. 8
[62]Approved by the Decree of the President of the Kyrgyz Republic of October 31, 2018 UP No. 221.
[63]Approved by the Decree of the President of the Kyrgyz Republic of October 12, 2021 UP No. 435.
[64]Approved by the Resolution of the Cabinet of Ministers of the Kyrgyz Republic dated December 25, 2021 No. 352
[65]Approved by the Decree of the President of the Kyrgyz Republic of February 10, 2023, UP No. 23.

The expansion of the use of DI systems is fully consistent with the second priority area for the rational use of water resources, especially in the context of the negative impacts of climate change.

1.4.2 Institutional organization for expanding the use of DI

Institutional organization for the introduction and expansion of the use of DI systems In Kyrgyzstan, it is the prerogative of local level institutions of decision-making and management, which are integrated into the national water resources management system.

At the highest political level, the National Council handles water issues for Water and Land Resources under the President of the Kyrgyz Republic, which is a consultative and deliberative body under the President of the Kyrgyz Republic. The purpose of the creation of the National Council is to develop systemic, comprehensive and coordinated recommendations and policy measures for the management of water and land resources, their use and protection, and its Chairman is the President of the Kyrgyz Republic. The main tasks and functions of the National Council are:

- coordination of the activities of ministries, administrative departments and other state bodies on the management of water and land resources, their use and protection;
- consideration of regulatory legal acts in the field of water and land management for submission to the Administration of the President of the Kyrgyz Republic.[66]

The Ministry of Agriculture of the Kyrgyz Republic is an authorized state executive body that implements state policy in the field of agro-industrial complex, including animal husbandry, veterinary medicine, fish farming (aquaculture), plant growing, plant quarantine, land reclamation, land resources, water resources for irrigation and production, irrigation and reclamation infrastructure. The tasks of the Ministry of Agriculture include the development and implementation of a unified state policy in the field of agriculture, water, forestry, food and processing industries, efficient and rational use of land resources, water resources in irrigation and reclamation systems.[67]

The Water Resources Service (WRS)) is a state institution and subordinate subdivision of the Ministry of Agriculture of the Kyrgyz Republic, which carries out state regulation of relations in the field of management and use of water resources. The main objectives of the Service are:

- introduction of a mechanism for integrated water resources management;
- ensuring sustainable management and rational use of water resources and water infrastructure facilities;
- ensuring effective interstate cooperation in the field of management and use of water resources and regulation of other interstate water relations.

Technological modernization of the agricultural sector of Kyrgyzstan is ensured by the Department of Mechanization of Innovative Technologies and Agricultural Cooperation under the Ministry of Agriculture of the Kyrgyz Republic, which carries out activities in the field of modernization and renewal of the machine and tractor fleet, increasing the level of mechanization and technical potential of agricultural production and the processing industry of agriculture, introducing new resource-saving energy sources and innovative technologies in all sectors of the agricultural sector, the creation of agricultural cooperatives, as well as the organization of work on the provision of leasing services for the provision

[66]Regulations on the National Council for Water and Land Resources under the President of the Kyrgyz Republic, approved by Decree of the President of the Kyrgyz Republic dated November 24, 2021 No. 532.
[67]Regulations on the Ministry of Agriculture of the Kyrgyz Republic, approved by the Resolution of the Cabinet of Ministers of the Kyrgyz Republic dated March 9, 2021 No. 83.

of machinery and equipment to rural producers.[68]It is this department that is the authorized state body involved in the introduction and expansion of the use of DI technology.

Scientific support for the introduction of technology in the Kyrgyz Republic is carried out by the Kyrgyz Research Institute of Irrigation under the Ministry of Agriculture of the Kyrgyz Republic, whose goal is to conduct research work in the field of irrigation, melioration, irrigated agriculture and hydrogeology to solve scientific and technical problems related to water, agriculture and environmental management. The Institute pursues a scientific, technical and technological policy in the water management industry.[69]

Since the beginning of the 2000s, the PF "Centre for Training, Consultations and Innovations" has been dealing with the implementation of DI since the beginning of the 2000s, which began its activities in 2002 as the Consulting and Training Centre of the Rural Advisory Service, supporting rural development by organizing and conducting trainings and providing appropriate information. The main target group were the regional RAS centres and other organizations that work directly with farmers. In 2008, after the general reform of the RAS, it was transformed into the Public Foundation "Centre for Training, Consultation and Innovation". This Fund was among the first service providers to install DI systems in Kyrgyzstan.

At present, a certain number of other private service providers have appeared in the country, engaged in the installation of equipment for DI systems.

1.4.3 General description of the DI technology

Drip irrigation (DI) technology can be categorized as a “consumer product” from a market point of view, according to the criteria of the Barrier Assessment Guidelines,[70] developed by UNEP and the Danish Technical University, since it is widely used in home gardens by the population of the country in the simplest technical solutions. However, taking into account the existing plans for the development of agricultural production in the Kyrgyz Republic, this technology can also be classified as “capital goods” in the future.

Drip irrigation is a method of moistening the soil in the root layer of plants by continuous portioned (drip) water supply with a special dropper. A DI system consists of a reservoir (tank), a filter, taps, a main, distribution and irrigation pipeline and a dropper. Irrigation water with the help of special droppers without loss is supplied to each plant.

In the 1980s, a number of projects were implemented in the Republic to introduce drip irrigation technologies on experimental plots with an area of more than 10 hectares in Batken region (vineyards), Issyk-Kul region (apple and apricot orchards), Chui region (vegetables), etc. In 1990s, with the help of drip irrigation, about 800 hectares of perennial fruit plantations were already irrigated. However, soon, further promotion of drip irrigation systems in the Kyrgyz Republic stopped. And only after 2008, various international projects began to finance the implementation and dissemination of water-saving technologies and drip irrigation technology in the Kyrgyz Republic. Against the backdrop of

[68]Regulations on the Department of Mechanization, Innovative Technologies and Agricultural Cooperation under the Ministry of Agriculture of the Kyrgyz Republic approved by the Resolution of the Cabinet of Ministers of the Kyrgyz Republic dated August 6, 2021 No. 116

[69]Charter of the Kyrgyz Research Institute of Irrigation under the Ministry of Agriculture of the Kyrgyz Republic approved by the Resolution of the Cabinet of Ministers of the Kyrgyz Republic dated February 18, 2022 No. 82.

[70]Nygaard, I. and Hansen, U. (2015). Overcoming Barriers to the Transfer and Diffusion of Climate Technologies: Second edition. UNEP DTU Partnership, Copenhagen. This guide is available at https://tech-action.unepccc.org/wp-content/uploads/sites/2/2021/01/overcoming-barriers-to-the-transfer-and-diffusion-of-climate-technologies-2nd-edition.pdf www.tech-action.org.

the difficult economic situation in Kyrgyzstan, which causes a lack of investment, the use of DI is primarily expedient in conditions where this technology has undeniable advantages,

- in areas of irrigation with acute water deficit;
- on slopes, uneven and foothill lands;
- on highly permeable soils (stony, sandy, gravelly, etc.);
- on those lands where other methods of irrigation (irrigation along furrows and strips, sprinkling, etc.) are not acceptable and inefficient
- in greenhouses throughout the country.[71]

The significant cost of equipment and operation of drip irrigation systems predetermines the feasibility of their use, primarily for irrigating high-yielding crops that are in steady demand in domestic and foreign markets at the level of wholesale and retail prices that ensure the profitability of their production. The most attractive from this point of view are fruit, berry and melon crops. Therefore, today, DI systems in the Kyrgyz Republic can be applied to apricot, apple, peach, cherry, vineyard, tomato, pepper, cucumber, strawberry, watermelon, melon and other highly profitable crops, as well as in greenhouses for vegetables.

As of January 1, 2021, 2,574 greenhouses of various types were operating in the republic, according to the Ministry of Agriculture, with the total area of approximately 182 hectare. They mainly grow vegetables (cucumbers, tomatoes, peppers), as well as lemons and flowers.

The greenhouse construction boom in Kyrgyzstan began after 2010. Those who have mastered technology well are expanding. Some have closed due to various problems. Since 2017, greenhouse farms have receive access to preferential loans for two years, and now there are proposals to increase the loan repayment period up to five years.[72]

According to the Ministry of Agriculture, today the demand for drip irrigation in the Kyrgyz Republic is increasing. Therefore, it is planned to build a plant for the production of drip irrigation equipment in Kyrgyzstan, and work is currently underway to attract investors. This plant will probably operate in the framework of a public-private partnership. The Aiyl Bank provides farmers with leasing for well repair and equipment purchase credits. However, in 2021, only 2.5 thousand hectares of farmland were covered by drip irrigation. [73]

A number of economic and environmental benefits of this technology were identified during discussions with stakeholders:

- Saving irrigation water 3-10 times;
- Increasing crop yields by 20-30%;
- Good development of annual shoots, acceleration of crop maturation by 10-20 days;
- It is not allowed to wash away the fertile soil layer;
- Possibility of fertilizing together with irrigation water;
- Fewer weeds between rows;
- Semi / full automation of watering and reduction of manual labour of the waterer;
- Energy savings (if an electric pump is used).
- Development of a repair base maintenance and new jobs.
- Expansion of services of consulting service providers. [74]

[71]UNECE. 2015 Modern irrigation technologies. Recommendations for implementation in Kyrgyzstan
[72]Anastasia Bengard. April 14, 2021. 24.kg agency,
[73]Y. Kopytin Kyrgyzstan will start producing equipment for drip irrigation of lands. Agency 24.kg, 29.12.2021
[74] Agroportal of Kyrgyzstan, Agricultural news. https://agro.kg/en/plant_growing/6550/

1.4.4 Identification of Barriers to Drip Irrigation Technology

As a result of the study, online survey and consultations with stakeholders, a list of all the major barriers that will have to be faced in the transfer, implementation and dissemination of DI technology was prepared and discussed. Based on the outcomes of stakeholder discussions, 21 barriers were identified, of which thirteen key barriers were ranked as important to expanding the use of DI in Kyrgyzstan.

1.4.4.1 Economic and financial barriers

Based on the analysis of the regulatory framework for technical reports of international projects, on the results of online surveys of the members of the SWG and on discussions with stakeholders, the following barriers of this category can be identified that impede the diffusion of DI technology in the Kyrgyz Republic:

- Expensive equipment. This barrier is associated primarily with the low livelihoods of the majority of interested small farmers, who form the majority of the country's agricultural producers. Selling prices are also affected by high customs duties, taxes and high transaction costs for importers and retailers. High land fragmentation and reluctance to form cooperatives does not prevent economies of scale from being exploited and reducing the overhead costs of transport and installation of equipment for farmers.
- Lack of concessional credit financing for farmers who need DI systems. Lack of affordable credit resources is a common problem for farmers associated with high interest rates of commercial banks and insufficient financing of the state program of the DI on preferential loans for farmers.
- The energy dependence of some DI systems on the availability of electricity for water supply, which increases operating costs. In some cases, the use of DI pumping systems depends on access to electricity sources, which introduces certain restrictions and significantly increases the cost of operating DI systems.

1.4.4.2 Non-financial barriers

In addition to economic and financial barriers, the stakeholders' discussions and surveys and face-to-face meetings led to the formulation of a number of non-financial barriers, including the following:

- *Policy, legal and regulatory*
  - Lack of DI development policy. This barrier is associated with the absence, first of all, of an irrigation policy that promotes water saving and water efficiency. At the same time, the use of traditional gravity and furrow irrigation is already showing its inefficiency associated with high water losses during transportation due to infiltration and evaporation, which becomes especially evident in the context of climate change in Kyrgyzstan (heat waves, the number of consecutive days without precipitation, more frequent periods shallow rivers).
  - Gaps in technical regulatory documents on DI. This barrier is determined by the lack of technical documents that determine the procedure for use, requirements for the quality of irrigation water.
- *Institutional*
  - Lack of advisory and repair service. Drip irrigation has not yet become a mandatory and technically developed type of advisory assistance to farmers in the system of rural advisory services according to the scheme: field survey - calculation of the technical specification of equipment - places of purchase - training in use - supply

of spare parts and consumables - equipment repair. Separate existing private campaigns do not yet fully meet the systemic technological needs in the field and do not provide relevant services.

- *Market*
  - Lack of a production base for the manufacture of high-quality DI systems and spare parts. All currently used KO systems are assembled from imported components; the production of spare parts outside the country has not yet been established.
  - Lack of a supply network of quality spare parts in all regions. As a consequence of the previous barrier, there is no spare parts sales network in Kyrgyzstan covering all the regions.
- *Human management skills*
  - Lack of knowledge and practical skills of agricultural business entities on the proper operation of DI systems. Most of the DI systems currently in use often break down and many farmers refuse to continue using them. This is due to the lack of a culture of operation and ignorance of the rules and regularity of maintenance.
  - Lack of technical expertise to install and maintain a drip irrigation systems. The previous barrier could have been avoided if the country had technical expertise, which is just beginning to take shape, but not available everywhere.
- *Information and awareness*
  - Low awareness and awareness of the benefits and importance of developing DI as a water efficient technology. Among others, this barrier is an important constraint to the development of the use of DI systems, due to the lack of champions promoting DI in general and the lack of communication products in the media and social networks, especially at the local level. In principle, this is the result of the lack of a policy to promote water-efficient use of water resources in the country as a whole. The shortage of estimated quantitative data on the benefits of using DI, especially for perennial plantations, does not allow farmers to make a choice in favour of DI.
  - Lack of information about modern high-tech DI systems. A number of greenhouse farms that are actively developing in Kyrgyzstan are currently interested and looking for automated DI systems using Internet resources. There are no trade and information platforms for information promotion and sales of such DI systems in the country.
- *Others: Environment*
  - Lack of available sources of clean water. The water supplied to the fields and plots of farmers at the local community level is brought mainly through earthen channels with a high level of suspended particles that quickly clog filters and drippers of DI systems, so it is especially advantageous to install drip systems near groundwater wells, which have a high natural quality water.

The key barriers identified based on the results of discussions with stakeholders and assessed by their importance are presented in Table. 1.9.

Table 1.9. Key barriers hindering the deployment and diffusion of DI.

Categories	Barriers	Score
Economic and financial		
1	The high cost of equipment	5
2	Lack of concessional funding for farmers who need QR systems	5
3	The energy dependence of some HPS systems on the availability of electricity for water supply, which increases operating costs.	4
Non-financial		
Policy, legal and regulatory		

Categories	Barriers	Score
4	Lack of KO development policy	5
5	Gaps in technical regulatory documents on QR	3
Institutional		
6	Lack of advisory and repair service	5
Market		
7	Lack of a production base for the manufacture of high-quality KO systems and spare parts	5
8	Lack of a supply chain of quality spare parts in all regions	4
Human management skills		
9	Lack of knowledge and practical skills of agricultural business entities on the proper operation of CR systems	4
10	Lack of technical expertise to install and maintain a drip irrigation system	4
Information and awareness barriers		
11	Low awareness and awareness of the benefits and importance of developing QR as a water efficient technology.	4
12	Lack of information about modern high-tech CR systems	3
Others: Environmental		
13	Lack of clean water sources	4

Logical problem analysis (LPA) of economic, financial and non-financial barriers to the deploy and diffuse the DI technology is presented as a tree of problems in Fig. 1.10 below.

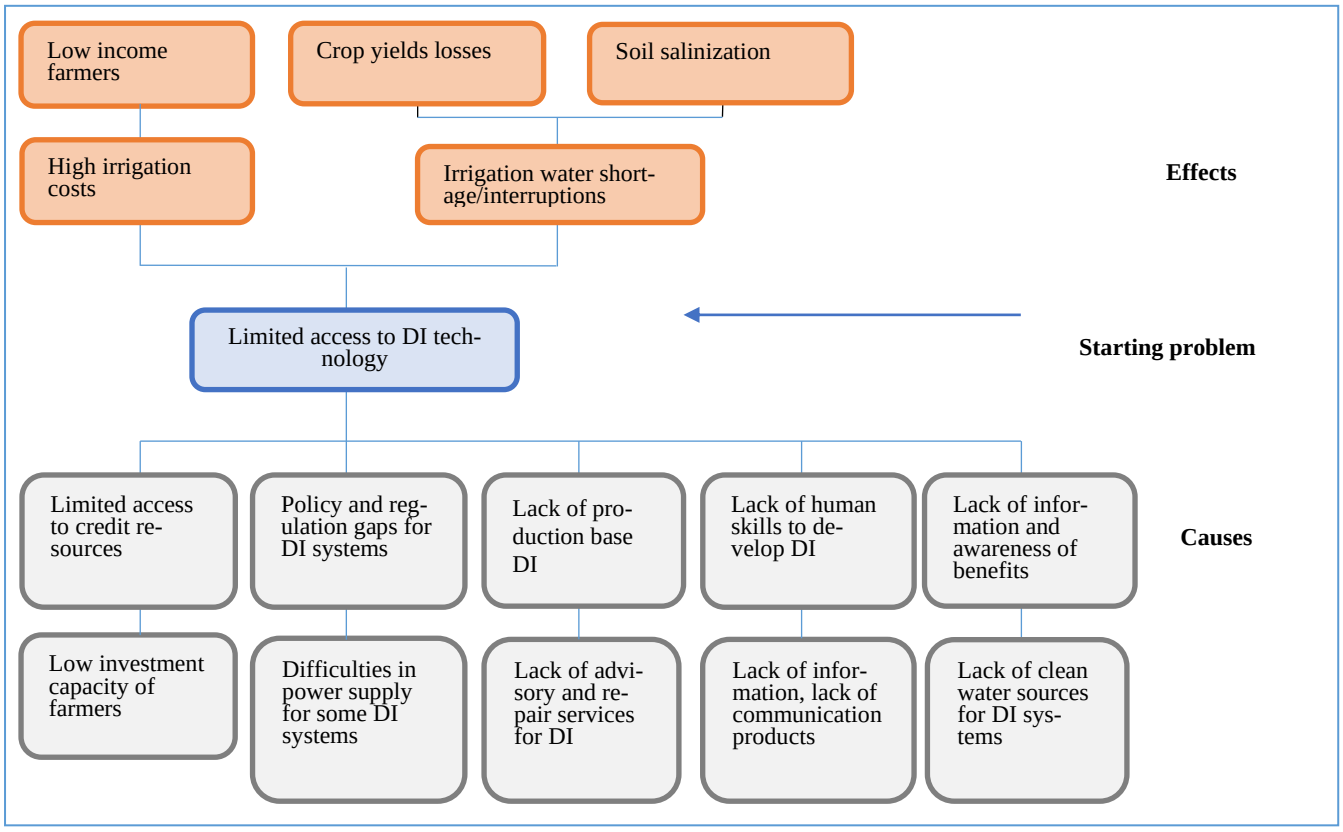


Figure 1.10. LPA problem tree on DI technology.

1.4.5 Possible measures to advance the technology

During consultations with stakeholders organized in person and as a result of an online survey, as well as meetings with stakeholders, as well as based on an analysis of the experience of national and international projects, the following measures were identified to facilitate the transfer of Drip Irrigation technology with its subsequent dissemination throughout the territory of Kyrgyzstan .

1.4.5.1 Economic and financial measures

Among the economic and financial measures proposed by the participants in the stakeholder discussions, we highlight the following:

- Building our own plant for the production of DI systems is expected to reduce the cost of DI systems.
- It is proposed to attract investments for the development of DI and improve access to cheap loans through the development of an addendum to the state program "Financing of Agriculture", aimed at supporting farmers who are going to install DI systems.
- In addition, it was proposed to mobilize international financial resources for the implementation of projects for the development of the capacity of DI and financial support for farmers.
- Another measure related to access to credit resources was proposed to be the development of the land market, which involves changing the legislation on land pledges for obtaining bank loans.
- The energy dependence of some DI systems, can be lessened by using inclined gravity DI systems on the terrain sites, or by increasing investments to bring electricity to DI sites.

1.4.5.2 Non-financial measures

- *Policy, legal and regulatory*
    - The absence of a policy for the development of DI and, above all, an irrigation policy that promotes water saving and water efficiency will be compensated by the development of an appropriate strategic document to increase effective use of water at the on-farm level by communities and at the level of individual water users and water saving on inter-farm irrigation systems.
    - In addition, to solve the problem of increasing water efficiency, a number of technical regulatory documents are needed to promote such technologies, including DI systems. Such technical documents defining the use order, irrigation water quality requirements, use and loss norms would help the wider development of DI.
- *Institutional*
    - For the development of advisory and repair services, services for the development of DI will be integrated into the list of services provided by RAS for advisory assistance to farmers including field surveys - calculation of technical specifications for equipment - places of purchase - training in use. And also through the development of DI service centres for the supply of spare parts and consumables and the repair of equipment based on existing private campaigns in the field.
- *Market*
    - As noted above, the Cabinet of Ministers is going to build a plant for the production of DI systems, i.e. to create a production base for the development of DI, therefore, this is a real measure that will reduce the dependence of the Kyrgyz Republic on the import of components and spare parts.

    - To remove the barrier due to the lack of a supply network of quality spare parts in all regions, it is necessary to create service centres for DIs and a sales network of spare parts covering all regions, which will overcome the shortage of quality spare parts.
- *Human management skills*
    - The practical skills of agricultural business entities in the proper operation of DI systems will be strengthened by measures to increase the capacity of DI users and service centres. In order to increase the culture of operation and knowledge of the rules and the regularity of maintenance, it is also proposed to conduct regular information campaigns on best practices in the field.
    - Special training programs to expand technical expertise and improve the skills of RAS professionals will also be developed and implemented for the subsequent transfer of knowledge and strengthening the skills of DI users.
- *Information and awareness barriers*
    - In order to disseminate information and raise awareness about the benefits and importance of developing DI as a water efficient technology, it is proposed to develop communication products and conduct information campaigns on water efficient technologies in the media and social networks, especially at the local level with the presentation of quantitative data on the benefits of using DI, especially for new multi-year plantations.
    - To address the issue of a general lack of information about modern high-tech DI systems, it was proposed to create a trading and information platform with the preparation of information products and promotions on high-tech DI systems.
- *Others: Environmental*
    - Kyrgyzstan has a significant number of mothballed wells that are now being rehabilitated by the communities themselves. This practice is proposed to be further developed for use in DI systems. In addition, as a cheap measure, the creation of sedimentation tanks for irrigation water was proposed.

Logical problem analysis (LPA) for economic, financial and non-financial measures for the deployment and diffusion of DI technology is presented as a task tree in Fig. 1.11 below.

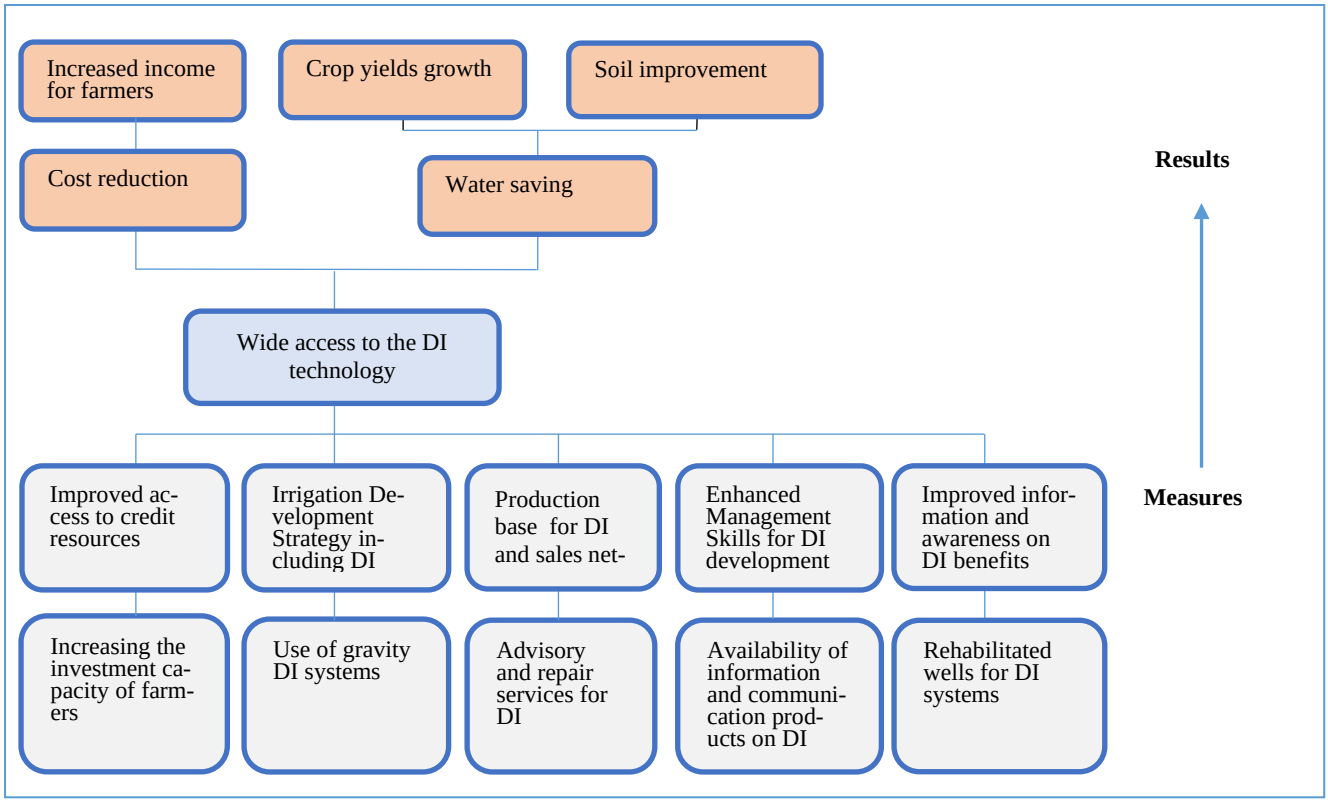


Figure 1.11 LPA objective tree on DI technology.

Tab. 1.10. below presents a set of barriers that impede the development of DI technology and related measures that will remove barriers to the promotion and widespread use of DI technology in the context of climate change in all regions of Kyrgyzstan.

Table 1.10. List of barriers and measures for the development of the Drip Irrigation technology

Catego-ries, No.	barriers	No.	Measures
Economic and financial			
1	The high cost of equipment	1	Building our own plant for the production of DI systems is expected to reduce the cost of DI systems.
		2	Development of the development of the land market, which involves changing the legislation on land pledges for obtaining bank loans by farmers.
		3	In addition, it was proposed to mobilize international financial resources for the implementation of projects for the development of the capacity of DI and financial support for farmers.
2	Lack of concessional funding for farmers who need DI systems	4	It is proposed to attract investments for the development of DI and improve access to cheap loans through the development of an addendum to the state program "Financing of Agriculture", aimed at supporting farmers who are going to install DI systems.
3	The energy dependence of some DI systems on the availability of electricity for water supply, which increases operating costs.	5	Where possible, the need for electricity for pumps should be removed by inclined DI systems using the terrain of the sites or solved by increasing investment in the creation of DI.
Non-financial			
Policy, legal and regulatory			
4	Lack of DI development policy	6	Development of a strategy for improving water efficiency and water saving in irrigation
5	Gaps in technical regulatory documents on DI	7	Development of technical regulatory documents for the promotion of water efficient technologies, including DI systems. Such technical documents defining the use order, irrigation water quality requirements, use and loss norms would help the wider development of DI.
Institutional			
6	Lack of advisory and repair service	8	Integration of the entire range of services for advisory assistance to farmers into the list of today's RAS services, including field survey - calculation of the technical specification of equipment - places of purchase - training in use.
		9	As well as the development of DI service centres for the supply of spare parts and consumables and the repair of equipment based on existing private campaigns in the field.
Market			
7	Lack of a production base for the manufacture of high-quality DI systems and spare parts	10	Construction of a plant for the production of DI systems, i.e. corresponding production base for DI, therefore, this is a real measure that will reduce the dependence of the Kyrgyz Republic on the import of components and spare parts.
8	Lack of a supply chain of quality spare parts in all regions	elev en	The creation of service centres for DI and a network of sales of spare parts covering all regions will make it possible to overcome this barrier.
Human management skills			
9	Lack of knowledge and practical skills of agricultural business entities on the proper operation of DI systems	12	Increasing the capacity of RAS and DI service centres to increase the culture of operation and knowledge of the rules and regularity of maintenance is also proposed, as well as to conduct regular information campaigns on the best DI practices.
10	Lack of technical expertise to install and maintain a drip irrigation system	13	Special trainings and programs to expand the technical expertise and professional development of professionals will be developed and conducted regularly.

Catego-ries, No.	barriers	No.	Measures
Information and awareness			
eleven	Low awareness and awareness of the benefits and im-portance of developing DI as a water efficient technology.	14	Development of communication products and information campaigns on water efficient technologies in the media and social networks, especially at the local level, with the presentation of quantitative data on the benefits of using DI, especially for new perennial plantations.
12	Lack of information about modern high-tech DI systems	15	Creation of trade and information platforms, preparation of information products, and holding promotions on high-tech DI systems.
Others: Environmental			
13	Lack of clean water sources	16	Kyrgyzstan has a significant number of mothballed wells that are now being rehabilitated by the commu-nities themselves. In addition, as a cheap measure, it is possible to provide for the creation of sedimentation tanks for turbid water.

1.5 Linkages of the identified barriers

The barriers identified in the course of the analysis, which the priority technologies of the "Agriculture" sector faces now, also made it possible to identify a number of links between them (see tab. 1.11), in order where it is possible to obtain maximum synergy and increase the effects of the recommended measures.

Table 1.11. Key barriers identified for the three priority climate technologies in agriculture.

No.	Sustainable pasture management (SPM)	Organic Agriculture (OA)	Drip Irrigation (DI)
Economic and financial			
1	Lack of investment in sustainable pasture ecosystems	Lack of investment in OA expansion	The high cost of equipment
2	Limited access to loans and necessary agricultural inputs for SPM	Lack of equity capital for OA start-ups	Lack of concessional funding for farmers who need DI systems
3	Decreasing productivity of pastures and livestock	Limited access of OA producers to loans on acceptable terms	The energy dependence of some DI systems on the availability of electricity for water supply, which increases operating costs.
Non-financial			
Political legal and regulatory			
4	Lack of state policy for pasture development	Lack and absence of a strategic policy document for the development of the OA	Lack of DI development policy
5	Gaps in normative legal acts regulating the management and use of pastures	Gaps in technical regulations for OA	Gaps in technical regulatory documents on DI
Institutional			
6	Uncertainty in the institutional organization of community-based pasture management	Lack of certification system and uncertainty with voluntary certification of OA products	Lack of advisory and repair service
Market			
7	Lack of high-quality and affordable seed material of productive breeds of animals and pasture grasses	Lack of organic seed and planting material	Lack of a production base for the manufacture of high-quality DI systems and spare parts
8		Lack of quality control of imported seed material	Lack of a supply chain of quality spare parts in all regions
9		Difficulties in marketing OA products	
Human management skills			
10	Lack of pasture improvement practices (pasture rotation, reseeding, irrigation, afforestation, etc.)	Lack of knowledge and practical skills among economic entities of agriculture for the production of organic products	Lack of knowledge and practical skills of agricultural business entities on the proper operation of DI systems
11	Low PC capacity for SPM and limited knowledge of current SPM tools	Insufficient use of biological plant protection products and organic fertilizers by economic entities of agricultural enterprises,	Lack of technical expertise to install and maintain a drip irrigation system

No.	Sustainable pasture management (SPM)	Organic Agriculture (OA)	Drip Irrigation (DI)
12	Lack of a unified system of permanent monitoring of the state of pastures and data		
Social			
13	Lack of integration of gender equality aspects in pasture management systems	Not identified	Not identified
Network			
14	Weak cooperation and coordination of stakeholders at the local level	Not identified	Not identified
Information and awareness			
15	Lack of seasonal agrometeorological forecasts for pasture users and communities	Insufficient scientific capacity for advisory support on OA.	Low awareness and awareness of the benefits and importance of developing DI as a water efficient technology.
16	Lack of scientific research and data on climate impacts on pastures and animals	Low awareness and awareness of the OA, its benefits and the importance of development in the KR	Lack of information about modern high-tech DI systems
17	Lack of climate awareness and adaptive knowledge of government officials, local authorities and users on sustainable pasture management	Lack of information on current OA technologies	
17	Lack of information on modern technologies for SPM		
Other			
19	Continued pasture degradation	Decreased soil fertility	Lack of clean water sources for DI
20	Growing vulnerability of livestock and pasture ecosystems to adverse impacts of climate hazards	Small-scale farm production OA	

As it can be seen from the table above, there are some common characteristics across all priority technologies in the sector. The following are common barriers for all:

- Lack of financial resources: The low level of investment potential is a barrier for all three selected technologies. The PUA does not have enough funds to modernize pasture management using software products and GIS maps, to create databases for pasture monitoring and inventory, as well as for quality breeding material, watering and afforestation of pastures. The OA lacks resources for quality organic seeds and planting stock, organic fertilizers and biological pest control products. DI lacks funds for the development of the production base and the supply chain of materials and spare parts to the regions, as well as for the introduction of high-tech systems. Potential users of DI lack funds for field system equipment and water tanks. For all three technologies, there is a lack of funds for research and development and development of practical recommendations. All technologies need funds to strengthen the capacity of the system of advisory services and services. Current international projects are unable to provide financial support for the introduction and dissemination of each of the three priority technologies. Private service providers operating in the market for all three technologies do not receive enough orders for services due to

lack of funds from end users and the low purchasing power of most rural households. Current international projects are unable to provide financial support for the introduction and dissemination of each of the three priority technologies. Private service providers operating in the market for all three technologies do not receive enough orders for services due to lack of funds from end users and the low purchasing power of most rural households. Current international projects are unable to provide financial support for the introduction and dissemination of each of the three priority technologies. Private service providers operating in the market for all three technologies do not receive enough orders for services due to lack of funds from end users and the low purchasing power of most rural households.

- Policy and regulation gaps: This barrier is high across all three technologies and includes sectoral policy needs to address climate resilience in general. This also includes funding needs for strengthening the institutional capacities of organizations associated with the introduction of all three technologies.
- Human Management Skills: All three technologies demonstrate a lack of knowledge, skills to manage them. Weak capacity is shown by the Pasture Committees for SPM, the introduction of the OA also shows a lack of knowledge of agricultural practices of organic production. DI shows a lack of skills in both installation and operation, both at the level of users and at the level of service providers.
- Lack of Awareness and Information: End users and especially advisory services of all three priority technologies face low access to good information and a lack of Kyrgyz-adapted learning tools.
- The lack of effective coordination and partnership network also affects the adoption and dissemination of all three technologies, including government agencies, academia, local governments, farmer associations and the private sector, as well as international projects.

1.6 Creation of favourable conditions for overcoming barriers in Agriculture

The measures identified during the analysis with the participation of stakeholders are presented in Table. 1.12.

Table 1.12. Key measures for three priority climate technologies in agriculture.

No.	Sustainable pasture management	Organic Agriculture	Drip Irrigation
Economic and financial			
1	Development of a state program to preserve the fertility of natural pasture systems	Investments for the development of OA through the new state program for OA aimed at creating a favourable environment for OA and subsidizing OA producers.	Building our own plant for the production of DI systems is expected to reduce the cost of DI systems.
2	Mobilization of international resources for the implementation of projects for the restoration of natural pasture systems	Using state reserve lands, it was proposed to support the initiatives of private owners using the mechanism of "public-private partnership" to create large land areas of the OA and new "Organic Aimaks"	Development of the development of the land market, which involves changing the legislation on land pledges for obtaining bank loans by farmers.
3	Continuation and expansion of the state agricultural financing program for pasture users	Mobilization of international financial resources for the implementation of projects for the development of the capacity of the OA and financial support for farmers practicing OA.	In addition, it was proposed to mobilize international financial resources for the implementation of projects for the development of the capacity of DIs and financial support for farmers.
4	Reducing interest rates on loans for pasture users	Continuation and expansion of the state program "Financing of Agriculture" for lending at preferential interest to agricultural producers, highlighting them in a separate category of beneficiaries	It is proposed to attract investments for the development of DI and improve access to cheap loans through the development of an addendum to the state program “Financing of Agriculture”, aimed at supporting farmers who are going to install DI systems.
5	Livestock regulation in grazing	Access to credit resources will be improved through the land market development strategy, which involves changing the legislation on land collateral for obtaining bank loans.	Where possible, the need for electricity for pumps should be removed by inclined DI systems using the terrain of the sites or solved by increasing investment in the creation of DI.
6	Reducing the number of unproductive animals and the transition to breeding more productive breeds of livestock		
7	Creation of cultural pastures in every community		
Non-financial			
Policy, legal and regulatory			
8	Development and adoption of the State program for the development and conservation of pasture lands	Development and adoption of the State Program for the development of agricultural crops with clearly formulated political goals and objectives for creating a favourable environment, allocating new areas for agricultural crops, as well as subsidizing agricultural producers.	Development of a strategy for improving water efficiency and water saving in irrigation
9	Adoption of legal acts on sowing degraded pastures	Adoption/introduction of amendments to the legal documents on the requirements for the production process	Development of technical regulatory documents for the promotion of water efficient technologies, including DI

No.	Sustainable pasture management	Organic Agriculture	Drip Irrigation
		of OA, the criteria and procedure for certification of organic products of OA and the support of OA in general.	systems. Such technical documents defining the use order, irrigation water quality requirements, use and loss norms would help the wider development of DI.
		Institutional	
10	Strengthening the role and institutional status of PUAs and Pasture Committees at the legislative level	Improving the transparency of the system of voluntary certification of organic products and finalizing the national standard in terms of implementation procedures using scientific developments and research results.	Integration into the list of today's RAS of the entire range of services for advisory assistance to farmers on field survey - calculation of the technical specification of equipment - places of purchase - training in use.
11	Special support for pastoral communities during migration to distant pastures for integration into the early warning system for natural disasters.	Harmonize national and international standards for OA production.	As well as the development of DI service centres for the supply of spare parts and consumables and the repair of equipment based on existing private campaigns in the field.
12	Establishment of the State Pasture Service for irrigation and reclamation construction in pastures, including pasture infrastructure	Equip laboratories and accredit the national organization to IFOAM.	
		Market	
13	Revision and strengthening of the legal framework for seed production (regulations on seed and breeding farms) strengthening the link between science and production	As part of the development process of seed and flame farms, launched by the state, to establish seed farms oriented to the OA market for the production of high-quality organic seeds and planting material to expand the areas of OA;	Construction of a plant for the production of DI systems, i.e. corresponding manufacturing basis for DI, therefore, this is a effective measure that will reduce the dependence of the Kyrgyz Republic on the import of DI components and spare parts.
14	Strengthening the network of semkhozes (seed farms)for the production and propagation of seeds of pasture grasses and breeding farms to increase the breeding herd	Strengthen control over the import into the territory of the republic of GMO-containing seeds, the use of which is contrary to organic methods of agricultural production is constantly growing. Introduce customs duties on such materials.	Establishment of service centres for DI and a network of sales of spare parts, covering all regions.
15		Expand marketing services and promotion of healthy eating based on organic products, make regular advertising campaigns, fairs of organic products already voluntarily certified in the Kyrgyz Republic. to develop a catalogue of OS products and manufacturers and place it on Internet resources and social networks. Expand the local organic trade network.	
		Human management skills	
16	Creation of seed funds for growing seeds of natural pasture grasses and reseeding seeds of natural pasture grasses	As measures to overcome this barrier, the process of increasing the institutional and individual potential, carried out by the FOM “BIO.KG” and the PF “Bio	Increasing the capacity of RAS users and DI service centres to increase the culture of operation and knowledge

No.	Sustainable pasture management	Organic Agriculture	Drip Irrigation
		Service" within the framework of the mobilized resources of international projects, will be expanded, taking into account the development of farmers' skills in marketing and financial management. number of major barriers. In addition, educational and methodological materials on OA will be developed to connect to the process of capacity building of the RAS. Training modules on OS will be integrated into the curriculum of KNAU.	of the rules and regularity of maintenance is also proposed to conduct regular information campaigns on the best DI practices. Special trainings and programs to expand the technical expertise and professional development of professionals will be developed and conducted regularly.
17	Creation of artificial glaciers to solve water supply issues	To overcome this barrier, the production of organic fertilizers and biological plant protection products will be expanded in all regions of the country and information and training campaigns will be held on the rules and norms for their use.	
18	The use of electric fences for pasture rotation		
19	Pasture irrigation		
20	Afforestation on pasture lands		
21	Improvement of pasture infrastructure		
22	Improving the technical capacity of pasture committees on modern tools for climate change resilience SPM		
23	Development of improved long-term pasture management plans and an annual pasture use plan (including a pasture turnover mechanism)		
24	Development of an electronic application for livestock breeders with databases on the state of pastures		
25	Annual evaluation of pasture productivity, maintenance of databases by years (PC)		
26	Development of a unified monitoring system and databases at all levels of management		
27	Carrying out land management of pastures with the transfer of data from the PUA and PC		
		Social	
28	Developing tailored programs and exceeding the capacity of national and local stakeholders on gender equality in rural development, livestock and SPM	Not identified	Not identified
28	Integrating gender into local development planning and long-term pasture management plans		

No.	Sustainable pasture management	Organic Agriculture	Drip Irrigation
29	Carrying out information events for women and youth of local communities about modern technologies of agriculture and SPM		
	Network		
30	Strengthen the relationship between the aiyl okmotu (seluprava), forestries, WUAs and pasture committees on the management and use of pasture resources through the implementation of joint projects and holding coordination meetings.	In order to strengthen, coordinate and involve local state administrations, local governments, as well as research institutions and business communities in the process of development of the OA from the implementation of the tasks of organic agricultural production, regular meetings Coordinating Council for the Development of Organic Agricultural Production under the Government of the Kyrgyz Republic will be held. The DOAD will become the working secretariat of the council and will prepare materials to accelerate the expansion of the DOAD as a competitive advantage of the Kyrgyz Republic in the region and monitor the implementation of the decisions taken by the council.	Not identified
31	Monitoring the activities of PUAs and PCs to identify PUAs and PCs requiring state support and development of relevant projects/applications.		
	Information and awareness		
32	Increase the technical capacity of Kyrgyzhydromet to develop seasonal agrometeorological forecasts and disseminate through channels available to local self-governments, PUAs and farmers	The subject of OA will be included in the Plans of scientific work of the relevant institutions to develop appropriate recommendations on the best practices of OA, as well as to form a scientific basis for the harmonization of national and international standards of OA. The process of developing teaching aids for educational institutions and practical guides, training materials and visual materials on agricultural technology and agroecology for the training of advisory services and farmers will be intensified. The Organic Aimak initiative will continue.	Development of communication products and information campaigns on water efficient technologies in the media and social networks, especially at the local level, with the presentation of quantitative data on the benefits of using FB, especially for new perennial plantations.
33	Strengthening scientific potential through exchanges and conferences, including international ones, as well as strengthening the regulatory framework of scientific institutions	To address these issues, a number of communication products will be developed and a number of information and promotional events will be held to promote OA products using the media, Internet resources and social networks.	Creation of trade and information platforms, preparation of information products, and holding promotions on high-tech DI systems.
34	Publish popular materials on the impact of climate change on pastures and climate-resilient adaptive pasture management	The complex nature of the OA technology, integrating a whole set of techniques and approaches of agricul-	

No.	Sustainable pasture management	Organic Agriculture	Drip Irrigation
35	Develop training programs and increase the capacity of LSGs on climate-resilient pasture management	tural production based on agroecology, will also receive wide information support both from the scientific and educational institutions of NGOs, and from business - manufacturers, importers and dealers of the corresponding equipment for OA.	
36	Develop area-specific training programs and build the capacity of farmers for climate-resilient pasture management		
37	Develop training programs on SPM in the context of climate change for universities		
		Other	
38	Development and maintenance of a cadastre for monitoring degraded lands and ensuring access for PUAs	Currently, the Ministry of Agriculture is developing a concept for the development of the land market, where one of the directions has already been announced is the consolidation of agricultural land. As expected, as a result of its implementation, a number of farms with large land plots will appear, where it will become possible to carry out zero tillage and organize crop rotation. This barrier will be overcome by the development of schemes for soil fertilization with organic-mineral fertilizers based on individual fields. For this, the Republican Soil-Agrochemical Station will be involved, which will conduct surveys of all agricultural lands intended for agricultural land.	Kyrgyzstan has a significant number of mothballed wells that are now being rehabilitated by the communities themselves. In addition, as a cheap measure, it is possible to provide for the creation of sedimentation tanks for turbid water.
39	Development, publication and dissemination of materials to combat land degradation		
40	Development of Land Degradation Guidelines and regular capacity building courses for PUAs and pasture users		
41	Development/revision and integration into the PMP of sections on grazing sites rotation.		
42	Strengthening the work of veterinary services and the range of veterinary preparations.		
43	Development of mechanisms and implementation of climate risk insurance		

In the previous section, some general barriers were identified, which can be broadly classified into the following categories: lack of financial resources; inadequate policies and regulations; insufficient management skills, insufficient information and awareness; and lack of partnerships. Thus, favourable conditions for overcoming common barriers can be divided into the following categories, as follows (see Table 1.13).

Table 1.13. General technology barriers in agriculture and enabling measures.

General Barriers	Enabling framework	Technologies
Lack of financial resources	• Allocation of subsidies under state programs • Mobilization of resources of international funds • Empowering private investment	SPM, OA, DI
Gaps in policy and regulation	• Development of strategic policy documents • Development of by-laws for the introduction of technologies	SPM, OA, DI
Human management skills	• Strengthening Research • Development of training modules and programs and conducting training and advanced training	SPM, OA, DI
Lack of awareness and information	• Development of communication products • Engagement of advisory services • Conducting information campaigns in the media, on the Internet resources, and in social networks.	SPM, OA, DI
Lack of effective coordination and partnership network	• Strengthening existing coordination mechanisms at the national level • Activation of the work of farmers' organizations in the field	SPM, OA, DI

2. Sector "Water Resources"

The goal of barrier analysis is to understand the market conditions for each of the selected technologies and to identify barriers to their deployment and diffusion.

The main steps in the barrier analysis were as follows:

- Identifying all possible barriers by reviewing the literature, conducting interviews and/or brain-storming workshops
- Formation of a long list of barriers in order to select the most significant
- Classification of the main selected barriers with the construction of a hierarchy of categories.[75]

In the result of the technologies prioritization during the first project phase, three technologies were selected in the Water Resources Sector:

1. Energy and resource-saving drinking water supply systems from surface sources using local materials.
2. Energy efficient pumps for pumping stations of the Kyrgyz Republic"
3. Subsoil irrigation against the background of closed drainage by the method of subsoil irrigation.

In addition, the following technologies were selected as pipeline technologies:

- Automated systems for the measurement and distribution of irrigation water, including water metering checkpoints with the installation of anti-vandal water meters
- New wastewater treatment facilities.
- Water leakage metering devices.

This Chapter presents preliminary goals for the transfer and diffusion of prioritised technologies, analysis of the identified barriers. Based on an analysis of the relationship between barriers and possible solutions, some measures are proposed to help eliminate barriers, the resource requirements, strengths and weaknesses of each solution are assessed.

In preparing this section, the expert used the results of work with members of the Sectoral Working Group, guided by the document: "Overcoming Barriers to the Transfer and Diffusion of Climate Technologies"[76], as well as similar completed documents of such countries as Ukraine, Moldova, Azerbaijan, etc.[77]

2.1 Preliminary targets for the transfer and diffusion of the “Energy and resource saving drinking water supply systems from surface waters sources with local materials” technology (ERSDWSS)

The legislation of the Kyrgyz Republic establishes the order of priorities for the purposes of water use, distribution of water, these are the following:

- use of water for drinking and household needs;
- use of water for irrigation and watering of livestock;
- use of water for the purposes of generating electricity, including renewable energy;

[75]A step-by-step guide for countries conducting technology needs assessments. James Haslip, Rasa Narkevičiūtė and Jorge Rogat. This version was completed on September 10, 2015.
[76] www.tech-action.org.
[77]Ukraine Technology needs assessment for climate change adaptation barrier analysis and enabling framework report. 2 June 2020/

- use of water for industry, including mining and agriculture;
- use of water for the purposes of fishing and fish farming;
- use of water for sports and health purposes;
- use of water for other purposes.

The country's strategic documents outline the general goal: increasing the provision of the population of Kyrgyzstan with drinking water of standard quality, improving the health and quality of life of the population of the republic, reducing the harmful impact on the environment through the construction, reconstruction and modernization of drinking water supply and sanitation systems.[78]

This is supposed to be achieved by:

- increasing the provision of the population of Kyrgyzstan with drinking water of standard quality,
- improving the health and quality of life of the population of the republic,
- reducing the harmful impact on the environment through the construction, reconstruction and modernization of drinking water supply and sanitation systems.
- increasing the access of the population to drinking water supply, sanitation and sanitation services through the development of centralized drinking water supply and sanitation systems, their design, construction and operation on the basis of uniform requirements of technical regulations, standards and current regulations;
- providing the population with safe drinking water of standard quality;
- ensuring safety and security from threats to the health of water consumers;
- adaptation of the drinking water supply and sanitation sector to climate change;
- ensuring proper operation and maintenance of drinking water supply and sanitation systems[79].

Since at present the problem of providing the population of cities and other settlements with high-quality drinking water is still acute in the Kyrgyz Republic. In many villages and small towns, there is a shortage of drinking water of standard quality due to imperfect water treatment. What is the main reason for the spread of intestinal infections, hepatitis and diseases of the gastrointestinal tract, the occurrence of pathologies and the increased impact of carcinogenic and mutagenic factors on the human body. As of January 1, 2018, 715 priority villages were identified, in which the construction and rehabilitation of water supply systems is a priority. In addition, it is necessary to rehabilitate water supply systems in 448 villages.

The main purpose of the implementation of this Technology is: to expand the access of the population to high-quality drinking water through the construction of new water supply systems using local materials. This will contribute to an increase in the number of jobs, a decrease in the cost of operating facilities for the preparation and supply of drinking water, which will positively affect the value of tariffs for its supply services, wages of workers, etc.

The current crisis situation in the field of drinking water supply is due to the lack of measures to protect sources of drinking water supply, the unsatisfactory technical condition of water supply systems, etc.

The introduction of this technology for the preparation and production of drinking water of standard quality from surface sources using local materials is aimed at improving the system for providing and accessing drinking water, reducing the burden on women and children, who are the main households

[78] The Programme for the Development of Drinking Water Supply and Sanitation Systems in Settlements of the Kyrgyz Republic until 2026 (to the Decree of the Government of the Kyrgyz Republic dated June 12, 2020 No. 330) (minjust.gov.kg)
[79] Ibid.

responsible for delivering water to the house, especially in the poorest households, improving the health and well-being of the population and empowering the most vulnerable groups.

2.2 Barrier Analysis and Possible Enabling Measures for the ERSDWSS technology

According to the UNEP DTU Partnership Guidelines to identify barriers to the deployment and diffusion of technologies, the analysis was conducted while considering and grouping barriers under the following categories:

1. *Economic and financial:* high cost of capital, investment in technology considered risky (e.g. due to several previous local benchmarks), low expected rate of return
2. *Market conditions:* Few local suppliers of ancillary goods and services, uneven playing field (e.g. due to subsidies for competing technologies), market control by industry players
3. *Legal and Regulatory***:** Technology opposed to actor (e.g. utilities), insufficient legal structure, tightly controlled sector, conflicts of interest, political instability, bureaucracy, rent seeking
4. *Network*: weak communication between entities, preference is given to existing networks, limited distribution networks
5. *Institutional and organizational capacity***:** few professional institutions, limited institutional capacity, limited managerial and organizational skills
6. *Human skills:* unskilled technical
7. *Social, cultural and behavioural:* consumer preferences and social prejudices, traditions, dispersed settlements
8. *Information and awareness:* inadequate information, feedback, lack of awareness.
9. *Technical:* poor quality engineering/ performance
10. *Other***:** environmental impact, condition of physical infrastructure.[80]

In order to identify barriers, before the Joint Meeting of the Sectoral Working Groups on Agriculture and Water Resources (held on April 19, 2023), a study was conducted that included several research methodologies: a review of policy documents, technical literature, including publications of international projects, two rounds of an online survey members of the sectoral working groups (the first on collecting barriers and the second on determining the importance of barriers) and direct interviews with various stakeholders. During the consultations, a list of all the major barriers that will have to be faced in the transfer, implementation and dissemination of SPM technology was prepared and discussed.

2.2.1 General description of the ERSDWSS technology

This technology is considered as a preventive measure against the existing risks of shortage of water resources for drinking needs in connection with such consequences of climate change as an increase in air temperature and a decrease in precipitation.

At present, the problem of providing the population of small towns and cities of regional significance, as well as rural settlements with high-quality drinking water is very acute in the Kyrgyz Republic. In many villages and small towns, there is a shortage of drinking water of standardized quality due to imperfect water purification. In addition, this is the main reason for the spread of intestinal infections,

[80] TNA Guide Series Overcoming Barriers to Transfer and Diffusion of Climate Technology Second Edition Ivan Nygaard Ulrich Elmer Hansen 2015 UNEP DTU

hepatitis and diseases of the gastrointestinal tract, the occurrence of pathologies and the increased impact of carcinogenic and mutagenic factors on the human body.

The current crisis situation in the field of drinking water supply is due to the lack of measures to protect sources of drinking water supply, the unsatisfactory technical condition of water supply systems.

To purify drinking water, all materials are imported from abroad, for example, quartz sand, sodium hypochlorite. Whereas local deposits in the Issyk-Kul and Jalal-Abad regions can fully meet the needs of the republic.

Sodium hypochlorite can also be produced on the basis of local deposits of natural salt (Tuz village, Kochkor region, Nouruz, etc.).

This technology involves the use of local materials: quartz sand, natural salt, construction of micro hydroelectric power plants / solar panels. This will provide the amount of water for 60,000 people. * 230 l/person per day. Due to the use of local materials, it is possible to reduce the cost of 1 m3 for water consumers.

This technology will create jobs related to construction and engineering, the supply of inert materials, the production of sodium hypochlorite, as well as the operation and maintenance of a drinking water treatment system. The number of employees for maintenance and operation per one facility is on average 21 people, for 24 = 496 people.

Improving water supply systems will reduce the incidence of the population caused by the use of poor-quality drinking water, which will reduce the cost of treating people, help increase the income of the population and increase economic activity in the regions, and provide comfortable living conditions.

In environmental terms, it will improve the quality from the harmful effects of substances polluting sources of drinking water supply. The use of renewable energy sources and energy efficient equipment (control systems, pumps, bactericidal installations, etc.) to provide the population with drinking water will reduce the anthropogenic load on the environment, while reducing GHG emissions from less energy consumption.

2.2.2. Identifying Barriers to ERSDWSS technology

The analysis of barriers for the Technology was carried out based on:

- the desk analysis of relevant documents, legal acts, country and sectoral strategic documents
- the consultations with relevant employees of the Department for Drinking Water Supply and Sanitation, and
- the work with members of the SWG.

In the course of the work carried out, quite a lot of barriers were identified, 26 in total. The results of the analysis of the barriers by category, their brief description, as well as their assessment in points are given in tabular form (see tab. 2.1).

Table 2.1. Preliminarily list of identified barriers to the Technology "Energy and resource-saving drinking water supply systems from surface sources

Category	#	Barrier	Score
Economic and financial: high cost of capital, investment in technology considered risky, low expected rate of return	1	Lack of financial resources: donor and national investment	3
	2	Low tariffs of drinking water suppliers	4
	3	Existing old debts of a number of municipal enterprises and organizations of drinking water supply and sanitation	3

Category	#	Barrier	Score
	4	Insufficient level of accounting at enterprises and organizations of drinking water supply and sanitation	4
	5	No exemption when using local materials for drinking water supply	3
Market conditions: few local suppliers of ancillary goods and services, unequal market conditions	6	Lack of local manufacturers for the production of electrolysis plants for the production of sodium hypochlorite	4
	7	Lack of local manufacturers of solar panels for mini hydropower plants	4
Regulation: anti-tech faces, insufficient legal framework, high control over the sector, conflicts of interest, political instability, bureaucracy, corruption	8	Absence of a sectoral normative legal act on the regulation of tariffs in the sector of domestic and drinking water supply and sanitation.	3
	9	Most of the DWSS systems, after restoration and new construction, were transferred to the ownership of RCADWC, which are unstable	4
	10	Lack of a license to develop deposits of salt, quartz sand	3
	11	Absence of the Act on the allocation of land for the construction of micro-hydro power plants	3
	12	Outdated building codes and maintenance standards	3
	13	The regulatory legal framework for the drinking water supply and sanitation sector is outdated	3
Network: weak interconnection between actors, preference is given to existing networks, limited distribution networks	14	Conservative thinking of designers, managers	3
Institutional and organizational capacity: Few professional institutions, limited institutional capacity, limited managerial and organizational skills	15	Insufficient number and qualification of personnel in the DDWSS	3
	16	Unresolved institutional issues. Frequent reorganization of the industry	3
Human skills: unskilled technical staff and inadequate training	17	Lack of qualified engineering and management personnel, as well as locksmiths, plumbers and welders.	3
	18	Lack of teachers and insufficient qualifications of teachers for the design, operation of systems	3
	19	Lack of preferencess for admission to universities for the specialty water supply and sanitation, high school exams passing score for applicants	3
Information and awareness: inadequate information, lack of feedback, insufficient awareness	20	Lack of knowledge and information about the possibility of obtaining sodium hypochlorite from local salt deposits (in the Jalal-Abad region, in the Kochkor region, etc.)	3
	21	Lack of knowledge and information about the possibility of obtaining the use of solar energy for electricity generation in the WWW system	3
Technical: Poor technology quality/performance, few local benchmarks	22	Design decisions are made without appropriate technical research and justification.	3
	23	Lack of production control of water quality in most urban, municipal and rural water supply systems	3
	24	Lack of positive practice of applying this Technology in the Kyrgyz Republic	3

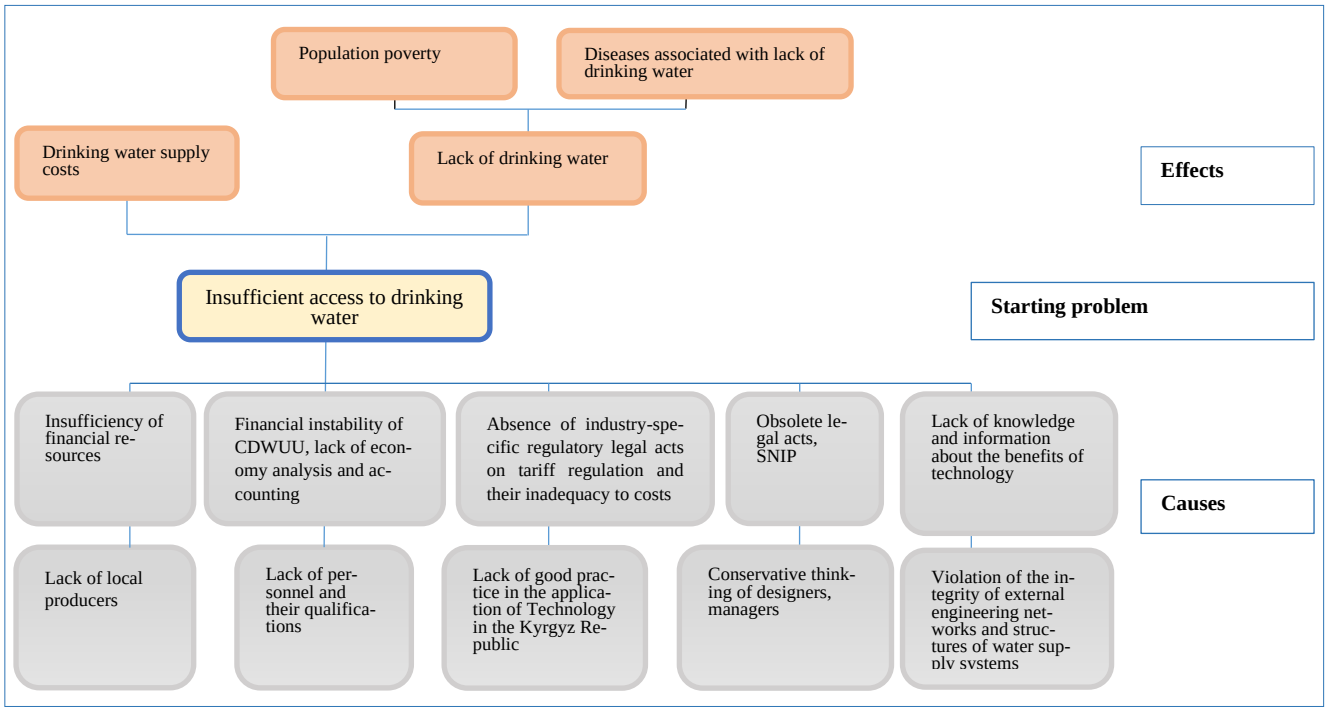
Category	#	Barrier	Score
Other: environmental impact, physical infra-structure conditions	25	Non-compliance with the regime of sanitary protection zones of rural water supply sources	3
	26	21. Violation of the integrity of external engineering networks and structures of vocational education system, as well as intra-house networks, without coordination with the relevant services	3

UNEP DTU Guidelines provides for root cause analysis and logical analysis of identified problems for the implementation of priority technologies with a tool to achieve a deep understanding of the problem, which can be graphically presented in the form of the Problem Tree. Logical Problems Analysis is applied for this with the main goal to place barriers into a hierarchy of causes and effects as a basis for preparing a concrete and realistic action plan. In the presented approach, each problem is associated with immediate causes at the bottom and immediate consequences at the top. At the same time, the problems located at the bottom of the Tree are the root problems/barriers. According to UNEP DTU Guidelines,[81] the problem tree should include all barriers identified during the screening process.

Due to the fact that for the implementation of ERSDWSS technology, 26 barriers were identified, the problem tree included only for the main barriers, taking into account the feasibility of overcoming them.

Logical problem analysis (LPA) of economic, financial and non-financial barriers to the introduction and dissemination of ERSDWSS technology is presented as a problem tree in fig. 2.1.

Figure 2.1. ERSDWSS problem tree



2.2.2.1 Economic and financial barriers for ERSDWSS technology

If we consider the economy of the republic, then, according to the World Bank, it is highly susceptible to external shocks due to its high dependence on remittances (30% of GDP) and gold mining (10% of

[81] Ivan Nygaard, Ulrich Elmer Hansen. 2015/ Overcoming barriers to the transfer and diffusion of climate technologies. Second Edition. UNEP DTU Partnership. https://tech-action.unepccc.org/wp-content/uploads/sites/2/2021/01/overcoming-barriers-to-the-transfer-and-diffusion-of-climate-technologies-2nd-edition.pdf

GDP) and exports (35%), and in terms of income, the republic belongs to lower middle income countries.

The strong and sustainable economic growth of the country requires institutional strengthening and economic policies aimed at developing the private sector, stimulating international trade and financially sustainable energy production.

Therefore, among the economic and financial Barriers, the following were also identified:

- low tariffs of drinking water suppliers
- insufficient level of accounting at enterprises and organizations of drinking water supply and sanitation, which were assigned the highest score - 4.

And:

- lack of financial resources: donor and national investments
- existing old debts of a number of municipal enterprises and organizations of drinking water supply and sanitation
- lack of benefits when using local materials for drinking water supply, which is assigned a score of -3.
- inefficient credit system

Low tariffs of drinking water suppliers. Lack of financial resources: donor and national investment[82], which is partly due to the fact that the tariffs set by local authorities are usually much lower than the real full cost of services, so the investment does not pay off, water systems are unsustainable. So, as of 2018, the average republican tariff for drinking water was 23 KG soms per person, while the cost is 37 soms per person, which is 1.64 times higher than the tariff.[83]
According to official data, currently residents of Bishkek pay 5 som 38 tyiyn (KG cents) per cubic meter, while the cost is 7 som 70 tyiyn per cubic meter. The price per cubic meter of water is 8 soms in the Chui region and 15 soms in the Jalal-Abad region, and in some districts of the Osh region (Uzgen district) it reaches 39 soms.[84]

When adopting tariffs, deputies of local elected bodies (Keneshes) do not take into account really justified economical costs for drinking water supply and sanitation services, thereby tariffs are accepted below the cost of services. The tariff is adopted not justified, but convenient and desirable for the population, which is extremely dangerous for the preservation of drinking water supply and sanitation systems in the future. Thus, the incomes of enterprises depend on the tariffs approved by the local Keneshes, while the production costs are formed in market conditions. This causes low wages for workers, which does not withstand competitiveness in the labor market.

In this connection, in almost all villages of the Kyrgyz Republic, drinking water supply enterprises are in a pre-bankrupt state. Many of them are not even able to quickly pay off electricity bills, not to mention the implementation of major and current repairs of drinking water supply systems.

Today, in the whole country, it is necessary to build new water supply facilities in 657 villages, carry out repair and restoration work in 595 villages. In the Kyrgyz Republic, only 16% of the 453 local self-governments (Ayil okmotu) are in a state of financial self-sufficiency and have sufficient income for development. And the rest - 84% of the aiyl okmotu exist at the expense of subsidies.

[82] The Programme for the Development of Drinking Water Supply and Sanitation Systems in Settlements of the Kyrgyz Republic until 2026 (to the Decree of the Government of the Kyrgyz Republic dated June 12, 2020 No. 330) (minjust.gov.kg)
[83]Analysis of the regulatory impact on the draft Regulations on the procedure for the development and application of prices (tariffs) in the field of drinking water supply and sanitation 2018
[84]https://lifenews.kg/2023/01/23/58002449

Despite the intensive measures taken in recent years, some issues of providing the population with drinking water remain unresolved due to insufficient financial security of drinking water suppliers and the lack of a regulatory legal act regulating the procedure for determining prices (tariffs) for the services of household and drinking water entities. water supply and sanitation to provide consumers with drinking water.

In this regard, in many aiyl okmotus of the republic, appropriate work is not carried out on high-quality maintenance and maintenance of water supply systems built in 2001-2014 at the expense of external donors. As a result, if in recent years water supply systems have been built and operated in 553 villages, at the moment, water supply networks in 35 villages have already been destroyed, looted, and out of order due to the untimely repair and restoration work.[85]

Inefficient credit system. Today, the credit system in Kyrgyzstan is conservative, it has found its consumer and it is becoming more and more difficult to find new customers. The activities of commercial banks are aimed at the further development of existing entrepreneurs, which ultimately creates conditions for job creation, but does not present an opportunity for most start-up entrepreneurs to create their own business from scratch.[86]As a rule, the largest loans are issued for the development of an existing business.

The interest rate on loans provided to entrepreneurs for operational activities is over 25% per year, for the repayment of which the company's profit of about 40-50% is required. What is an unattainable task in the conditions of modern tariff policy and the state of water supply and sanitation systems, the unsatisfactory condition of which is also an obstacle to obtaining a loan, since the largest loans are issued for the development of an existing business. A separate problem is the requirement by banks for collateral, while the price valuation of the collateral property is most often two times lower than the actual one.

Insufficient level of accounting at enterprises and organizations of drinking water supply and sanitation. Drinking water supply operators do not know how to carry out full-fledged tariff calculations. Since in rural areas the specialists of water supply companies are low-skilled, they prepare tariff calculations at a very low level, while not taking into account such important indicators as payback and sustainability. The consequence of this is the rapid obsolescence and deterioration of drinking water supply systems. This pattern is observed everywhere even with newly built and rehabilitated water supply systems.[87]

Existing old debts of a number of municipal enterprises and drinking water supply and sanitation organizations also do not contribute to the stable operation of drinking water supply organizations. Lack of benefits when using local materials for drinking water supply. As shown above, the legislation of the republic prioritizes the use of water for drinking and household needs. However, incentives for the use of local materials that reduce the cost of operating costs of drinking water suppliers are not provided.

Economic and financial barriers to the ERSDWSS technology and their brief description are given in the following tab. 2.2.

[85]Ibid

[86] Main Directions for the Development of the Banking System of the Kyrgyz Republic for 2018-2021 (Approved by the Resolution of the Board of the National Bank of the Kyrgyz Republic dated December 27, 2017 No. 2017-P-11/54-1-(BS)) (minjust.gov.kg)

[87]Regulatory Impact Analysis for the draft Regulation on the procedure for the development and application of prices (tariffs) in the field of drinking water supply and sanitation

Table 2.2. Economic and financial barriers to ERSDWSS technology

Categories	Barriers	Score
Economic and financial	1. Lack of financial resources: donor and national investment	3
	2. Low tariffs of drinking water suppliers	4
	3. Existing old debts of a number of municipal enterprises and organizations of drinking water supply and sanitation	3
	4. Insufficient level of accounting at enterprises and organizations of drinking water supply and sanitation	4
	5. Lack of benefits when using local materials for drinking water supply	3

2.2.2.2 Non-financial barriers for ERSDWSS technology

Among the non-financial barriers, the following were identified, with the highest score of 4:

- lack of local manufacturers for the production of electrolysis plants for the production of sodium hypochlorite
- lack of local manufacturers of solar panels for mini hydroelectric power plants
- most of the DWSS systems, after restoration and new construction, were transferred to the ownership of RCADWCs, which are unstable.

A lower score is determined for the remaining 18 identified barriers, equal to 3 (see tab. 2.3).

Lack of local manufacturers for the production of electrolysis equipment for the production of sodium hypochlorite. Currently, there are no local manufacturers in the republic for the production of electrolysis plants for the production of sodium hypochlorite, so the latter is imported from abroad, which leads to an increase in the cost of system operation in water supply and drinking water services.

Lack of local manufacturers of solar panels for mini hydropower plants. Lack of local manufacturers of solar panels for mini hydropower does not allow expanding the scale of construction of mini hydroelectric power stations, both in the country and in the drinking water supply industry.

Organizational barrier: most of the drinking water supply systems, after restoration and new construction, were transferred to the ownership of RCADWC. In December 2001, the Government issued a Decree “On the transfer of rural water supply systems (except for district centres) to the ownership of rural public associations of drinking water consumers and their subsequent operation” No. drinking water consumers of the rural water supply system”. RCADWC is a voluntary association of citizens, in accordance with the established procedure, uniting based on their common interests to meet the needs of the population living in a certain territory for drinking water in terms of quality that meets all standards and hygienic requirements.

The objectives of RCADWC activities are:

- Operation and maintenance of water supply systems and distribution of water among the members of the association; – distribution of water on contractual terms;
- Rehabilitation and improvement of water supply systems within the service area and implementation of civil works as required;
- Acquisition, replacement, operation and maintenance of hydraulic equipment;
- Planning and implementation of the rehabilitation and modernization of water supply systems in the service area in order to reduce water loss and increase the efficiency of its use;
- Planning, installation, use and maintenance of metering devices for the distribution of water to various water users and ensuring proper management of the network;

- Collection of payments;
- Training and instructing members of the association on the economical and efficient use of available drinking water, etc.

To date, the activities of most of the working associations are not effective. In the course of their activities, they face a lot of problems. First, there are problems of a legislative nature: there is no single legislative act that regulates the activities of RCADWC, and second, there are difficulties of an organizational, managerial and bureaucratic nature. Third, there are problems of a financial nature: charging, financing and taxation, and fourthly, problems related to water quality.[88].

In this connection, the Cabinet of Ministers of the Kyrgyz Republic decided[89]during 1.01.2023-31.12.2024, conduct a pilot project in the Naryn region to organize the integrated maintenance and development of irrigation systems, drinking water supply systems, as well as pasture management in ayil aimaks with the creation on the basis of local self-government bodies of a unified system for collecting, administering and distributing payments levied in order to ensure the operation, maintenance and development of irrigation systems, drinking water supply systems, as well as the improvement of pastures and pasture infrastructure. To this end, it is proposed to create the appropriate municipal bodies, to the balance of which the RCADWC, WUA and PC will be transferred.

The experience of implementing this pilot project will be studied and decisions will be made on its further distribution in the Republic.

The list of non-financial barriers for ERSDWSS technology are presented in the tab. 2.3 below.

Table 2.3. Non-financial barriers for ERSDWSS technology

Category	Barriers	Score
Market conditions	1. Lack of local manufacturers for the production of electrolysis plants for the production of sodium hypochlorite	4
	2. Lack of local manufacturers of solar panels for mini hydropower plants	4
Regulation:	3. Absence of a sectoral normative legal act on the regulation of tariffs in the sector of domestic and drinking water supply and sanitation.	3
	4. Most of the DWSS systems, after restoration and new construction, were transferred to the ownership of RCADWCs, which are unstable	4
	5. Lack of a license to develop deposits of salt, quartz sand	3
	6. Absence of the Act on the allocation of land for the construction of micro-hydro power plants	3
	7. Outdated building codes and maintenance standards	3
	8. The regulatory legal framework for the drinking water supply and sanitation sector is outdated	3
Network	9. Conservative thinking of designers, managers	3
Institutional and organizational capacity	10. Insufficient number and qualification of personnel in the DDWSS	3
	11. Unresolved institutional issues. Frequent reorganization of the industry	3
Human skills	12. Lack of qualified engineering and management personnel, as well as locksmiths, plumbers and welders.	3
	13. Lack of teachers and insufficient qualifications of teachers for the design, operation of systems	3
	14. Lack of preferences for admission to universities for the specialty water supply and sanitation, high school exams passing score for applicants	3

[88]https://moluch.ru/archive/262/60503/
[89]Decree of the Cabinet of Ministers of the Kyrgyz Republic of December 26, 2022 №713

Category	Barriers	Score
Information and awareness	15. Lack of knowledge and information about the possibility of obtaining sodium hypochlorite from local salt deposits (in the Jalal-Abad region, in the Kochkor region, etc.)	3
	16. Lack of knowledge and information about the possibility of obtaining the use of solar energy for electricity generation in the WWW system	3
Technical	17. Design decisions are made without appropriate technical research and justification.	3
	18. Lack of production control of water quality in most urban, municipal and rural water supply systems	3
	19. Lack of positive practice of applying this Technology in the Kyrgyz Republic	3
Other: environmental impact, physical infrastructure conditions	20. Non-compliance with the regime of sanitary protection zones of rural water supply sources	3
	21. Violation of the integrity of external engineering networks and structures of Vocational Education system, as well as intra-house networks, without coordination with the relevant services	3

A small barrier is the lack of a license for the development of salt deposits, quartz sand in the state body, i.e. it is necessary to go through all the necessary procedures to obtain a license for the right to use subsoil for the development of mineral deposits.[90]

The absence of the Act on the allocation of land for the construction of micro-hydro power plants is also a small barrier for the construction of micro-hydro power plants / solar panels (RES), which is mandatory in this case.

The regulatory legal framework for the drinking water supply and sanitation sector is largely outdated and hinders its development in accordance with relevant international standards. There are contradictions in the regulatory legal acts regarding the issues of determining the boundaries of responsibility, competencies, norms and standards for design and construction, determining the cost of construction, holding accountable for violations of the legislation in DWSS, licensing procedures. They reduce the effectiveness of capital investments in the sector, as they require the creation of expensive infrastructure with overestimated characteristics (capacity of systems and pipe diameters, duplication of tanks, etc.). As a result, there are negative consequences for the affordability and feasibility of projects in the sector.

Barriers here include the following:

- Lack of teachers and the insufficient qualifications of teachers in the design and operation of systems lead to the fact that mostly non-specialists work in the industry, which leads to improper management of organizations and often to their bankruptcy
- Lack of benefits when entering universities for the specialty water supply and sanitation, high school exams passing score leads to the fact that applicants cannot overcome the high school exams passing score and cannot get higher education and enter the industry
- Insufficient number and qualifications of personnel in the DDWSS system lead to frequent changes in personnel; in the industry, mostly non-specialists work. Design decisions are made without appropriate technical research and justification, which leads to the creation of expensive infrastructure with overestimated characteristics (capacity of systems and pipe diameters, duplication of tanks, etc.)
- Lack of qualified engineering and management personnel, as well as locksmiths, plumbers and welders, which leads to unprofessional actions in enterprises

[90] http://cbd.minjust.gov.kg/act/view/ru-ru/111782

- Frequent reorganization of the industry, leading to unclear distribution of roles among stakeholders, leads to gaps in coordination and accountability.
- Lack of production control of water quality in most urban, municipal and rural water supply systems leads to the lack of information about the quality of drinking water used, the lack of planned and effective measures to improve the situation.
- Lack of knowledge and information about the possibility of obtaining sodium hypochlorite from local salt deposits (in the Jalal-Abad region, in the Kochkor region, etc.), about the use of solar energy to produce electricity, leads to the fact that these reagents are imported from abroad, which leads to an increase in the cost of projects, services for the supply of drinking water.
- The conservative thinking of the population, designers, managers leads to the fact that the projects do not include the use of local materials, advanced technologies for obtaining electricity.
- Non-compliance with the regime of sanitary protection zones of rural water supply sources leads to pollution of water resources, diseases of the population using poor-quality drinking water, and complaints from the population.

All the main identified barriers for this technology were analysed based on Logical Problems Analysis. Additionally, during the process for the analysis market mapping was conducted to survey enabling frames, market actors and service providers.

The main task of market mapping is to bring together disparate, competitive, mutually suspicious and demanding business people and motivate them to work towards a common goal. In general, the process of market mapping can consist of three stages:

a. creation of a preliminary market map
b. market participation process
c. the action phase that results from the formation of a functioning network of market participants based on relationships formed and trust generated.[91]

The results of the technology market mapping are presented in Annex I B, showing the relationships and influence in three directions: regulatory framework, market actors and service providers, based on the prevailing conditions in the Republic.

2.2.3 Identified measures for ERSDWSS

The process of identifying Measures to overcome, mitigate the identified Barriers included the following:

- study of strategic documents: national and sectoral
- holding consultations and discussions with stakeholders, experts, and SWG members.

In addition, the list of measures is prepared because of the consultant's knowledge and international experience.

2.2.3.1 Economic and financial measures for ERSDWSS

In order to overcome/mitigate the identified barriers in the category: Economic and financial, the following Measures were proposed:

- Improving investment policy

[91]Overcoming Barriers to Transfer and Diffusion of Climate Technology Second Edition Contributors Ivan Nygaard Ulrich Elmer Hansen UNEP DTU Partnership 2015. https://tech-action.unepccc.org/wp-content/uploads/sites/2/2021/01/overcoming-barriers-to-the-transfer-and-diffusion-of-climate-technologies-2nd-edition.pdf

- Increasing the capacity of DDWSS to prepare project applications to various funds
- Refinement and adoption of the sectoral normative legal act on the regulation of tariffs in the drinking water supply and sanitation protection sector
- Adoption of tariffs for the supply of drinking water adequate to the costs incurred for the operation of systems and taking into account inflation and development opportunities
- Awareness rising work with LSG bodies, the population
- Capacity Building of Local Kenesh Members
- Carry out phased write-offs of financial debts of DWSS service providers accumulated from previous state-owned enterprises
- Improving the financial literacy of accountants, economists
- Training to work with the 1C Accounting Software in the field.

The list of proposed economic and financial measures is given in tab. 2.4.

Table 2.4. The list of measures by category of barriers

Category	Barriers	Measures
Economic and financial	Lack of financial resources: donor and national investment	Improving investment policy
		Increasing the capacity of DDWSS to prepare project applications to various funds
	Low tariffs of drinking water suppliers	Adoption of tariffs for the supply of drinking water adequate to the costs incurred for the operation of systems and taking into account inflation and development opportunities as well as payment method for population
		Explanatory work with LSG bodies, the population
		Capacity Building of Local Kenesh Members
	Existing old debts of a number of municipal enterprises and organizations of drinking water supply and sanitation	Carry out phased write-offs of financial debts of DWSS service providers accumulated from previous state-owned enterprises
	Insufficient level of accounting at enterprises and organizations of drinking water supply and sanitation	Improving the financial literacy of accountants, economists
		Training to work with the 1C Program in the field

2.2.3.2 Non-financial measures

In order to overcome/mitigate the identified non financial barriers for other categories, the following measures have been proposed by SWG members:

- Establishment of a policy that promotes the development of local manufacturers of electrolysis plants
- Formation of policies that promote the development of local manufacturers of solar panels
- Implementation of sustainable business models through the implementation of the Public-Private Partnership (outsourcing) model
- Refinement and adoption of an industry-specific NLA on tariff regulation
- Studying the results of the implementation of the pilot project in the a / a of the Naryn region PKM No. 713 dated 12/26/2022
- Introducing an amendment to the Law "On Subsoil" in Article 35. P. 3.
- Development of a regulation on the allocation of water fund lands for micro hydroelectric power plants for the DWSS sector

- Conducting an analysis of existing SNIPs
- Conducting analysis and evaluation of legal acts in the field of drinking water supply and sanitation
- Informing about good practices and examples
- Studying and informing about good PPP practices
- Pursuing a unified comprehensive policy and improving the coordination of actions of state bodies and local self-governments
- Pursuing a unified comprehensive policy and increasing the coordination of actions of state bodies and local self-governments
- To study the issue of the feasibility of creating the Republican State Enterprise "Kyrgyzta-zasuu"
- Implementation of the Vocational Training Program and the Roadmap for its implementation.
- Increasing the capacity of colleges, universities in the field of DWSS
- Lowering the school exams score threshold for admission to a university in the direction of DWSS
- Implementation of training on a budgetary basis under the DDWSS quotas of vocational schools and higher educational institutions
- Increasing interagency cooperation on the possibilities of developing local underground water deposits for drinking water purification: DDWSS and MNRETS, etc.
- Increasing interdepartmental cooperation on the use of solar energy in the DWSS systems: State Agency for Architecture, Construction and Utilities (SAACU), DDWSS, MEC, MNRETS, etc.
- Studying and informing about the positive practices of solar energy generation and application in the DWSS sector
- Increasing the role of the Vocational and Higher Education institutions in providing advice to expand and ensure regular training of personnel and the organization of the exchange of best practices in design, research and development.
- Creation of a state enterprise for maintenance of DWSS systems at the district level.
- Organization of three stationary and one mobile laboratory for DDWSS to control of DWSS in rural areas
- Studying foreign examples and informing
- Development and implementation of an interdepartmental mechanism for a selective study of the state of sanitary protection zones of sources of centralized water supply.
- The application of the articles of the Code of the Kyrgyz Republic on Administrative Law Violations dated October 28, 2021 No. 128

All of them are summarized in tab. 2.5.

Table 2.5. Non-financial measures for ERSDWSS technology by categories of barriers

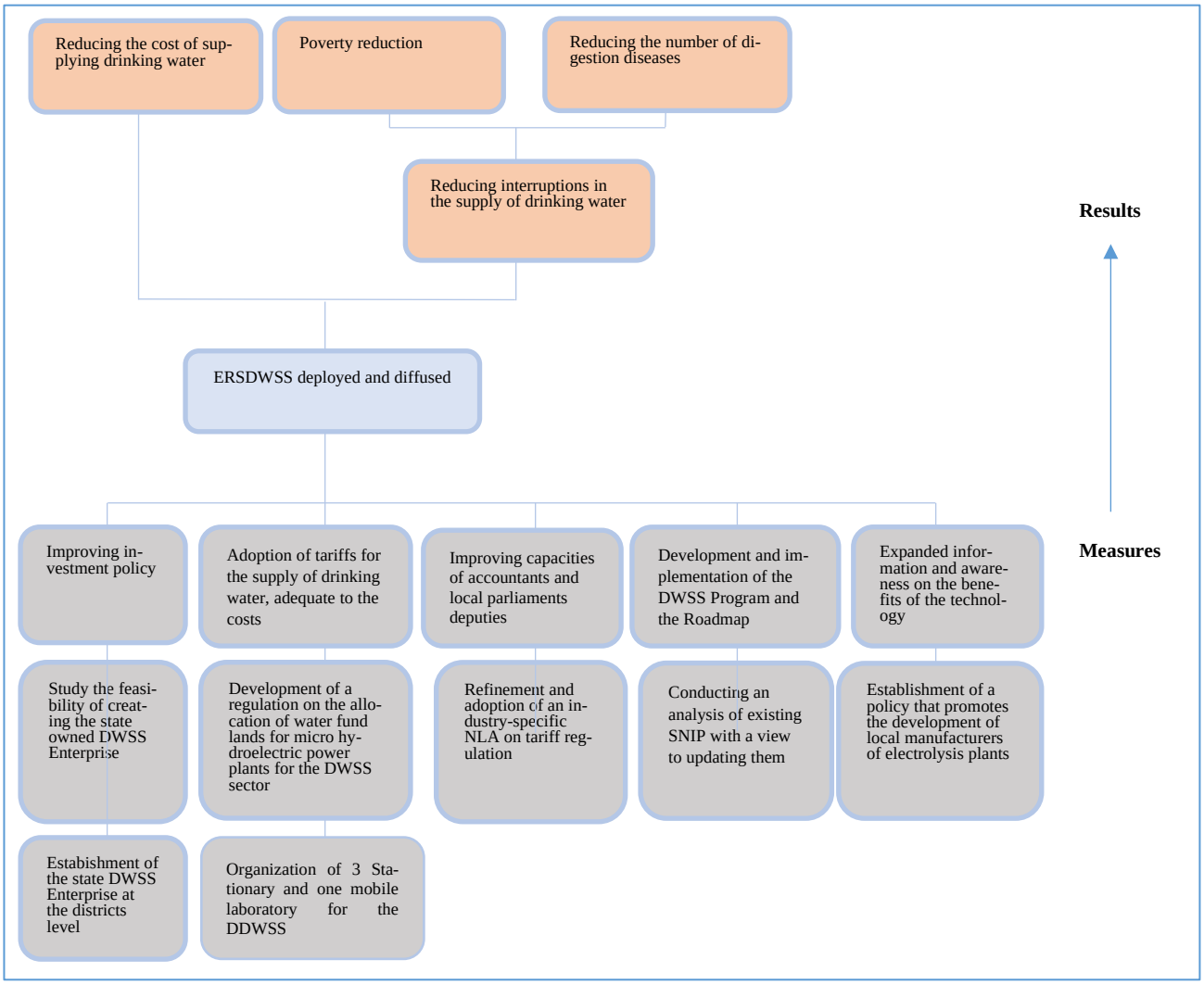
Category	Barriers	Measures
Market conditions	Lack of local manufacturers for the production of electrolysis plants for the production of sodium hypochlorite	Establishment of a policy that promotes the development of local manufacturers of electrolysis plants
	Lack of local manufacturers of solar panels for mini hydropower plants	Formation of policies that promote the development of local manufacturers of solar panels
		Implementation of sustainable business models through the implementation of the Public-Private Partnership (outsourcing) model

Category	Barriers	Measures
Regulation	Absence of a sectoral normative legal act on the regulation of tariffs in the sector of domestic and drinking water supply and sanitation.	Refinement and adoption of an industry-specific NLA on tariff regulation
	Most of the DWS systems, after restoration and new construction, were transferred to the ownership of CDWUUs, which are unstable	Studying the results of the implementation of the pilot project in the a / a of the Naryn region PKM No. 713 dated 12/26/2022
	Lack of a license to develop deposits of salt, quartz sand	Introducing an amendment to the Law "On Subsoil" in Article 35. P. 3.
	Absence of the Act on the allocation of land for the construction of micro-hydro power plants	Development of a regulation on the allocation of water fund lands for micro hydroelectric power plants for the DWS sector
	Outdated building codes and maintenance standards	Conducting an analysis of existing SNIP for their renewal
	The regulatory legal framework for the drinking water supply and sanitation sector is outdated	Analysis and evaluation of legal acts in the field of WSS
Network	Conservative thinking of designers, managers	Informing about good practices and examples
		Studying and informing about good PPP practices
Institutional and organizational capacity	Insufficient number and qualification of personnel in the DDWSS system	Pursuing a unified comprehensive policy and improving the coordination of actions of state bodies and local self-governments
	Unresolved institutional issues. Frequent reorganization of the industry	Pursuing a unified comprehensive policy and increasing the coordination of actions of state bodies and local self-governments
		To study the issue of the feasibility of creating the Republican State Enterprise "Kyrgyztazasuu"
Human skills	Lack of qualified engineering and management personnel, as well as locksmiths, plumbers and welders.	Implementation of the DWSS education Program and the Roadmap for its implementation.
	Lack of teachers and insufficient qualifications of teachers for the design and operation of DWSS systems	Increasing the capacity of colleges, universities in the field of DWSS
	Lack of benefits for admission to universities for the specialty water supply and sanitation, high school exams passing score for applicants	Lowering the exams score threshold for admission to a university in the direction of DWSS. Implementation of training on a budgetary basis under the quotas for DDWSS
Information and awareness	Lack of knowledge and information about the possibility of obtaining sodium hypochlorite from local salt deposits (in the Jalal-Abad region, in the Kochkor region, etc.),	Increasing interagency cooperation on the possibilities of developing local deposits for drinking water purification: SAACU, MNRETS, etc.
	Lack of knowledge and information about the possibility of obtaining the use of solar energy for electricity generation in the DWSS system	Increasing interdepartmental cooperation on the use of solar energy in the DWSS system: SAACU, MEC, MNRETS etc.
		Studying and informing about the positive practices of solar energy production and application in the DWSS sector

Category	Barriers	Measures
	Design decisions are made without appropriate technical research and justification.	Increasing the role of the Vocational and Higher Education institutions in providing advice to expand and ensure regular training of personnel and the organization of the exchange of best practices in design,
Technical:	Lack of production control of water quality in most urban, municipal and rural water supply systems	Creation of a state enterprise for maintenance of DWSS systems at the district level.
		Organization of three production and one mobile laboratory of the Far East and Higher Educational Establishment for the production control of HP in rural areas
	Lack of positive practice of applying this Technology in the Kyrgyz Republic	Studying foreign examples and informing for the preparation of pilot projects
Other: environmental impact, physical infrastructure conditions	Non-compliance with the regime of sanitary protection zones of rural water supply sources	Development and implementation of an interdepartmental mechanism for a selective study of the state of sanitary protection zones of sources of centralized HP
		Application of articles of the Code of the Kyrgyz Republic on Administrative Law Violations dated October 28, 2021 No. 128.

Logical problem analysis (LPA) of economic, financial and non-financial measures to the deployment and diffusion of RESDWSS technology is presented as an objective tree in fig. 2.2 below.

Figure 2.2. Objective Tree for RESDWSS technology



The market analysis for ERSDWSS technology was carried out using a "market mapping" approach. This approach helped to visualize the commercial and institutional environment for each of the technology market. The whole system was considered in the context of its three main components:

- Enabling business environment.
- Market players and connections, and
- Service providers.

The corresponding figure in presented in Annex II to this Report.

2.3. Barriers analysis and proposed enabling measures for the Energy Efficient Pumping stations (EEPS) technology

In order to identify barriers, before the Joint Meeting of the Sectoral Working Groups on Agriculture and Water Resources (held on April 19, 2023), a study was conducted that included several research methodologies: a review of policy documents, technical literature, including publications of international projects, two rounds of an online survey members of the sectoral working groups (the first on collecting barriers and the second on determining the importance of barriers) and direct interviews with various stakeholders. During the consultations, a list of all the major barriers that will have to be faced in the transfer, implementation and dissemination of EEPS technology was prepared and discussed.

2.3.1 General description of EEPS technology

The main consumer of water in the country is irrigated agriculture; more than 90% of the available water resources are used for irrigation needs. To grow crops in drylands, pumping stations were built more than half a century ago; 115 units (365 aggregate units), providing irrigation water to 57.0 thousand hectares (6% of the total irrigation area).

Re-equipment of pumping stations, especially in recent years, has become a necessary task, since the service life of the equipment has exceeded the norm by 4-5 times, it is morally and physically obsolete.

Despite the fact that technical re-equipment has begun in recent years, it is far from sufficient and covered only 20-30% of what was needed. In addition, the re-equipment is carried out within the existing equipment, for example, pumps - 3.5 kW, and units of 1.5 kW are needed.

Thus, the purpose of introducing the proposed Technology No. 2 is to reduce the shortage of water resources resulting from interruptions in the operation of outdated energy-intensive equipment of pumping stations. In connection with the forecasts of river flow reduction, this technology will indirectly help reduce water scarcity, as electricity consumption will be reduced, as well as reduce the load on water resources, since the main electricity generation is carried out by hydroelectric power plants.

The timely provision of irrigation water to dry fields will increase the sustainability of agricultural production in these areas, as well as support the livelihoods of farmers and the supply of food to local and national markets.

It is required to replace all 365 pumping units at 115 pumping stations, as well as purchase additional ones for each pumping station. Thus, this technology has a good market potential. Improving services for the supply of irrigation water, as well as fees for irrigation services and reducing the burden on the republican budget, increasing wages for workers at pumping stations. It is noteworthy that a reduction in electricity consumption by about half (at the rate of 1.08 Kyrgyz soms per 1 kWh) will lead to savings in public funds of about 244.0 million soms per year.

The introduction of this Technology will reduce the hard manual labour, the staffing of pumping station workers, which will increase the wages of the remaining workers. If implemented, this technology could improve irrigation services for approximately 89,700 people across the country. Electricity consumption by pumping stations will be reduced by about half, which will reduce greenhouse gas emissions.

2.3.2 Identified barriers to EEPS technology

The analysis of barriers for EEPS technology was also carried out on the basis of:

- Desk analysis of relevant documents, legal acts, country and sectoral strategic documents and UNEP DTU Guidelines.
- Consultations with relevant employees of the Water Resources Service of the Ministry of Agriculture of the Kyrgyz Republic and the members of the SWG.

The results of the analysis of barriers by category, their brief description, as well as their score values are given in tabular form below, (tab. 2.6), as well as in a LPA graphical form as a problem Tree.

As can be seen from the table below, barriers of the first group such as:

- Lack of financial resources: donor and national investments
- Interruptions in the supply of electricity to pumping stations
- Insufficient qualifications for the operation of pumping units at pumping stations

- Lack of information on good practices for the use of more efficient pumping aggregates were assigned the highest score of 4.

The second group including the following barriers:

- Lack of economic analysis of the operation of pumping stations
- Lack of local manufacturers for the production of electric pumps
- Conservative thinking of managers
- The Rules of the Technical Safety and Technical Exploitation for electrical installations at pumping stations are not followed
- Lack of information on positive practices for the construction of mini HPPs to serve the NS received a score of three.

And two barriers:

- Lack of incentives aimed at saving electricity
- The regulatory legal framework of the sector does not provide for incentives for the use of energy efficient pumps was scored at 2 points.

The full list of the identified barriers by categories with brief descriptions and score values is presented in tab. 2.6.

Table 2.6. The identified barriers to EEPS technology

Category	Barriers	Description of effects	Score: Assassin (5), Critical (4), Important (3), Less important (2), Minor (1).
Economic and financial	1. Lack of financial resources: donor and national investment	Despite the measures taken by the Cabinet of Ministers of the Kyrgyz Republic, there is still a problem of lack of financial resources. There are no opportunities to modernize pumping stations with new electric units.	4
	2. Lack of economic analysis of the work of n.s.	Does not allow for analysis to reduce energy consumption by pumping stations, to purchase more energy efficient pumps	3
	3. Lack of incentives aimed at saving electricity	Does not contribute to the installation of efficient e / units	2
Market conditions	4. Lack of local manufacturers for the production of electric pumps	The need to purchase and deliver electric pumps from abroad	3
Regulation	5. Conservative thinking of DWSS managers	It leads to the fact that high-cost electric pumps are purchased and installed, both in terms of cost and in terms of electricity consumption by inertia	3
Network	6. Interruptions in the supply of electricity to pumping stations	Leads to frequent breakdowns of units, shortage of water resources	4

Category	Barriers	Description of effects	Score: Assassin (5), Critical (4), Important (3), Less important (2), Minor (1).
	7. Conservative thinking of managers	It leads to the purchase and installation of high-cost electric pumps, both in terms of cost and electricity consumption, of the previous model	3
Institutional and organizational capacity	8. The regulatory legal framework of the sector does not provide incentives for the use of energy efficient pumps	In this connection, electric pumps of the sample previously installed, of the Soviet period, are installed	2
Human skills	9. The Rules of the Technical Safety and Exploitation on electrical installations at pumping stations are not complied with	Maintenance personnel do not develop and do not implement organizational and technical measures that should provide for a reduction in the cost of operating pumping stations[92].	3
	10. Inability to analyse the efficiency of the pumping station: the efficiency is not determined, the estimated need for electricity, there are no research data on pressure losses in pipelines and shutoff valves, the compliance of volumes and water supply modes with the technical indicators of pumping and power equipment is not studied. There is no assessment of the effectiveness of the work of pumping stations	The lack of the possibility of analysing the effectiveness of the work of pumping stations.	3
	11. Insufficient qualifications for the operation of pumping units at pumping stations	Leads to frequent breakdowns, protracted repairs, shortage of water resources	4
Information and awareness	12. Lack of information on positive practices for the construction of mini	It leads to the fact that electric pumps are purchased and installed at a high cost, both in terms of cost and electricity consumption.	3

[92] E. Kozhoev. 2009. Measures and recommendations to improve the collection of fees for irrigation services. IWRM project in the Ferghana Valley. Tashkent.

Category	Barriers	Description of effects	Score: Assassin (5), Critical (4), Important (3), Less important (2), Minor (1).
	Hydropower installations to service the pumping stations		
Technical	13. Lack of positive practices for the use of more efficient electric units	It leads to the fact that electric pumps are purchased and installed at a high cost, both in terms of cost and electricity consumption.	3

2.3.2.1 Economic and financial barriers to EEPS technology

In the process of work, the following economic and financial Barriers of the Technology under consideration were identified:

- Insufficiency of financial resources: donor and national investments. Since, despite the measures taken by the GKR, due to a lack of financial resources, there is still a problem in providing irrigation water, there are no opportunities to modernize pumping stations with new electric units
- Lack of economic analysis of researcher's work: leads to the inability to assess the effectiveness of researcher's work.
- The lack of benefits aimed at saving electricity does not contribute to reducing energy consumption

The list of economic and financial barriers to EEPS deployment and diffusion with description of related consequences is given in tab. 2.7.

Table 2.7. Economic and financial barriers to EEPS

Category	Barriers	Description
Economic and financial	1. Lack of financial resources: donor and national investment	Despite the measures taken by the Cabinet of Ministers of the Kyrgyz Republic, there is still a problem of lack of financial resources. There are no opportunities to modernize pumping stations with new electric units.
	2. Lack of economic analysis of the work of Pumping stations	Does not allow for analysis to reduce energy consumption by pumping stations, to purchase more energy efficient pumps
	3. Lack of incentives aimed at saving electricity	Does not contribute to the installation of efficient e / units

2.3.2.2 Non-financial barriers to EEPS technology

Among the non-financial Barriers, the following were identified:

- Lack of local manufacturers for the production of electric pumps, which leads to the need to purchase and deliver electric pumps from abroad.

- Conservative thinking of managers leads to the fact that, by inertia, high-cost electric pumps are purchased and installed, both in terms of cost and electricity consumption
- Interruptions in the supply of electricity to pumping stations leads to frequent breakdowns of units, a shortage of water resources
- The sector's regulatory framework does not provide for incentives for the use of energy efficient pumps. In this connection, electric pumps installed, during the Soviet period, are still operational.
- Technical Safety Rules and the Rules for the exploitation and operation of electrical installations at pumping stations are not followed. Maintenance personnel do not develop and do not implement organizational and technical measures that should provide for a reduction of costs of operating pumping stations
- Inability to analyse the efficiency of the pumping station: the efficiency is not determined, the estimated need for electricity, there are no research data on pressure losses in pipelines and valves, the compliance of the volumes and water supply regime with the technical indicators of pumping and power equipment is not studied.
- Insufficient qualification of personnel for the operation of pumping units at pumping stations leads to frequent breakdowns, protracted repairs, shortage of water resources
- Lack of information on positive practices for the construction of mini HPPs to service the n.s. leads to the fact that high-cost electric pumps are purchased and installed, both in terms of cost and energy consumption.

In a generalized form, those barriers are presented by category and their consequences description in tab. 2.8.

Table 2.8. Non-financial barriers identified for EEPS technology

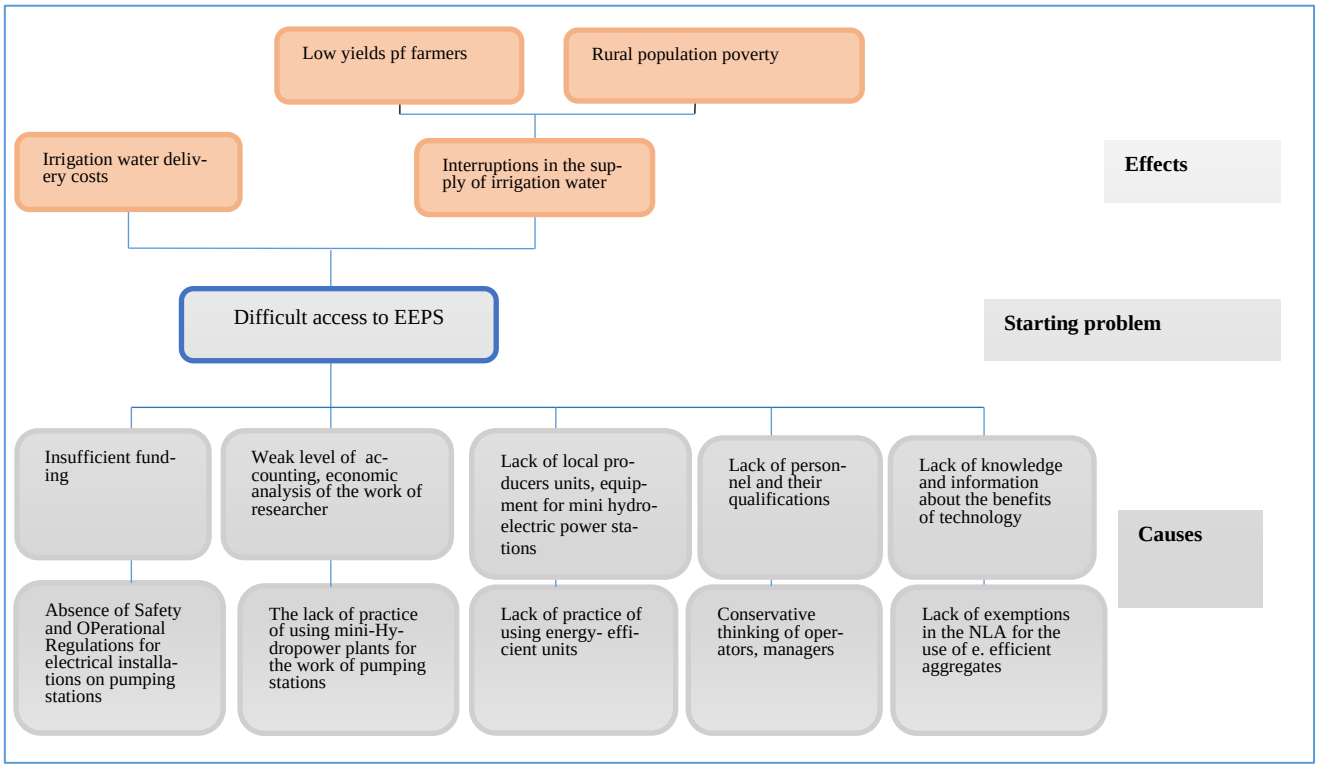
Category	Barriers	Description of effects
Market conditions	1. Lack of local manufacturers for the production of electric pumps	The need to purchase and deliver electric pumps from abroad
Regulation	2. Conservative thinking of DWSS managers	It leads to the fact that high-cost electric pumps are purchased and installed, both in terms of cost and in terms of electricity consumption by inertia
Network	3. Interruptions in the supply of electricity to pumping stations	Leads to frequent breakdowns of units, shortage of water resources
	4. Conservative thinking of managers	It leads to the purchase and installation of high-cost electric pumps, both in terms of cost and electricity consumption, of the previous model
Institutional and organizational capacity	5. The regulatory legal framework of the sector does not provide incentives for the use of energy efficient pumps	In this connection, electric pumps of the sample previously installed, of the Soviet period, are installed
Human skills	6. The Rules of the Technical Safety and Exploitation on electrical installations at pumping stations are not followed as appropriate	Maintenance personnel do not develop and do not implement organizational and technical measures that should provide for a reduction in the cost of operating pumping stations[93].

[93] E. Kozhoev. 2009. Measures and recommendations to improve the collection of fees for irrigation services. IWRM project in the Ferghana Valley. Tashkent.

Category	Barriers	Description of effects
	7. Inability to analyse the efficiency of the pumping station: the efficiency is not determined, the estimated need for electricity, there are no research data on pressure losses in pipelines and shutoff valves, the compliance of volumes and water supply modes with the technical indicators of pumping and power equipment is not studied. There is no assessment of the effectiveness of the work of pumping stations	The lack of the possibility of analysing the effectiveness of the work of pumping stations.
	8. Insufficient qualifications for the operation of pumping units at pumping stations	Leads to frequent breakdowns, protracted repairs, shortage of water resources
Information and awareness	9. Lack of information on positive practices for the construction of mini Hydropower installations to service the pumping stations	It leads to the fact that electric pumps are purchased and installed at a high cost, both in terms of cost and electricity consumption.
Technical	10. Lack of positive practices for the use of more efficient electric units	It leads to the fact that electric pumps are purchased and installed at a high cost, both in terms of cost and electricity consumption.

Logical problem analysis (LPA) of economic, financial and non-financial problems to the deployment and diffusion of EEPS technology is presented as a problem tree in fig. 2.3 below.

Figure 2.3.LPA Problem Tree for EEPS



The market analysis for EEPS technology was carried out using a "market mapping" approach. The corresponding scheme in presented in Annex I B to this Report.

2.3.3 Identified measures for EEPS technology

The main purpose of identifying and analyzing barriers is the formulation of a list of measures that contribute to overcoming / mitigating barriers. These measures have been identified based on stakeholder consultation, the consultant's own knowledge and international experience, and are listed by category in tab. 2.9.

Table 2.9. Full list of proposed measures by categories of barriers for EEPS technology

Category	Barriers	Measures
Economic and financial	Lack of financial resources: donor and national investment	Implementation of a policy that facilitates the attraction of financial resources for energy-saving electric units
	Lack of economic analysis of the work of pumping stations	Capacity building: conducting training for service personnel
Market conditions	Lack of local manufacturers for the production of electric pumps	Market Research for Energy Efficient Pumps in order to acquire the most reliable in operation
Regulation	Lack of incentives for the installation of energy efficient electric pumps that help reduce energy consumption	Provide benefits for the installation of energy efficient electric pumps
		Studying the issue of the feasibility of creating a Marketing Service within the WRS under the Ministry of Agriculture
Network	Conservative thinking of managers. preference is given to brands of pumping units installed earlier	Informing managers about the possibilities of energy-efficient units
Institutional and organizational capacity	Lack of qualified engineering and management personnel, as well as locksmiths, electricians	Increasing the potential of universities, colleges

Category	Barriers	Measures
Human skills	Low qualification of service personnel, CA SVR and in the field	Organization of permanent courses to increase the potential of mechanics, electricians at the regional level
Information and awareness	Lack of knowledge and information on the possibility of reducing electrical energy consumption by using energy efficient pumps	Training of best practices for managers and operators
	The Rules of technical safety and exploitation of electrical installations in pumping stations are not followed up as appropriate. In accordance with which, maintenance personnel are obliged to develop and implement organizational and technical measures that should provide for a reduction in the cost of operating pumping stations.	Organization of permanent pumping stations' staff training: 1. Rules of technical exploitation/operation 2. Development of corresponding organizational and technical measures
Technical	Lack of positive practices for the application of this Technology	Study of international experience in the application of this technology in order to prepare a pilot project
Other	Interruptions in the supply of electrical energy to pumping stations	Consideration of the issue of construction of mini-hydropower plants for the work of pumping stations.

2.3.3.1 Economic and financial measures

To mitigate and overcome the economic and financial barriers of this technology, the following measures are proposed:

- Development a policy that facilitates the attraction of financial resources for energy-saving electric units
- Capacity building: conducting training for operating personnel in terms of economic analysis of the operation of pumping stations, tab. 2.10.

Table 2.10. The proposed measures to overcome economic and financial barriers to EEPS technology

Categories:	Barriers:	Measures
Economic and financial	Lack of financial resources: donor and national investment	Implementation of a policy that facilitates the attraction of financial resources for energy-saving electric units
	Lack of economic analysis of the operation of pumping stations	Capacity building: conducting training for operating personnel in terms of conducting an economic analysis of the operation of pumping stations

2.3.3.2 Non-financial measures

Among the non-financial measures, the following were identified:

- Studying the market for Energy Efficient Pumps in order to acquire the most reliable in operation
- Provide benefits for the installation of energy-efficient electric pumps, which, apparently, will require the preparation of legal acts
- Consideration / Study of the possibility of building a mini hydroelectric power station to ensure the operation of the n.s.
- To study the issue of the expediency of creating a Marketing Service in the Water Resource Service under the Ministry of Agriculture, which existed earlier. Currently, these functions are performed by the Basin Water Management Departments at the local level, which is an inefficient practice.
- Organization of permanent courses to increase the potential of mechanics, electricians at the regional level
- Training on the best practices for the use of energy-efficient electric units for managers and operators
- Study of international experience in the application of this Technology
- Organization of ongoing training of research staffon: 1) the rules of technical exploitation/operation 2) development of organizational and technical measures
- Consideration of the issue of building a mini-hydropower plant for the operation of a pilot pumping stations.

The list of proposed non-financial measures for this technology deployment and diffusion is given in tab. 2.11.

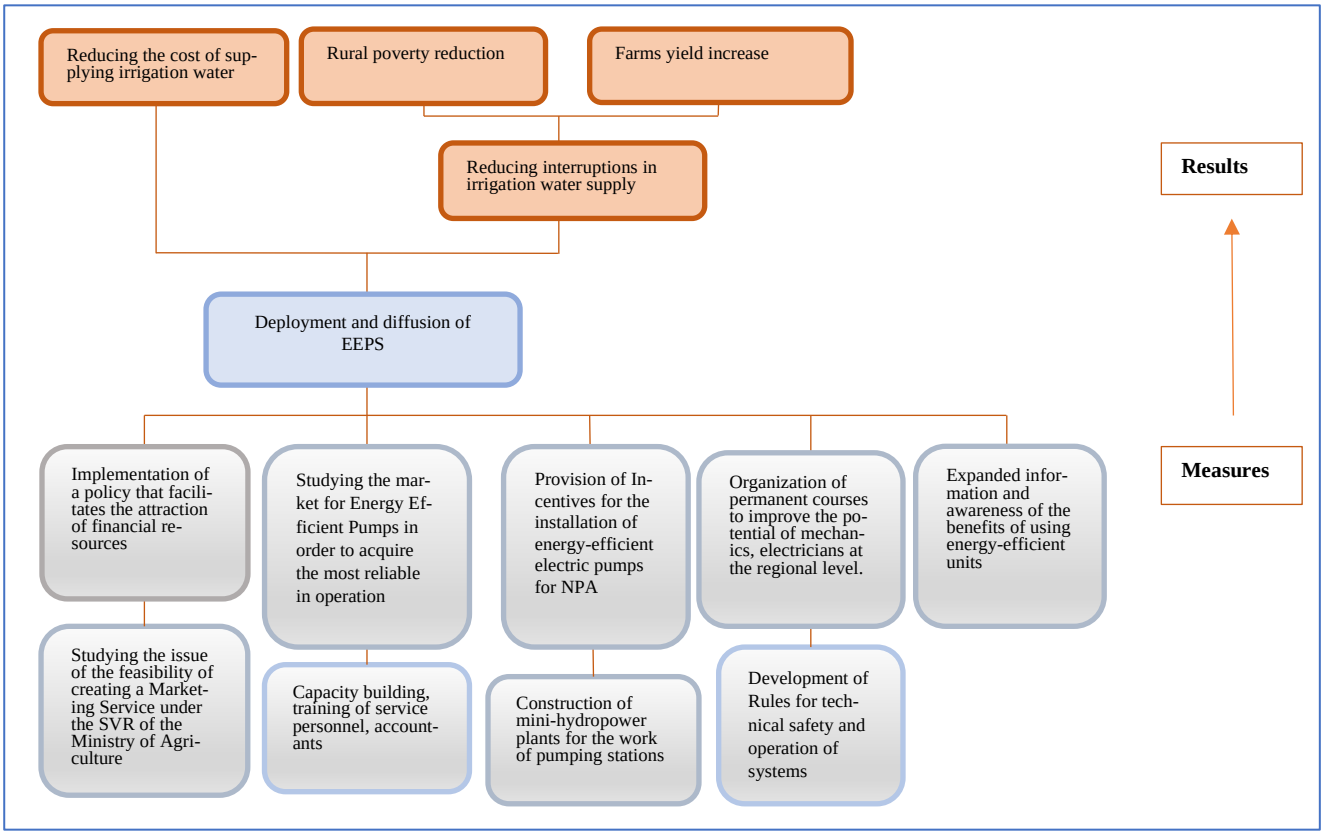
Table 2.11. The list of non-financial Measures to overcome the barriers to EEPS technology"

Categories:	Barriers:	Measures
Market conditions	Lack of local manufacturers for the production of electric pumps	Market research for energy efficient pumps
Regulation	Lack of incentives to reduce the energy consumption of pumping stations	Provision of benefits for the installation of energy efficient electric pumps
Network	Conservative thinking of managers Preference is given to brands of pumping units installed earlier	Consideration / Study of the possibility of building a mini hydroelectric power station to ensure the operation of the n.s.
Institutional and organizational capacity	Lack of qualified engineering and management personnel, as well as locksmiths, electricians	To study the issue of the feasibility of creating a Marketing Service under the WRS under Ministry of Agriculture
Human skills	Low qualification of service personnel of WRS and in the field	Organization of permanent courses to increase the potential of mechanics, electricians at the regional level
Information and awareness	Lack of knowledge and information on the possibility of reducing electrical energy consumption by using energy efficient pumps	Training of best practices for managers and operators
Technical	Lack of positive practices for the application of this Technology	Study of international experience in the application of this technology
	The Rules of the technical safety and operation of electrical installations in pumping stations are not followed up as appropriate. In accordance with which, maintenance personnel are obliged to develop and implement organizational and	Organization of permanent staff training for research workers: 1. Rules of technical operation 2. Development of organizational and technical measures

Categories:	Barriers:	Measures
	technical measures that should provide for a reduction in the cost of operating pumping stations.	
Other	Interruptions in the supply of electrical energy to pumping stations	Consideration of the issue of construction of mini-hydropower plants for the work of pumping stations

Logical problem analysis (LPA) of economic, financial and non-financial measures for the deployment and diffusion of EEPS technology is presented as an objectives tree in fig. 2.4 below.

Figure 2.4. Objective tree for EEPS technology



2.4 Barriers analysis and possible enabling measures for the "Subsoil irrigation against the background of closed drainage by the method of subsoil irrigation" (SSI) technology

The analysis of barriers for technology "Subsoil irrigation against the background of closed drainage by subsoil irrigation" was also carried out on the basis of:

- desk analysis of relevant documents, legal acts, country and sectoral strategic documents
- consultations with relevant staff of the Kyrgyz Research Institute of Irrigation and the work with members of the SWG.

2.4.1 General description of SSI technology

Up to 10.0 km3 of water per year is used for irrigation in the republic, of which up to 3.5 km3 is lost during transportation, out of which 1.5-1.9 km3 are lost in the on-farm irrigation channels network.

The method of subsurface irrigation using underground pipelines is a type of drip irrigation. The technology under consideration contributes to the rational use of water resources and in connection with the forecasts of runoff reduction as a result of Global climate change, this technology will help reduce water scarcity. This technology, when watering is carried out along underground molehills (i.e., surface irrigation is excluded, which at high temperatures contributes to evaporation from irrigation arrays), significantly prevents water evaporation.

Subsoil irrigation is economically much more efficient than surface irrigation and most fully satisfies the needs of agricultural crops, because. optimal conditions for the growth and development of plants are created, a higher water consumption coefficient, simplicity of design during construction and operation, productivity is increased by 30-50%, high yields are provided regardless of weather conditions, nutrients and microelements are stored in the soil, costs for combating weeds, etc.

The introduction of this technology will improve the quality of irrigation water supply services, increase the amount of income from irrigation fees for farmers, Water Users Associations, thereby supporting them financially. The introduction of this Technology will increase the yield of agricultural crops, which contributes to an increase in the income of the population.

The technology will reduce the hard manual labour of raising the gates of water intakes, and will help maintain the health of service personnel, farmers, including women farmers. This will free up time for other activities: alternative ways of earning money: housekeeping, gardening, vegetable growing, women's leisure. New jobs will be required to maintain collector-drainage and subsoil irrigation systems.

The technology implies the prevention of erosion of channels formed during unregulated supply of irrigation water to the distribution network, will reduce the shortage of water resources, irrigation water will be supplied in accordance with irrigation regimes, which will preserve the fertile soil layer. This will also reduce the processes of gully formation, erosion on irrigated lands, prevent the washout of the humus layer of the soil, the formation and flow of solid runoff into rivers, reservoirs, and drainage systems.

Thus, the purpose of implementing this Technology No. 3 is to reduce the shortage and loss of water resources, increase the sustainability of agricultural production by 30-50%, and improve the quality of services for the delivery of irrigation water.

2.4.2 Identify barriers to SSI technology

The results of the barriers analysis as per different categories, their brief description, as well as their assessment in points are given in tabular form, as well as in graphical form in the form of a Problem Tree.

The identified barriers of the first group with the highest score of 4 points are:

- Lack of financial resources: donor and national investments. Since, despite the measures taken by the Cabinet of Ministers of the Kyrgyz Republic, there is still a problem of lack of funds for the introduction of new Technologies
- The high cost of purchasing, installing a set of equipment and its operation, which leads to the fact that technologies aimed at economical and rational use of water resources are not used in the republic, but surface irrigation technologies are used. Which leads to soil compaction, humus washout, weed growth, low yields, etc.

The following barriers received 3 points:

- Lack of local manufacturers for the production of polyethylene pipes and flexible nylon hoses, and therefore there is a need to purchase and deliver from abroad.
- The absence of the state programming for the economical and rational use of water resources leads to the fact that technologies aimed at the economical and rational use of water resources are not used in the republic, but surface gravity irrigation technologies are used. What does not contribute to the reduction of the use of water resources in irrigation, leads to soil compaction, humus washout, growth of weeds, low yields, etc.
- The regulatory legal framework of the sector does not provide for incentives for the use of efficient irrigation technologies, which leads to the fact that few interested organizations, farmers use this technology.
- The conservative thinking of irrigation water supply managers leads to the fact that old methods of watering are used, mainly surface method
- Lack of research on the areas of possible application of this technology leads to the fact that few interested organizations, farmers apply this technology.
- Few qualified personnel for design and maintenance leads to the fact that few interested organizations, farmers apply this technology.
- Lack of positive practices for the application of this technology leads to the fact that few interested organizations, farmers use this technology.
- The need to build / reconstruct drainage and watering systems (collector-drainage), sluice-regulators, etc. leads to the fact that few interested organizations, farmers use this technology
- The need to carry out work to prevent possible clogging of subsoil humidifiers and perforations with debris, solid deposits leads to an increase in the cost of work when implementing this technology
- High requirements for the size of solid particles - no more than 1.0 mm, water turbidity - no more than 0.05 g/litre leads to an increase in the cost of work when implementing this technology.

The full list of barriers identified for the deployment and diffusion of SSI technology is presented in tab. 2.12.

Table 2.12. The list of barriers identified to SSI technology

Categories of Barriers	Barriers:	Description/Consequences	Score
Economic and financial	1. Lack of financial resources: donor and national investment	Despite the measures taken by the Cabinet of Ministers of the Kyrgyz Republic, there is still a problem of lack of funds for the introduction of new technologies	4
	2. The high cost of purchasing, installing a set of equipment and its operation	It leads to the fact that technologies aimed at the economical and rational use of water resources are not used in the republic, but surface irrigation technologies are used. Which leads to soil compaction, humus washout, weed growth, low yields, etc.	4
Market conditions	3. Lack of local manufacturers for the production of polyethylene pipes and flexible nylon hoses	The need to purchase and deliver from abroad	3
Regulation	4. Lack of a State Program for the Economical and Rational Use of Water Resources	It leads to the fact that technologies aimed at the economical and rational use of water resources are not used in the republic, but surface irrigation technologies are	3

Categories of Barriers	Barriers:	Description/Consequences	Score
		used. What does not contribute to the reduction of the use of water resources in irrigation leads to soil compaction, humus washout, weed growth, low yields, etc.	
	5. The regulatory legal framework of the sector does not provide for incentives for the use of efficient irrigation technologies	It leads to the fact that few interested organizations, farmers apply this Technology	3
Network	6. Conservative thinking of managers	Leads to the use of old methods of watering, mainly surface method	3
Institutional and organizational capacity	7. Lack of studies on the areas of possible application of this Technology	It leads to the fact that few interested organizations, farmers apply this Technology	3
Human skills	8. Lack of qualified personnel for design and maintenance	It leads to the fact that few interested organizations, farmers apply this Technology	3
Information and awareness	9. Lack of positive practices for the application of this Technology	It leads to the fact that few interested organizations, farmers apply this Technology	3
Technical	10. The need for construction/reconstruction of drainage and water supply systems (collector-drainage), sluice-regulators, etc.	It leads to the fact that few interested organizations, farmers apply this Technology	3
	11. The need to carry out work to prevent possible clogging of subsoil humidifiers and perforations with debris, solid deposits	Leads to an increase in the cost of work when implementing this technology	3
	12. High requirements for the size of solid particles - no more than 1.0 mm, water turbidity - no more than 0.05 g / litre	Leads to an increase in the cost of work when implementing this technology	3

2.4.2.1 Economic and financial barriers to SSI technology

The identified financial and economic barriers are as follows:

- Lack of financial resources: donor and national investments. Despite the measures taken by the Cabinet of Ministers of the Kyrgyz Republic, there is still a problem of lack of funds for the introduction of new Technologies
- High cost of purchasing, installing a set of equipment and its operation leads to the fact that technologies aimed at the economical and rational use of water resources are not used in the republic, but traditional surface irrigation technologies are used. What does not contribute to the reduction of the use of water resources in irrigation, leads to soil compaction, humus washout, growth of weeds, low yields, etc.

The economic and financial barriers to transfer of SSI technology identified within conducted analysis with brief description of the eventual consequences is given in tab. 2.13.

Table 2.13. Economic and Financial barriers to SSI technology

Categories of Barriers	Barriers:	Description/Consequences
Economic and financial	1. Lack of financial resources: donor and national investment	Despite the measures taken by the Cabinet of Ministers of the Kyrgyz Republic, there is still a problem of lack of funds for the introduction of new technologies
	2. The high cost of purchasing, installing a set of equipment and its operation	It leads to the fact that technologies aimed at the economical and rational use of water resources are not used in the republic, but surface irrigation technologies are used. Which leads to soil compaction, humus washout, weed growth, low yields, etc.

2.4.2.2 Non-financial barriers to SSI technology

The non-financial barriers of this technology include the following:

- Lack of local manufacturers for the production of polyethylene pipes and flexible nylon hoses leads to the need to purchase and deliver from abroad
- The absence of the state programming for the economical and rational use of water resources leads to the fact that technologies aimed at the economical and rational use of water resources are not used in the republic, but surface irrigation technologies are used. Which does not help reduce the use of water resources, leads to soil compaction, humus washout, weed growth, low yields, etc.
- The regulatory legal framework of the sector does not provide for incentives for the use of efficient irrigation technologies, which leads to the fact that few interested organizations, farmers use this technology
- Conservative thinking of managers leads to the fact that old ways of watering are applied, mostly in a superficial way
- Lack of research on the areas of possible application of this Technology leads to the fact that few interested organizations, farmers use this Technology
- Lack of qualified personnel for design and maintenance leads to the fact that few interested organizations, farmers apply this Technology
- Lack of positive practices for the application of this Technology leads to the fact that few interested organizations, farmers use this Technology
- The need to build / reconstruct drainage and watering systems (collector-drainage), sluice-regulators, etc. leads to the fact that few interested organizations, farmers use this Technology
- The need to carry out work to prevent possible clogging of subsoil humidifiers and perforations with debris, solid deposits leads to an increase in the cost of work when implementing this technology
- High requirements for the size of solid particles - no more than 1.0 mm, water turbidity - no more than 0.05 g/litre leads to an increase in the cost of work when implementing this technology.

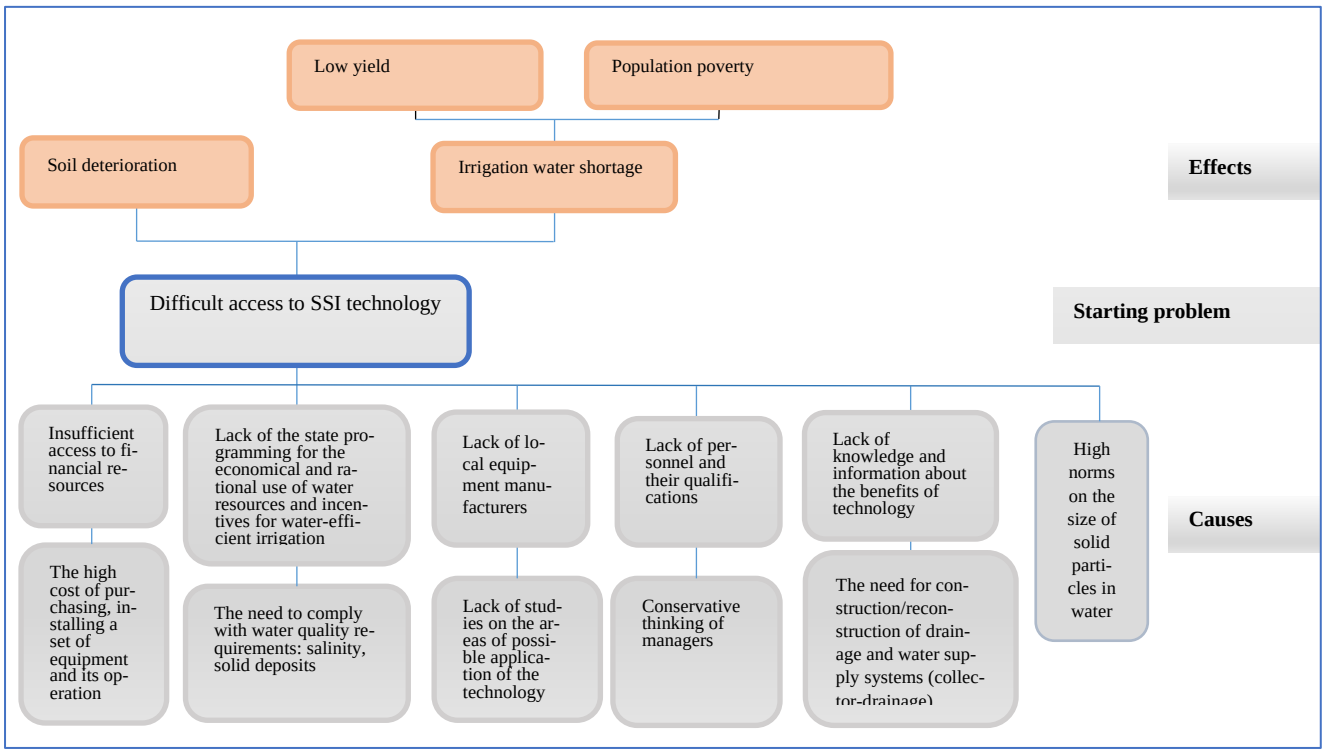
The list of non-financial barriers as per category of barriers to SSI deployment and diffusion with a short description of correlated consequences is given in tab. 2.14.

Table 2.14. Non-financial barriers to SSI technology

Categories of Barriers	Barriers:	Description/Consequences
Market conditions	3. Lack of local manufacturers for the production of polyethylene pipes and flexible nylon hoses	The need to purchase and deliver from abroad
Regulation	4. Lack of a State Program for the Economical and Rational Use of Water Resources	It leads to the fact that technologies aimed at the economical and rational use of water resources are not used in the republic, but surface irrigation technologies are used. What does not contribute to the reduction of the use of water resources in irrigation leads to soil compaction, humus washout, weed growth, low yields, etc.
	5. The regulatory legal framework of the sector does not provide for incentives for the use of efficient irrigation technologies	It leads to the fact that few interested organizations, farmers apply this Technology
Network	6. Conservative thinking of managers	Leads to the use of old methods of watering, mainly surface method
Institutional and organizational capacity	7. Lack of studies on the areas of possible application of this Technology	It leads to the fact that few interested organizations, farmers apply this Technology
Human skills	8. Lack of qualified personnel for design and maintenance	It leads to the fact that few interested organizations, farmers apply this Technology
Information and awareness	9. Lack of positive practices for the application of this Technology	It leads to the fact that few interested organizations, farmers apply this Technology
Technical	10. The need for construction/reconstruction of drainage and water supply systems (collector-drainage), sluice-regulators, etc.	It leads to the fact that few interested organizations, farmers apply this Technology
	11. The need to carry out work to prevent possible clogging of subsoil humidifiers and perforations with debris, solid deposits	Leads to an increase in the cost of work when implementing this technology
	12. High requirements for the size of solid particles - no more than 1.0 mm, water turbidity - no more than 0.05 g / litre	Leads to an increase in the cost of work when implementing this technology

Logical problem analysis (LPA) of economic, financial and non-financial barriers for the deployment and diffusion of SSI technology is presented as a problem tree in fig. 2.5 below.

Figure 2.5. Problem tree for SSI technology



The market analysis for SSI technology was carried out using a "market mapping" approach. The corresponding scheme in presented in Annex I B to this Report.

2.4.3 Measures proposed for SSI technology

In the result of conducted sectoral consultations, a set of measures has been proposed for deployment and diffusion of the SSI technology in Kyrgyzstan. The list of measures as per barriers categories is shown in tab. 2.15.

Table 2.15. The measures proposed for SSI

Category	Barriers	Possible Measures
Economic and financial	Lack of financial resources: donor and national investment	Attracting investments, increasing the volume of allocation of financial resources from the Republic of Belarus
	The high cost of purchasing, installing a set of equipment and its operation	Forming a policy that promotes the development of local producers for the development of drip irrigation: providing incentives for the supply of imported equipment
Market conditions	Lack of local manufacturers for the production of polyethylene pipes and flexible nylon hoses	Formation of policies that promote the development of local producers
		Implementation of sustainable public-private partnership business models (outsourcing)
Regulation	Lack of the state programming for the Economical and Rational Use of Water Resources	Development and adoption of the State Program for the economical and rational use of water resources in connection with climate change
	The regulatory legal framework of the sector does not provide for incentives for the use of efficient irrigation technologies	Make changes and additions to the NLA in terms of providing incentives when using efficient irrigation technologies

Category	Barriers	Possible Measures
Network	Conservative thinking of managers	Training on best irrigation practices aimed at reducing the use of water resources, managers, operators
Institutional and organizational capacity	Lack of studies on the areas of possible application of this Technology	Conducting research on the possibilities of using this Technology in the Republic with the development of recommendations
Human skills	Lack of qualified personnel for design and maintenance	Increasing the capacity of universities in the field of irrigation and GME SVR MOA
Information and awareness	Lack of positive practices for the application of this Technology	Studying the practice of applying this Technology and raising awareness of farmers in the republic
Technical	The need for construction/reconstruction of drainage and water supply systems (collector-drainage), sluice-regulators, etc.	Capacity Building of the Hydroreclamation Expedition of the WRS of the Ministry of Agriculture of the Kyrgyz Republic
	The need to carry out work to prevent possible clogging of subsoil humidifiers and perforations with debris, solid deposits	Capacity Building of the Hydroreclamation Expedition of the WRS under the Ministry of Agriculture of the Kyrgyz Republic
	High requirements for the size of solid particles - no more than 1.0 mm, water turbidity - no more than 0.05 g / litre	Organization of the monitoring system for solid sediments at water sources

2.4.3.1 Economic and Financial Measures for SSI.

The proposed economic and financial measures include the following:

- Attracting investments, increasing the volume of allocation of financial resources from the Republic of Belarus
- Formation of policies that promote the development of local producers (see tab. 2.16).

Table 2.16. The proposed economic and financial measures for SSI

Category	Barriers	Possible Measures
Economic and financial	Lack of financial resources: donor and national investment	Attracting investments, increasing the volume of allocation of financial resources from the Republic of Belarus
	The high cost of purchasing, installing a set of equipment and its operation	Forming a policy that promotes the development of local producers for the development of drip irrigation: providing incentives for the supply of imported equipment

2.4.3.2 Non-financial Measures for SSI.

The set of non-financial measures proposed within the consultations with SWG include the following:

- Formation of policies that promote the development of local producers
- Implementation of sustainable public-private partnership business models (outsourcing)
- Development and adoption of the State Program for the economical and rational use of water resources in connection with climate change
- Make changes and additions to the NLA in terms of providing incentives when using efficient irrigation technologies

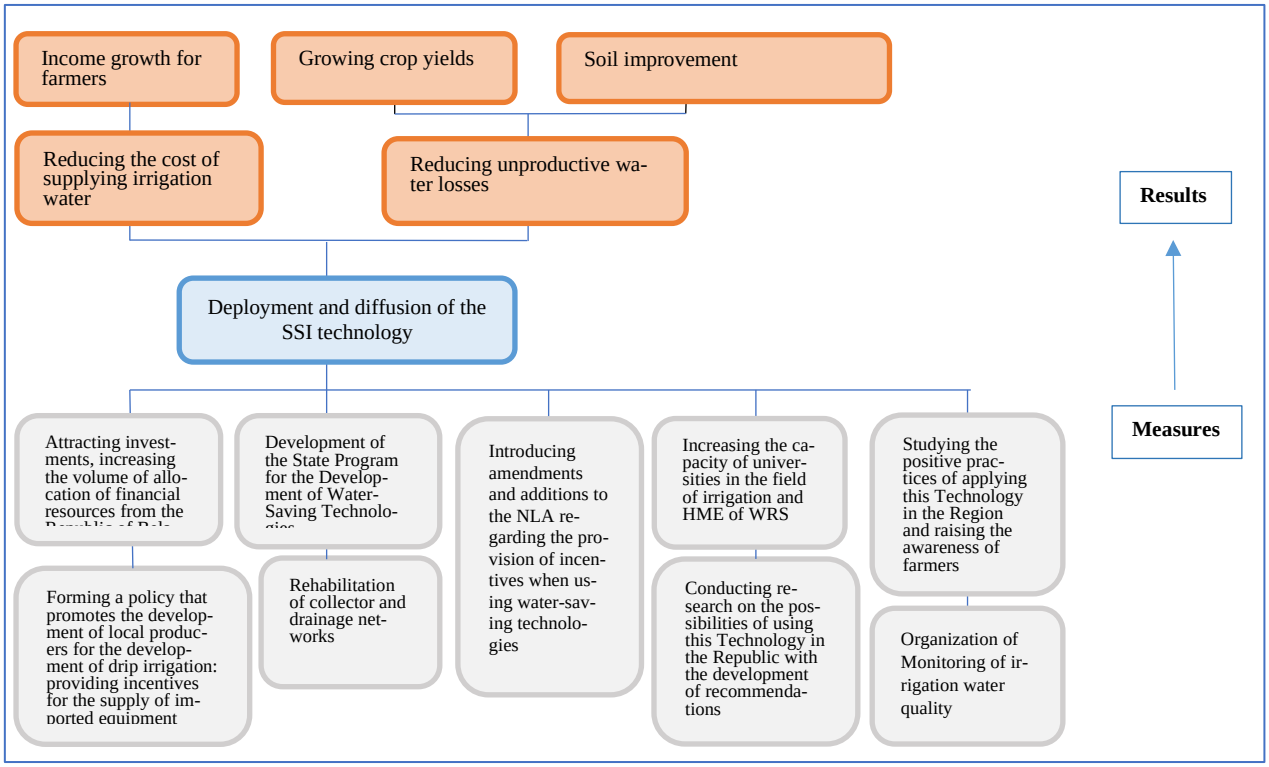
- Training on best irrigation practices aimed at reducing the use of water resources, managers, operators
- Conducting research on the possibilities of using this Technology in the Republic with the development of recommendations
- Increasing the capacity of universities in the field of irrigation and GME SVR MOA
- Studying the practice of applying this Technology and raising awareness of farmers in the republic
- Capacity Building of the Hydroreclamation Expedition of the WRS under the Ministry of Agriculture of the Kyrgyz Republic
- Organization of the monitoring system for solid sediments at sources (see tab. 2.17).

Table 2.17. Non-financial measures for SSI

Category	Barriers	Possible Measures
Market conditions	Lack of local manufacturers for the production of polyethylene pipes and flexible nylon hoses	Formation of policies that promote the development of local producers
		Implementation of sustainable public-private partnership business models (outsourcing)
Regulation	Lack of the state programming for the Economical and Rational Use of Water Resources	Development and adoption of the State Program for the economical and rational use of water resources in connection with climate change
	The regulatory legal framework of the sector does not provide for incentives for the use of efficient irrigation technologies	Make changes and additions to the NLA in terms of providing incentives when using efficient irrigation technologies
Network	Conservative thinking of managers	Training on best irrigation practices aimed at reducing the use of water resources, managers, operators
Institutional and organizational capacity	Lack of studies on the areas of possible application of this Technology	Conducting research on the possibilities of using this Technology in the Republic with the development of recommendations
Human skills	Lack of qualified personnel for design and maintenance	Increasing the capacity of universities in the field of irrigation and HME, WRS, MOA
Information and awareness	Lack of positive practices for the application of this Technology	Studying the practice of applying this Technology and raising awareness of farmers in the republic
Technical	The need for construction/reconstruction of drainage and water supply systems (collector-drainage), sluice-regulators, etc.	Capacity Building of the Hydroreclamation Expedition of the WRS of the Ministry of Agriculture of the Kyrgyz Republic
	The need to carry out work to prevent possible clogging of subsoil humidifiers and perforations with debris, solid deposits	Capacity Building of the Hydroreclamation Expedition of the WRS under the Ministry of Agriculture of the Kyrgyz Republic
	High requirements for the size of solid particles - no more than 1.0 mm, water turbidity - no more than 0.05 g / litre	Organization of the monitoring system for solid sediments at wsources

Logical problem analysis (LPA) of economic, financial and non-financial measures for the deployment and diffusion of SSI technology is presented as an objectives tree in fig. 2.5 below.

Figure 2.6. Objective tree for SSI technology



2.5 Linkages of the identified barriers

In order to maximize synergies and optimize the effects of the recommended measures, an analysis of the identified barriers for the three priority technologies of the Water Resources Sector was carried out for their relationship, revealing the following:

- the main barrier for all three priority technologies under consideration is the lack of financial resources: donor and national investments. In the same Category for two Technologies, essentially the same barrier is defined: “Insufficient level of accounting at enterprises and organizations of drinking water supply and sanitation” (RESDWSS) and “Lack of economic analysis of the work of a researcher.” (EEPS).
- In the Category “Market Conditions” for all three technologies’ barriers are noted: Lack of local manufacturers for the production of electrolysis plants for the production of sodium hypochlorite, for the production of electrical units and the production of polyethylene pipes and flexible nylon hoses.
- In the Category: “Regulation” barriers for three technologies it is noted that the regulatory framework is outdated (RESFWSS), and does not provide incentives for efficient irrigation technologies (EEPS and SSI).
- In the Category: “Network” for all three technologies, the common barrier is “Conservative thinking of designers, managers”.
- In the Category: “Human Skill” for all three Technologies, the barrier is “Insufficient number and level of qualification of personnel”.
- In the Category: “Information and Awareness” for all three Technologies, the barrier is the lack of knowledge and information (EEPS), specifically about the possibility of obtaining sodium hypochlorite from local salt deposits (RESDWSS) and the lack of positive practices for applying technologies (EEPS and SSI).

As the summary the List of identified barriers for the three priority technologies, tab. 2.18 shows commonalities and linkages of the barriers.

Table 2.18. Consolidated list of barriers identified for three priority technologies

Category	Barriers		
	RESDWSS	EEPS	SSI
Economic and financial	Lack of financial resources: donor and national investment	Lack of financial resources: donor and national investment	Lack of financial resources: donor and national investment
	Low tariffs of drinking water suppliers	Lack of economic analysis of the operation of pumping stations.	The high cost of purchasing, installing a set of equipment and its operation
	Existing old debts of a number of municipal enterprises and organizations of drinking water supply and sanitation	Lack of incentives for the installation of energy efficient electric pumps that help reduce energy consumption	
	Insufficient level of accounting at enterprises and organizations of drinking water supply and sanitation		
	Lack of incentives when using local materials for drinking water supply		
Market conditions	Lack of local manufacturers for the production of electrolysis plants for the production of sodium hypochlorite	Lack of local manufacturers for the production of electrical units	Lack of local manufacturers for the production of polyethylene pipes and flexible nylon hoses
	Lack of local manufacturers of solar panels for mini hydropower plants		
Regulation	Absence of a sectoral normative legal act on the regulation of tariffs in the sector of domestic and drinking water supply and sanitation.	Conservative thinking of managers	Lack of a state programming for the economical and rational use of water resources
	Most of the DWSS systems, after restoration and new construction, were transferred to the ownership of RCADWCs, which are unstable	The regulatory legal framework of the sector does not provide incentives for the use of energy efficient pumps	The regulatory legal framework of the sector does not provide for incentives for the use of efficient irrigation technologies
	Lack of a license to develop deposits of salt, quartz sand		
	Absence of the Act on the allocation of land for the construction of micro-hydro power plants		
	Outdated building codes and maintenance standards		
	The regulatory legal framework for the drinking water supply and sanitation sector is outdated		
Network	Not identified	Interruptions in the supply of electricity to pumping stations	Not identified

Category	Barriers		
	RESDWSS	EEPS	SSI
	Conservative thinking of designers, managers	Conservative thinking of managers	Conservative thinking of managers
Institutional and organizational capacity	Insufficient number and qualification of personnel in the DDWSS system	The regulatory legal framework of the sector does not provide incentives for the use of energy efficient pumps	Lack of studies on the areas of possible application of this Technology
	Unresolved institutional issues. Frequent reorganization of the industry		
Human skills	Lack of qualified engineering and management personnel, as well as locksmiths, plumbers and welders.	The Rules of the technical safety and exploitation for electrical installations at pumping stations are not followed up as appropriate.	Lack of qualified personnel for design and maintenance
	Lack of teachers and insufficient qualifications of teachers for the design, operation of systems	Inability to analyse the efficiency of the pumping station: the efficiency is not determined, the estimated need for electricity, there are no research data on pressure losses in pipelines and shutoff valves, the compliance of volumes and water supply modes with the technical indicators of pumping and power equipment is not studied.	
	Lack of preferences for admission to universities for the specialty water supply and sanitation, high school exams passing score for applicants	Insufficient qualifications for the operation of pumping units at pumping stations	
Information and awareness	Lack of knowledge and information about the possibility of obtaining sodium hypochlorite from local salt deposits (in the Jalal-Abad region, in the Kochkor region, etc.)	Lack of information on positive practices for the construction of mini HPPs to service the pumping stations	Lack of positive practices for the application of this Technology
	Lack of knowledge and information about the possibility of obtaining the use of solar energy for electricity generation in the WWW system		
Technical	Design decisions are made without appropriate technical research and justification.	Lack of positive practices for the use of more energy-efficient aggregates	The need for construction/reconstruction of drainage and water supply systems (collector-drainage), sluice-regulators, etc.
	Lack of production control of water quality in most urban, municipal and rural water supply systems		The need to carry out work to prevent possible clogging of subsoil humidifiers and perforations with debris, solid deposits
	Lack of positive practice of applying this Technology in the Kyrgyz Republic		High requirements for the size of solid particles - no more than 1.0 mm, water turbidity - no more than 0.05 g / litre

Category	Barriers		
	RESDWSS	EEPS	SSI
Other: environmental impact, physical infrastructure conditions	Non-compliance with the regime of sanitary protection zones of rural water supply sources	Not identified	No identified
	Violation of the integrity of external engineering networks and structures of DWSS systems, as well as intra-house networks, without coordination with the relevant services		

2.6 Creation of enabling conditions for overcoming barriers in the Water Resources Sector

Creating favourable conditions for overcoming the identified barriers for each technology is possible through the implementation of the measures that were listed above, the summary of which by categories is given in table 2.19.

- In the category of "Economic and financial" barriers, there is a common to all three technologies measure aimed at improving investment policy that helps to attract investment.
- In the category of “Market Conditions”, a common steering measure is defined as - Formation of a policy that promotes the development of local producers
- In the category of “Regulation”, the stimulating measure is the introduction of additions to the current legislation aimed at providing incentives to stimulate local producers.
- In the category of Barriers “Network” on the weak interconnection between the stakeholders, the common measures are: informing about good practices and examples, training and informing the best practices of managers, operators.
- In the category of “Human Skills”, the general measures are seen in the organization of ongoing courses to increase the capacity of service personnel, increase the capacity of universities, colleges in the field of water and water supply, in the field of irrigation, as well as HME, WRS and MOA
- Within the category on information and awareness, a common measure for all three Technologies will be the training of the best practices for policy makers, managers, operators and wider public.
- In the technical category, capacity building on the foreign technological experiences and informing the application of existing modern technologies are foreseen.

Table 2.19. Summary list of measures for the three priority technologies

Category	Measures		
	RESDWSS	EEPS	SSI
Economic and financial	Improving investment policy	Pursuing a policy that facilitates the attraction of financial resources for the purchase of energy-saving electric units	Attracting investments, increasing the volume of allocation of financial resources from the Republic of Belarus
	Increasing the capacity of DDWSS to prepare project applications to various funds		

Category	Measures		
	RESDWSS	EEPS	SSI
	Adoption of tariffs for the supply of drinking water adequate to the costs of operating the systems and taking into account inflation and development opportunities, as well as the solvency of the population		Forming a policy that promotes the development of local producers for the development of drip irrigation
	Explanatory work with LSG bodies, the population		
	Increasing the capacity of the compositions of Local Keneshes (local Parliament)		
	Carry out phased write-offs of financial debts of WSS service providers accumulated from previous state-owned enterprises		
	Improving the financial literacy of accountants, economists		
	Training to work with the accounting 1C Program in the field		
Market conditions	Establishment of a policy that promotes the development of local manufacturers of electrolysis plants	Studying the market for Energy Efficient Pumps in order to acquire the most reliable in operation	Formation of policies that promote the development of local producers
	Formation of policies that promote the development of local manufacturers of solar panels		Implementation of sustainable public-private partnership business models (outsourcing)
	Implementation of sustainable business models through the implementation of the Public-Private Partnership (outsourcing) model		
Regulation	Refinement and adoption of an industry-specific NLA on tariff regulation	Provide incentives for the installation of energy efficient electric pumps	Development and adoption of the State Program for the economical and rational use of water resources in connection with climate change
	Studying the results of the implementation of the pilot project in the a / a of the Naryn region PKM No. 713 dated 12/26/2022		Introduce amendments and additions to the regulatory legal acts regarding the provision of incentives when using efficient irrigation technologies
	Introducing an amendment to the Law "On Subsoil" in Article 35. P. 3.		
	Development of a regulation on the allocation of water fund lands for micro hydroelectric power plants for the DWSS sector		
	Conducting an analysis of existing SNIPs		

Category	Measures		
	RESDWSS	EEPS	SSI
	Analysis and evaluation of legal acts in the field of WSS		
Network	Informing about good practices and examples	Consideration / Study of the possibility of building a mini hydroelectric power station to ensure the operation of the pumping stations	Training on best irrigation practices aimed at reducing the use of water resources, managers, operators
	Studying and informing about good PPP practices		
Institutional and organizational capacity	Pursuing a unified comprehensive policy and improving the coordination of actions of state bodies and local self-governments	To study the issue of the feasibility of creating a Marketing Service under the WRS of the Ministry of Agriculture	Conducting research on the possibilities of using this technology in the Republic with the development of recommendations
	Pursuing a unified comprehensive policy and increasing the coordination of actions of state bodies and local self-governments		
	To study the issue of the feasibility of creating the Republican State Enterprise "Kyrgyztazasuu"		
Human skills	Implementation of the Program and the Roadmap for its implementation.	Organization of permanent courses to increase the potential of mechanics, electricians at the regional level	Increasing the capacity of universities in the field of irrigation and HME of WRS and MOA
	Increasing the capacity of colleges, universities in the field of DWSS	Capacity building, training of service personnel	
	Lowering the school exams threshold for admission to a university in the direction of HSS Implementation of training on a budgetary basis under the quotas of DDWSS		
Information and awareness	Increasing interagency cooperation on the possibilities of developing local deposits for drinking water purification DDWSS, SAACU, MNRETS, etc.	Training of best practices for managers and operators	Studying the practice of applying this technology and raising awareness of farmers
	Increasing interdepartmental cooperation on the use of solar energy in the DWSS system: SAACU, MEC, MNRETS etc.		
	Studying and informing about the positive practices of solar energy production and application in the DWSS sector		
Technical	Increasing the role of the DDWSS and Higher Education institutions in providing advice to expand and ensure regular training of personnel and the organization of the exchange of best practices in design, surveying	Study of international experience in the application of this technology	No identified

Category	Measures		
	RESDWSS	EEPS	SSI
	Creation of a state enterprise for maintenance of DWSS systems at the district level.	Organization of permanent pumping stations staff training: 1. Rules of technical operation 2. Development of organizational and technical measures	
	Organization of three production and one mobile laboratory of the DDWSS and Higher Educational institutions for the production control of DWSS systems in rural areas		
	Studying foreign examples and informing		
Other	Development and implementation of an interdepartmental mechanism for a selective study of the state of sanitary protection zones of sources of centralized HP	Consideration of the issue of building a mini hydroelectric power station for the work of n.s.	Capacity Building of the Hydroreclamation Expedition of the SVR of the Ministry of Agriculture of the Kyrgyz Republic
	Application of articles of the Code of the Kyrgyz Republic On Offenses dated October 28, 2021 No. 128.		Organization of the monitoring system for solid sediments at sources

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Annex I A: Agriculture Technologies' Markets Mapping

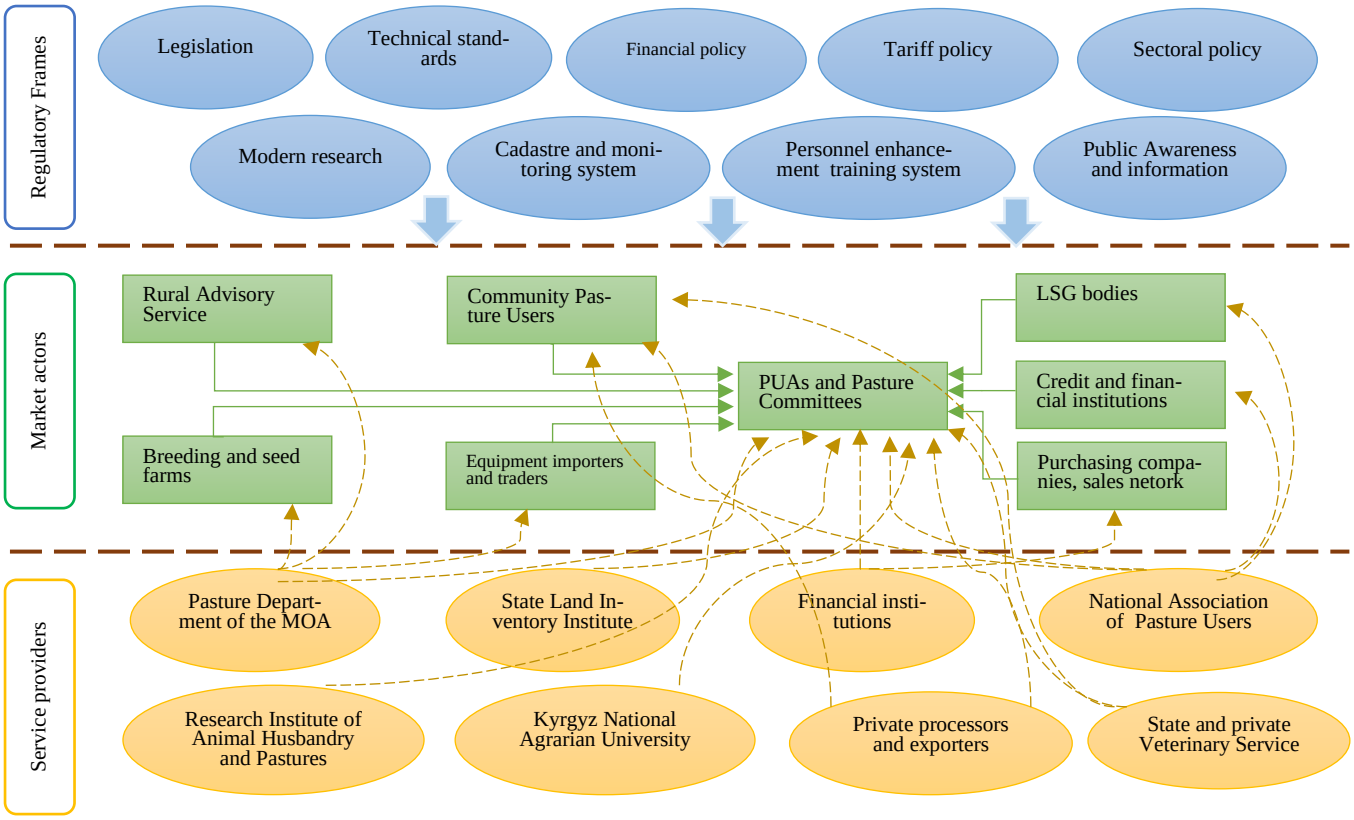

Figure 0.1. Mapping the market for sustainable pasture management

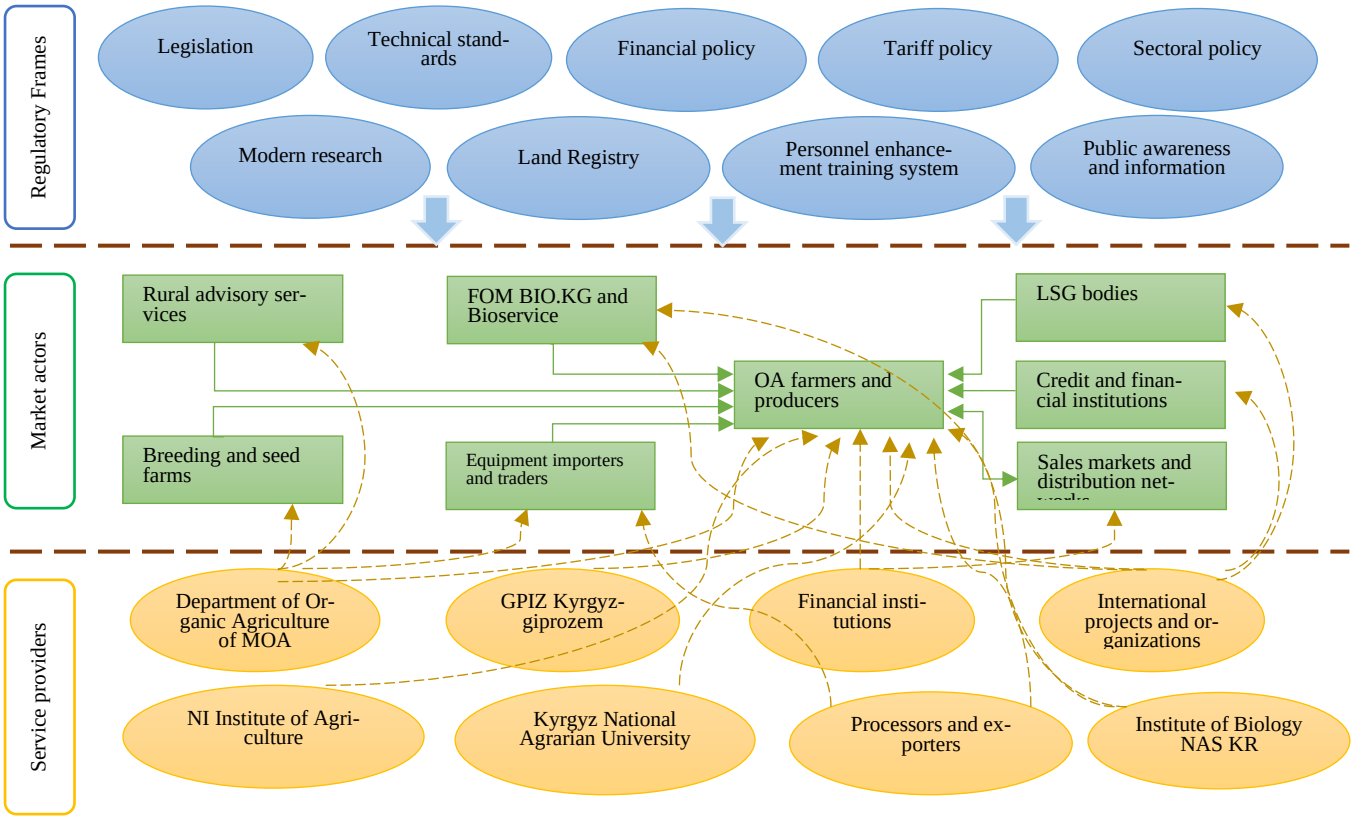

Figure 0.2. Mapping the Organic Agriculture Market

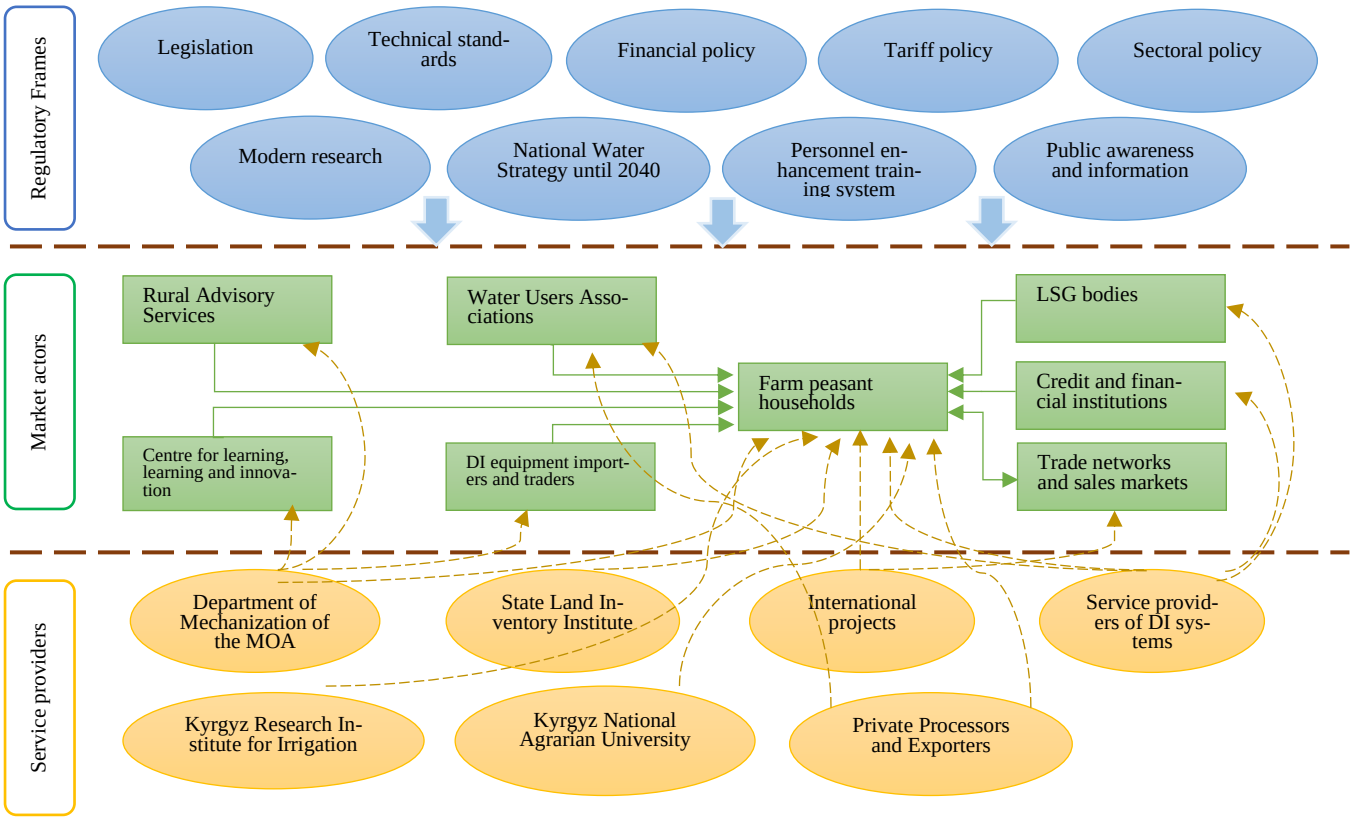

Figure 0.3. Mapping the Drip Irrigation Market

Annex I B: Water Sector Technologies' Markets Mapping

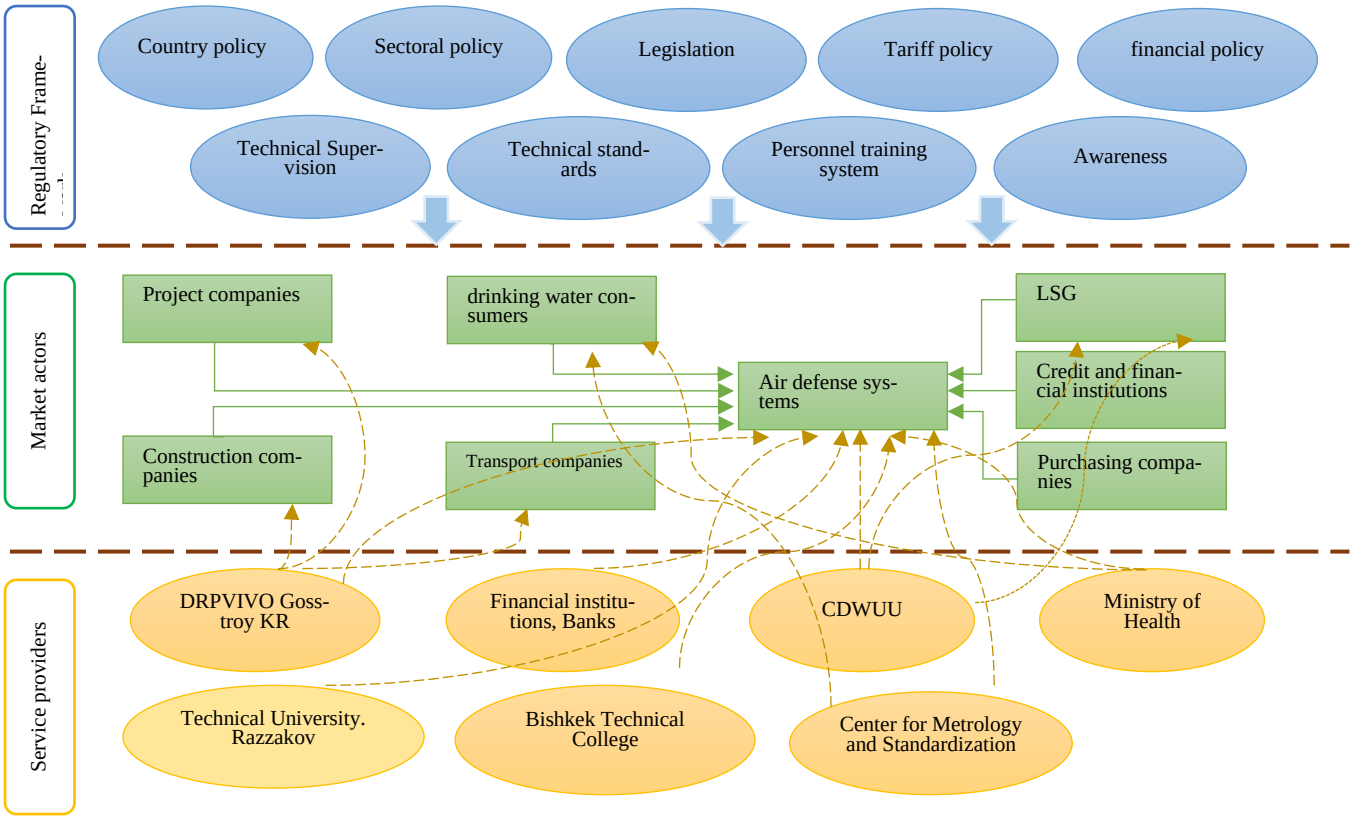

Figure 0.1. Mapping of the RESDWSS market

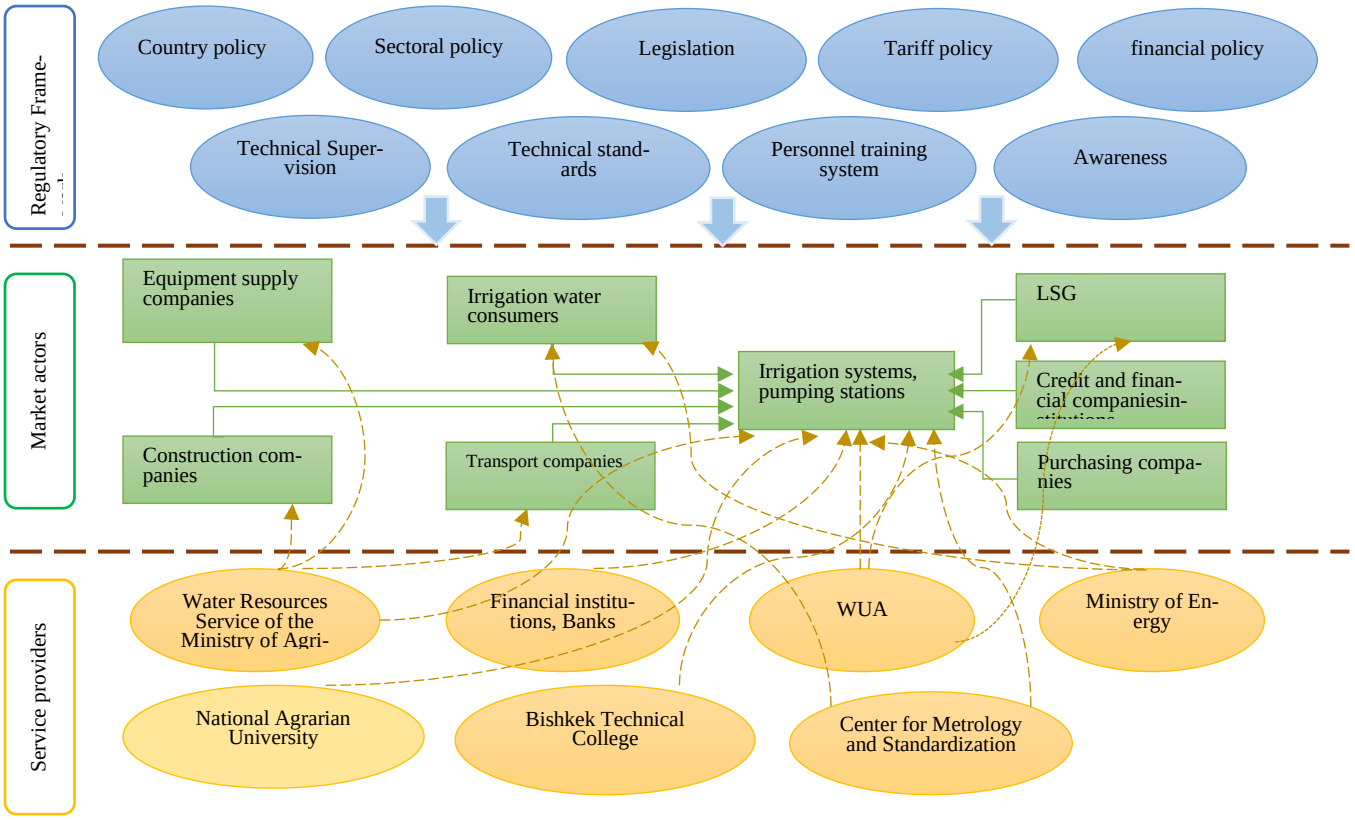

Figure 0.2. Market Mapping for the EEPS technology

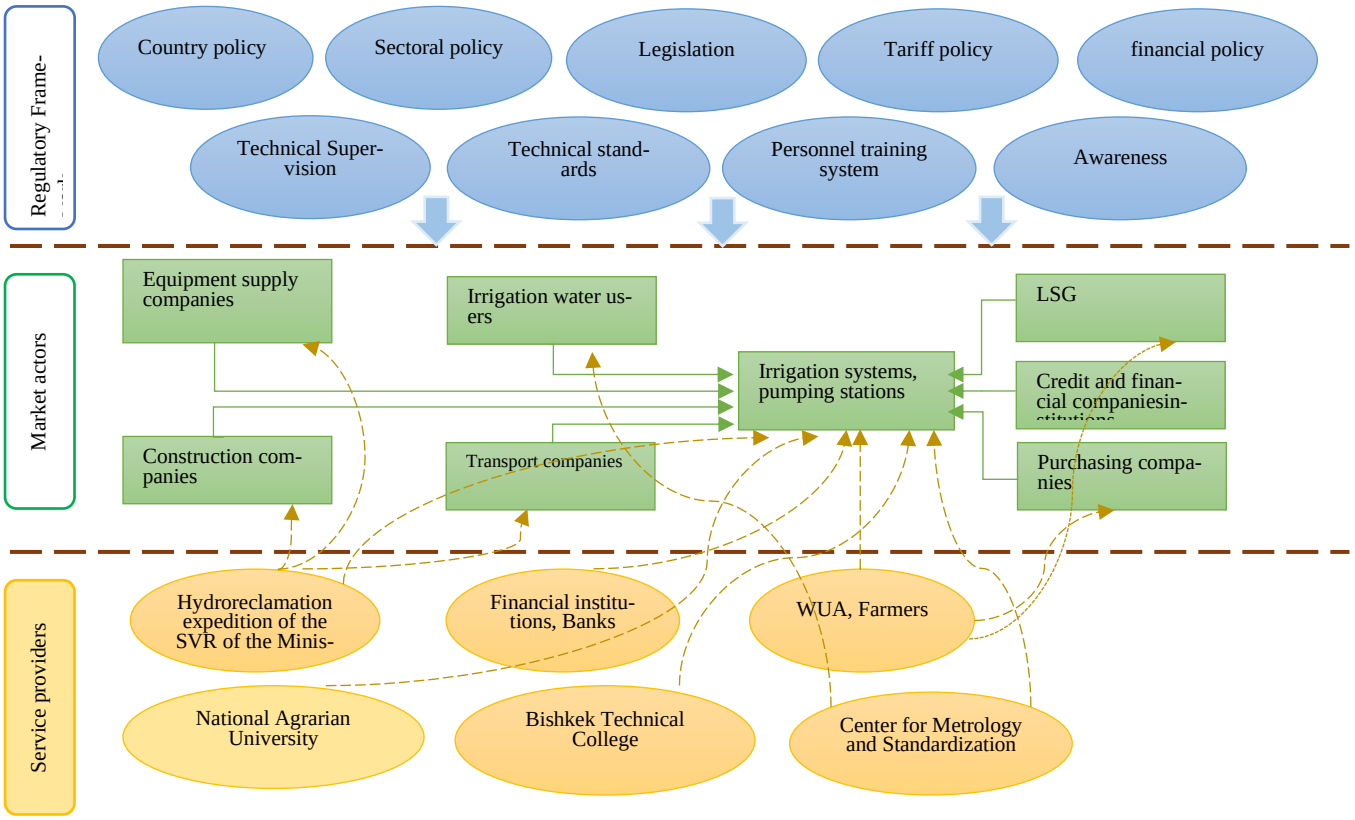

Figure 0.3. Market mapping for the SSI technology

Annex II: List of Involved Stakeholders and Contacts

Agriculture Sector

No.	Full name	Organization, position	Contacts
1.	Baydyldaev Murat Kerimbekovich	Deputy Minister of Agriculture. Working group leader	Tel. 0708260794 0550533562
2.	Sooronova Nuria Rakhmanberdievna	Deputy Minister of Agriculture	Tel. 0550 061-333
3.	Kozhogulov Nurlanbek Zhamalidinovich	Director of the Department of Agricultural Mechanization, Cooperation and Innovative Technologies	Tel. 66 44 81 0555678740
4.	Madyarov Zh.B.	Specialist of the department of agricultural mechanization, cooperation and innovative technologies	Email: tehinspekzia@mail.ru
5.	Rasul kyzy Aigerim	Leading Specialist of the Department of Organic Agriculture of the Ministry of Agriculture of the Kyrgyz Republic	Tel. 0550 353709 Email: aruslankyzy10@gmail.com
6.	Kydykmanov Emilbek Sagyndykovich	Main Department of Agrarian Policy and Forecasting of the Ministry of Agriculture	Email:kydykmanov58@mail.ru
7.	Aidaralieva Nurayym	Chief Specialist of the Agrarian Policy and Forecasting Department of the Ministry of Agriculture	Email:aydar7676@gmail.com
8.	Japarbekova Gulnara,	Department of Agrarian Policy and Forecasting of the Ministry of Agriculture	
9.	Zhumaev Nurlanbek Kadyrovich	Head of the Forestry Department of the Ministry of Agriculture	Email: n.jumaev@mail.ru
10.	Karabaev Aibek Nurudinovich	Specialist of the CCF of the Ministry of Natural Resources, Ecology and Technical Supervision.	Email:aibekusa@yahoo.com, Tel. 0776831189
11.	Dostukbek Obodoev	CCF project coordinator	Email: dostuk.obodoev.88@mail.ru
12.	Mambetov Kumushbek Bekitaevich,	Dean of the Faculty of Agronomy and Forestry of the Kyrgyz National Agrarian University /	Tel. +996(312)540535 Email: kumushbek.mambetov@mail.ru
13.	Egemberdiev Adymalik Abdykarovich	Director General of the National Association of Pasture Users	Tel. 550 500 002, E-mail: pasturekj@gmail.com
14.	Burkhanov Aitkul Mustafaevich	General Director of the Association of Forest Users and Land Users	T. 555 704878, 770 844 844 Email:a.burkhanov58@gmail.com
15.	Aidaraliev Iskenderbek Rysbekovy	Chairman of the Federation of Organic Movement "BIO KG"	Tel.0554 51 90 02 Email: federationbiokg@gmail.com

No.	Full name	Organization, position	Contacts
16.	Kadyrkulov Nurlan Maratovich	CEO of EcoAgro LLC	Email:ecoagros@yandex.ru kyrghyz1@yandex.ru
17.	Ukubaev Turatbek Galiyarovich	General Director of the Agro-Industrial Holding "Atalyk Group".	Email:office@atalyk.kg Phone +996 (312) 91-99-99
18.	Vedenev Alexey Gavrilovich	Chairman of the Association of Farmers and Peasants	Email:agvedenev@yandex.ru Phone: 0559000104
19.	Isaev Kutman Mukashevich	Republican Soil Agrochemical Station	Email:rpas@mail.ru
20.	Taranova Elena Pavlovna	Crop Development Department of the Ministry of Agriculture	Email:t_dpifl_2004@mail.ru
21.	Alzhanbaeva Zh.	Coordinating Council of the Ministry of Agriculture	Email: alzhanbaeva.zh@gmail.com
22.	Tuleev Tamchybek Karybekovich	Director of the IFAD Agricultural Projects Implementation Department	Tel. (312) 665 625 / 975 974 office@apiu.kg
23.	Chernikova Tatyana Gennadievna	Hydrometeorological Service of the Ministry of Emergency Situations	Tel. 31 48 35, 0777 900410 Email: chernikova@meteo.ktnet.kg
24.	Nurzhanov Bakytbek	Community Development and Investment Agency (ARIS) Specialist	Email: BNurjanov@aris.kg
25.	Akmatova Cholpon	Kyrgyz Association of Forest Users and Land Users	Email: cholponakmatova7@gmail.com
26.	Naimanbayeva Zamira	CFC, Gender Specialist	Email: zamiranaiman@gmail.com
27.	Barakanova Natalia	ARIS Specialist	Email:nbarakanova@aris.kg
28.	Dosuev Mirbek	ARIS Specialist	Email:mdosuev@aris.kg
29.	Tologonova Gulyayym	ARIS Specialist	Email:gtologonova@aris.kg
30.	Apasov Rysbek Tunguchbaevich	Advisor to the Minister of Agriculture, resource mobilization expert	0772575825 Email: invest305@mail.ru
31.	Bekenov Malik	Department of Pastures and Pedigree Animal Husbandry of the Ministry of Agriculture	Email:mbekenov@yandex.com
32.	Zhusupov Matraim	FAO Project Manager	Tel. 0777 909-001, E-mail: matraim.jusupov@fao.org
33.	Mambetov Omurbek	Agronomist FAO	Email: omurbek.mambetov@fao.org

Water Sector

No.	Full name	Organization, position	Contacts
1.	Mr. Dostukbek Obodoev	Project and Program Coordinator of the CCF MPRET KR	0999664646
2.	Mr. Abdybai Jailoobaev	Water Resources Service of the Ministry of Agriculture, Deputy Director, Member of the NOC, Chairman of the Task Force	djailobaev1961@mail.ru basssein@mail.ru
3.	Ms. Assel Raimkulova	Head of the Department of Water Resources Protection of the Department of Water and Land Resources of the Ministry of Economic Development and Trade of the Kyrgyz Republic	0552761576 raimkulova.asel@mail.ru
4.	Mr. Bozgunchiev Talai	Department of Water Resources Protection of the Department of Water and Land Resources of the Ministry of Economic Development and Trade of the Kyrgyz Republic	0509 007299 talaiboz@mail.ru
5.	Ms. Orozbakieva Shayyrgul Galievna	DRPWiVO under SAASZhKH, Leading Specialist of the Department for the Development of drinking water supply and sanitation	312810 orozbakieva@mail.ru
6.	Mr. Bekzhan Mamytov	Senior Specialist of the Water Resources Sector of the Ministry of Agriculture.	625350, 0555301964 mamytov-b@bk.ru
7.	Ms. Gulmira Satymkulova,	Chief Specialist of the Water Resources Department of the Water Resources Service of the Ministry of Agriculture, Head of the Secretariat of the Chu-Talas Interstate Water Commission	541409, 0550401304 gulmirasatymkulova@gmail.com
8.	Mr. Nurdin Miizamidinov	Chief Specialist of the Department of Operation and Ameliorative Systems of the Water Resources Service of the Ministry of Agriculture	0770580001 nurdin0758@gmail.com
9.	Mr. Buzurmankul Toktonaliev	Design Institute "Vodoavomatika", Director	541150 pkti@elcat.kg
10.	Mr. Dmitry Borisenko	Design Institute "Vodoavomatika", Ch. metrologist	541150 pkti@elcat.kg
11.	Mr. Amanzhol Atakhanov	KNIIIR, Deputy Director	0770672252 aatakanov@mail.ru
12.	Mr. Vitaly Shablovsky	Head of the laboratory KNIIIR	541164, 0555187771 wishab@mail.ru
13.	Mr. Alexander Grigoryevich Rogozin	LLC "HYDROTARAN KG" Head	0558 626210 hydroimpuls@list.ru
14.	Mr. Talantbek Musaev	Self employed Company Drop+	0551254535 Kitano_kg@mail.ru
15.	Mr. Baratali Turanovich Koshmatov	KNAU, professor	b.koshmatov52 < b.koshmatov52@mail.ru >
16.	Mr. Kanat Omurzakov	Deputy Dean of the Faculty of Hydroreclamation, Ecology and Land Management of KNAU	0773571535 kanat3884@gmail.com
17.	Mr. Tashmukhamed Khalmukhamedovich Karimov	KSTU im. Razzakov	0555520521 tashmukhamied@mail.ru

No.	Full name	Organization, position	Contacts
		Candidate of Technical Sciences, Honorary Professor Department of "Water supply, sanitation and hydrotechnical construction"	
18.	Mr. Matraim Zhusupov	FAO, Water Expert	0770902842 Matraim.Jusupov@fao.org
19.	Mr. Vladimir Ignatenko	Chief Engineer of Bishkek PU Gorvodokanal	561655,vodokanal@mepya.kg, svs@bischkek-suukanal.kg
20.	Mr. Erkinbek Imaralievich Kozhoev	Chairman of the National Union of Water Users Associations of the Kyrgyz Republic	0778214421 e.kozhoev@gmail.com
21.	Mr. Azizillaev Salavat	LLC CIC Community International Consulting	0770 902 842 cic.llc@mail.ru
22.	Mr. Ramazan Dunlarovich Suleev	Representative of Asiageocenter in the Kyrgyz Republic	Ramazan Suleev agc_kg@mail.r >
23.	Mr. Ryspek Apasov	Expert	0772575825 invest305@mail.ru