THE REPUBLIC OF KAZAKHSTAN

TECHNOLOGY NEEDS ASSESSMENT FOR CLIMATE CHANGE ADAPTATION

REPORT III

TECHNOLOGY ACTION PLAN (TAP) FOR ADAPTATION TECHNOLOGIES

August 2017

Disclaimer

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CONTENT

ABBREVIATIONS

GHG	Greenhouse Gases
GEF	Global Environmental Facility
EIA	Environmental Impact Assessment
GOK	Government of Kazakhstan
FP	Financial Planning
INDC	Intended Nationally Determined Contributions
IE	International Expert
IO	International Organization
IE	International Expert
MA	Ministry of Agriculture
MJ	Ministry of Justice
MID	Ministry of Investments and Development
MIA	Ministry of Internal Affairs
ME	Ministry of Energy
MES	Ministry of Education and Science
MNE	Ministry of National Economy
MF	Ministry of Finance
MRV	Monitoring, reporting, verification
NAMA	National Appropriate Mitigation Actions
NAP	National Allocation Plan
NE	National Expert
NATD	National Agency of Technology development
NDC	Nationally Determined Contribution
NGO	Non-Government Organization
SME	Small and Medium Business
PG	Public Governmental
PS	Private Sector
PF	Project Financing
PM	Project Management
PMU	Project Management Unit
R&D	Research and Development institute
TAP	Technology Action Plan
TA	Technical Assistance
TNA	Technology Needs Assessment
UNDP	United Nations Development Program
UNEP	United Nations Environment Program
UNFCCC	United Nations Framework Convention on Climate Change

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FOREWORD

The Republic of Kazakhstan attaches great importance to the climate change, which is considered as one of the priority global environmental problem facing by the humanity today. In November 2016, Kazakhstan ratified the Paris Climate Agreement. To achieve the global climate goal of keeping the temperature rise below 2 degrees Celsius, Kazakhstan submitted its Nationally Determined Contribution, expressed in 15% unconditional and 25% conditional decrease in GHG emissions compared to the base year 1990.

The Government of Kazakhstan has consistently advocated for measures to prevent climate change, and considers own ways to reduce its greenhouse gas emissions and adapt to climate change. The priority areas for us are development of renewable energy sources, energy efficiency and energy saving, diversification of crop production, use of no till technology and water-saving technologies that contribute to reducing greenhouse gas emissions and adapting to climate change.

Thus, Kazakhstan's Green Economy Concept, the Law on Energy Saving and Energy Efficiency, the Agro-industrial Complex Development Program for 2017-2021 and other legislative and regulatory acts are aimed at upgrading infrastructure and technologies to reduce greenhouse gas emissions and adapt to climate change. Implementation of these initiatives and state programs requires introduction of new technologies.

Technology Needs Assessment for mitigation and adaptation was the first important step in achieving the objectives of the governmental plans. The methodological aspects of Barrier Assessment for technologies introduction, and development of Technological Action Plans and Project Ideas for mitigation and adapting to climate change will be the starting point for their advancement.

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Executive Summary

Technology Action Plan (third part) is the final step in the Technology Needs Assessment (TNA) and its purpose is to continue to support planning the deployment of the priority technologies at the desired scale inside the country in order to accomplish the advantages and promote the climate change responses as determined by TNA.

Technology Action Plan (TAP) aims to support National Development Plans, building bridges between nationwide climate change policies and plans for development of specific sectors, funding and planning. The Report is based on the outputs of the Barrier Analysis and Enabling Framework component of adaptation TNA, and the final Report resulted in the Technology Action Plan on priority technologies of agriculture and water sectors.

The following methodological and guiding materials have been used to prepare the report: *Guidance for Preparing a Technology Action Plan, Enhancing Implementation of Technology Needs Assessments*, UNEP DTU, 2016[1], information of the climate platform[2] /.

An Action Plan was developed for each technology with the participation of national experts working in the agricultural and water sectors , along with sectoral stakeholders that contributed to the development of a number of measures aimed at addressing issues to eliminate common and specific barriers to the diffusion of technology.

The starting point for the Action Plan of each technology is an overview of the barriers and measures to eliminate them, as defined in previous reports, with the following stages:

1. Ambition for TAP
2. Action and activities for TAP
3. Identification of stakeholders and timing
4. Capacity requirements and cost estimates
5. Management planning (contingency planning, next steps)
6. TAP Summary overview

The information analysis was carried out in stages:

1) Ranking of measures for inclusion to TAP

2) Selection of activities and activities for TAP

3) Identification of activities

4) Assessment of capacity and funding needs

5) Review of risk and contingencies and

Final step of report is TAP Summary overview.

The Project Ideas developed in the Report represent the first step to attract investors' interest in the transfer, dissemination and implementation of adaptation technologies; conceptually they are concentrated message of projects aiming to demonstrate new priority technologies which are to be replicated and up-scaled across the country and attract funding for the implementation of TAP for each technology. The Project Ideas of *no till and diversification of crop production, drip irrigation technology and technology of hydrological phenomena* technologies are presented in the Chapter 4 of the Report.

The proposed Project Ideas are based on the approach that the joint implementation of these technologies will strengthen the process of climate change adaptation as *no till, diversification of crop production and drip irrigation technologies* aim at sustainable management of agriculture. All the technologies proposed share common barriers and measures aimed at eliminating these barriers and, in general, at sustainable management of agriculture and introduction of climate-friendly technologies.

[1] http://www.tech-action.org/Publications/TNA-Guidebooks

[2] http: //www.tech-action.org

Potential benefits from the implementation of prioritized technologies supported by the by the adaptation Technology Action Plan are:

- valuable source of information in planning NDCs as adaptation responses to climate changes;
- important source of information for National Communications since it contains specific actions aimed to enhance climate change adaptation in Kazakhstan;
- significant source of information in planning the work of Ministries and reporting on adaptation responses as part of the Paris Agreement ratified by Kazakhstan on the 4th of November 2016.
- improves the coordination and cooperation between the stakeholders at different levels;
- contributes to the improvement of regulatory framework on funding, and creating the enabling environment of adaptation action at the local level, in particular by farmers;
- shows the significance of strengthening the capacity of research institutions.

Implementation of the proposed Project Ideas starting with pilot projects as a way to demonstrate effective methods of adaptation in agricultural sector and following their replication and upscaling will improve the productivity of agriculture, thus contributing toward Kazakhstan's adaptation to climate change based on resilient and sustainable economy.

Chapter 1. Brief description of sectors and current situation.

Agriculture is crucial for the economic and social development of the country and addressing issues of food security, poverty reduction and sustainable rural development. The area of farmland in 2015 was 21 022.9 thousand hectares including 11 771.1 thousand hectares of wheat.

The vast territories of Kazakhstan and different climatic conditions make it a unique country for agriculture, forestry, hunting, fishing and ecotourism. Agricultural production depends on weather conditions, still summer droughts affect crop yields, and irrigation and drainage systems need to be restored.

Kazakhstan is a major producer and exporter of wheat and is one of the world's largest flour exporters. Grain is harvested mainly in the north/north-east and across a significant part of the western and central regions. Nevertheless, the government of Kazakhstan encourages diversification of crop production such as fodder, cereals and oilseeds in order to support the livestock sector. The eastern and southeastern regions are favorable for oilseeds, sugar beets, corn, fruit and vegetables. The climate of Southern Kazakhstan is favorable for fruit and vegetables as well as cotton and rice. The livestock sector is also present in Kazakhstan, with a significant portion of the state funding allocated for this sector, including support for the import of stud stock.

Crop farming and animal breeding have become the basis of agriculture; these are the priority areas of economic development and have the potential for development, but the future development of these sectors is subject to the technologies and natural resources used, including climate change.

According to the estimates of the 3rd – the 6th National Communication, over the past 70 years, Kazakhstan has seen the countrywide increase in the average annual and seasonal air temperatures, with rates intensifying in the 1980s On average, average annual air temperatures in Kazakhstan have been observed above the climatic normal [3]. It is expected that the climate will become more arid and risky for agricultural production due to higher temperatures and longer periods of drought. The impact of climate change requires shifts in land management and use of a range of sustainable technologies related to conservation and restoration of land. As part of the development of the economy, the Government of Kazakhstan has prepared a number of sectoral strategic tools aimed at developing and facilitating support for soil conservation measures and climate change adaptation measures.

Kazakhstan belongs to the states that are characterized by inadequate water supply and uneven distribution of water across the country, and is highly dependent on transboundary river flows from China, Russia, Uzbekistan and Kyrgyzstan. Thus, the amount of water flow depends on the intake of the countries that are located in the upper reaches of the river.

The main water consumers are agriculture and industry, respectively 68% and 27%. The main consumer of water resources is irrigated farming, and its water needs increase in the warmer part of the year.

The total volume of water intake in 2015 was 22.8 km3, including 15.5 km3 per year for agriculture, of which 12.2 km3 per year is spent on regular irrigation across 1.35 million hectares, while the remaining 3.3 km3 per year are distributed between agricultural supply, irrigation, hayfields and pasture irrigation[4].

Conservation technologies of water supply and irrigation in agriculture in Kazakhstan cover less than 7% of the irrigated land, or 95.8 thousand hectares. The projected average water intake for agriculture is 21 km3 per year. Irrigation technologies in Kazakhstan are based on

[3] The Third-Sixth National Communication of the Republic of Kazakhstan to the UN Framework Convention on Climate Change

[4] State program for Development of Agro-Industrial Complex of the Republic of Kazakhstan for 2017-2021, Presidential Decree dated March 19, 2010, No. 957

furrow irrigation, which causes the highest losses as compared to other irrigation technologies, such as sprinkling and drip irrigation. According to the Ministry of Agriculture (2014), in 2012 the share of irrigation technologies in the total irrigated area was as follows: 93% (furrow irrigation), 5% (sprinkling); and 2% (drip irrigation). Furrow irrigation has a water efficiency of 70% (30% loss), sprinkler technology - 80% and drip irrigation technology - 92%[5]. .

Another important factor affecting water consumption in the agricultural sector is the composition of the crops. There is a big difference in how much water is used by different crops. In irrigated regions of Kazakhstan, rice, cotton and perennial grasses are the crops with the highest water consumption; they also occupy large parts of the irrigated area (9%, 14%, and 18%, respectively). Of these crops, rice currently has the highest demand for water. Although the areas sown with rice are smaller than those of cotton and perennial grasses, rice represents the largest total demand for water.

The experience of deploying drip irrigation systems in Southern Kazakhstan shows that, subject to strict compliance with the crop cultivation practices, even low-yield soils completely unsuitable for conventional crop cultivation may produce high yields with drip irrigation systems and efficient use of water and land resources compared to traditional technologies[6]. .

One of the crucial components of the climate change adaptation program is the warning system for extreme hydrological phenomena (floods, etc.), which is a way of early detection of threatening phenomena. This enables communities to be ready to take action to reduce the negative consequences. Thus, the main goal of the warning system is to increase the preparedness for flood and under flood threats and other extreme water phenomena.

The current situation in the above sectors and the current policy declared in the national strategic instruments is provided in Table. 1.1 Existing policies in the Agriculture and Water sectors and current technology profile.

[5] Policies and measures to increase efficiency of water use and water supply for agriculture. Policy brief as part of the project "Integrated Approach to Development of Climate-Friendly Economies of Central Asia" DIW ECON,2015

[6] Experience of use of moisture-conservation technologies in irrigation in the Southern Kazakhstan, K. Anzelm, http://www.cawater-info.net/6wwf/conference_tashkent2011/files/anzelm_abstract_r.pdf

Table.1.1. Existing policies in the Agriculture and Water sectors and current technology profile

The existing laws, regulations and policies	When enacted/revised	Main content of the document	Current technological profile
Strategy "Kazakhstan-2050": a new political course of the state	Adopted the President 14.12.2012.	The main objective of the Strategy is creation of favourable society by 2050 on the basis of a strong state, developed economy and opportunities for universal labour	Priority technologies in the Technology Needs Assessment (adaptation) project are the measures for the sustainable management of natural resources and increasing their efficiency, increasing resilience to climate change, addressing issues of improving soil properties, soil management and the implementation of sustainable practices in agriculture. These technologies are not entirely new for Kazakhstan's agriculture, but due to existing barriers these are not widely used by farmers and agricultural businesses. The general and specific measures proposed are aimed at overcoming barriers and supporting broad dissemination of technologies. ***No-till* technology:** Objectives: application of this technology is in line with the economic, social and environmental priorities of the country's development, and it contributes to ensuring the priority of security by increasing productivity, the weight of the agricultural sector in the economic system as well as boosts income of the rural population. **Diversification of crop production:** In the country, work is underway to diversify crop production, wheat areas have been reduced, and rice fields have been diminished, while the areas of feeding crops and flax have grown in size. The application of this technology corresponds to the economic, social and environmental priorities of the country's development. It is aimed at ensuring food security, increasing productivity and implementing the strategy of economic diversification by increasing the weight of the agricultural sector in the economic realm
Strategic Development Plan of the Republic of Kazakhstan until 2020	Adopted by the President on 1.10.2010 №922	The strategic development program complements the long-term Strategy 2050	Current situation in the sector: The share of wheat in farm production tends to decrease. Oilseeds and legumes are included in crop rotation to diversify the risks of the volatility of prices and promote sustainable agriculture. The use of moisture- and resource-saving technologies of agriculture, in particular, minimal and zero tillage is evident. At the same time, there is no definition of "moisture-saving" technologies. Such technologies have been introduced in recent years with the .
Program for the development of the	Adopted by the President on	The strategic program of the development agro-industrial complex of	**Current situation:** There are challenges in the agricultural sector: low rates of crop

agro-industrial complex in the Republic of Kazakhstan for 2017-2021	14.02.2017 №420	RK, which complements the strategic planning system of country, ensuring the priority and implementation of the goals and objectives of the governmental strategic documents..	diversification and development of the seed breeding system, irrational use of agricultural land, non-compliance with scientifically sound recommendations on crop rotation and technology requirements, low technical capacity of agriculture, low availability of subsidies for most farmers and low effectiveness of subsidies per hectare **Water management** Use of water conservation technologies for agricultural irrigation is less than 7% on the irrigated lands. **Prevention of harmful effects of water** Water flows induce the threat of emergencies caused by spring or summer floods recorded on rivers in virtually all regions of Kazakhstan.
Concept to transit of the Republic of Kazakhstan to the Green economy	Adopted by the President on 30.05.2013 № 577	TThe concept of Kazakhstan's "Green economy" is the transition to a new economy based on improving the welfare and quality of life of the population; the country's entry into the 30 top developed countries of the world; and minimizing the impact on environmental and natural resources. Instruments for the implementation of the objectives of the Concept are the current documents of sectoral	The main tasks of the transition to "green economy" are: 1) to increase the efficiency of the use and management of natural resources; 2) to upgrade the existing infrastructure and construct new infrastructure; 3) to improve the well-being of the population and the quality of the environment through mitigation of the environmental impact; 4) to improve national security, including water security
The state program of infrastructural development "Nurly Jol" for 2015 - 2019	Adopted by the President on 6.04.2015 № 1030	The strategic program of infrastructure development, which complements the system of strategic planning of the Republic of Kazakhstan and the program for the development of the agro-industrial complex of the Republic of Kazakhstan	Current situation: Economic conditions require additional involvement of the state in the agro-industrial complex. The volume of the funds invested by the state in farmers' fixed assets in 2014 increased by 14.4%. Support measures are becoming even more urgent, and one of the priority areas is the industrial (utility) infrastructure. Development includes strengthening institutional structures, including the development of science and innovation; sustainable environmental development of the regions and increasing energy efficiency; development of transport infrastructure. In respect of sustainable environmental development, green economy and energy efficiency, efforts are focused on environmental restoration, emission reduction, development of environmentally sound technologies and renewable energy sources Additional support for the agro-industrial complex. The volume of financial support will be increased in order to subsidize the interest rate on loans and leasing obligations, reimburse interest rates on loans (lease), develop animal breeding, and raise the productivity and quality of livestock products.

Chapter 2 Technologies action plan in agriculture

2.1. The main barriers and proposed measures to introduce the climate-friendly technologies in the agricultural sector

At the initial stage of the TNA, sectoral policies, programs, and action plans were analyzed. Program documents, regulations, research articles and other relevant inputs were studied in order to analyze the barriers, which were further evaluated for their significance and ranking.

In order to understand the main problems in the sectors, a logical analysis of problems (LAP) was used to identify the cause and effect relationships of barriers, which discover opportunities to intervene in the process of realizing the economic and social potential of a technology. The use of logical analysis made it possible to construct a task tree that helped visualize the goals to improve the transfer of technology. The implementation of technologies is connected with financial and economic conditions. Market analysis helped visualize the commercial and institutional environment for each technology market. The whole system was considered in terms of its three main components:

- Favorable business environment.
- Participants of the market chain and relationship.
- Service providers.

This approach made it possible to get a visual understanding of the sector's problems.

One common barrier that restrains farmers' adoption of sustainable farming practices is associated with high investments and a high interest rate on loans that create difficulties for medium and small farms. Measures related to economic and financial barriers are to consider incentives to attract investments in climate change adaptation technologies and create agricultural structures with a low interest rate to ensure greater access of rural farmers to investment funds.

General policy and regulatory barriers are associated with the improvement of legal and regulatory provisions. Experts propose improvements to the legislation encompassing a concept of climate change adaptation, climate-friendly technologies, development of climate change adaptation plans, including, for agricultural and water sectors and issues of soil. The technologies proposed may be feasible only if there is a conducive and effective regulatory framework.

The challenge for the institutional capacity of the rural sector of Kazakhstan is inadequate research and innovative development in sustainable agriculture and a lack of knowledge of evolving climate change risks for agriculture. Disseminating knowledge to farmers' communities and those working in close cooperation with farmers is crucial for adaptation responses. Insufficient communication between researchers, academia and agricultural businesses creates big gaps in the transfer of technology. In order to address these gaps, it is necessary to improve R&D in the agricultural sector, to increase the capacity of research institutions and advisory services, with practical application of knowledge and advisory services to be encouraged. There is a need to involve international structures to support the implementation of cost-effective adaptation methods and technologies of climate. The research community should take a more active part in addressing climate issues, including sustainability and adaptation to climate change.

Flawed infrastructure of the market is a serious challenge for rural businesses. Small farmers have weak links with market and go by limited internal production.

Lack of information and knowledge about the benefits of climate technologies requires the involvement of the media, researchers, and consultants in order to make sure that the general

public becomes aware of the importance of adopting eco-technologies and addressing issues related to climate change risks.

Lack of qualified skills is often a factor preventing successful implementation of innovative and modern agricultural practices. There is an acute need to strengthen human capital in the agriculture.

The main barriers and measures to overcome such barriers are provided in Table 1.2 **Overview of barriers and measures to overcome in the agricultural sector are** below, with detailed description of actions developed and shown in the Technology Action Plan, for each technology.

Table 1.2. Overview of barriers and measures to overcome barriers in the agricultural sector

Categories	Identified barriers	Measures to overcome barriers
Economic and financial	High initial investment	Expand access to finance
Market conditions	Unsatisfactory market structure	Improve access to products and service
Legal and regulatory	Inadequate policy, legal and regulatory framework	Improve policy and enabling environment and strengthen a regulatory framework
Network structures	Poor interaction between the constituents, preferring new technology	Strengthen the network of farmers and stakeholders
Institutional and organizational capacity	Limited institutional capabilities	Improve the system of supporting farmers with scientific research, higher education programs, training and retraining of existing specialists
Human skills	Poor knowledge of technologies in the country	Expand capacity-building initiatives and cooperation (technology-oriented)
Social, cultural and behavioural		
Information and awareness	Inadequate awareness	Raising public awareness and increasing the interest of the media in promotion of climate-friendly technologies with the participation of research organizations, experts, producers of agricultural machinery
Technical	Inadequate level of expertise	Need to enhance the qualifications

2.2 Action plan for the no-till technology and diversification of crop production

The purpose of implementing a no-till technology is to increase fertility of soils that have suffered from the negative impact of unfavorable weather conditions.

A conventional farming system leads to soil degradation and low cost-effectiveness, whereas transition to no-till will increase the sustainability of crops over time, reduce the dependence on weather conditions, and diminish the risks. The technology increases labor productivity, reduces needs for labor force and machinery. No-till will reduce dependence of yields on weather conditions, which is an adaptation measure in response to climate change.

Although a modern technology is resource-saving, it is more expensive, primarily because expensive equipment has to be purchased. Equipment costs are increasing, although the amount of equipment is decreasing. This requires expenditures on using herbicides and controlling weeds. Therefore, this requires the government to regulate procurement prices in order to stimulate the use of new technologies.

In order to address institutional issues, it is necessary to do the following: strengthen institutional aspects that will be supporting farmers in promoting technologies, reorganize or establish a coordinating board for technology implementation. If no-till is not to be implemented, with conventional farming left in place, crop yields will decrease due to increased risks of aridity, and complexity.

Practice shows that the development of climate-friendly technologies is indispensable if we are to diversify without losing the existing grain potential in Kazakhstan. The issue of diversification should be seen as enhancing the effectiveness of climate-friendly technologies. Proper crop rotation will allow the nutrients of fertilizers to be used more effectively to cope with weeds, pests and diseases, and will make it possible to suppress their harmful effect on crop plants. Cultivation of various crops with proper crop rotation creates better health conditions for crops, protects soil from erosion, makes it possible to accumulate organic matter in soil and improve its physical properties. Wheat crops in crop rotation fields have less weed than permanent crops.

Survey results[7] have shown that the most crucial feature of setting up crop rotations in the steppe zone of Kazakhstan is a scientifically sound alternation of crops in crop rotations, which differ from each other in terms of economically useful and biological properties, primarily, in terms of the ability to productively utilize precipitations in different periods of the year. In our case, this is not only no till, but also the diversification of crop production.

It should be noted that these two technologies have similar implementation challenges. Based on this, we are considering an action plan together for these two technologies.

The Working Group analyzed the reasons limiting the use of climate-friendly technologies, which was done in stages. At the initial stage, the analysis of sectoral policies, programs, action plans was carried out. At the initial stage, sectoral policies, programs, and action plans were analyzed. Program documents, regulations, research articles and other relevant inputs were studied in order to analyze the barriers, which were further evaluated for their significance and ranking. Below in table 1.3. you may find a group of stakeholders involved in the process.

Diversification and no till as the basis for transition to crop rotations, 2011, https://www.slideshare.net/slavalist/no-till

Table 1. 3 Starting point information for TAP (information from earlier TNA stages)

Prioritised technology for this TAP	**No-till, diversification of growing crop**	
Stakeholders involved	**Name & Institute**	**Contact information (email, tel.)**
	Kanat Baigarin, National Focal Point and NU Vice President	kbaigarin@climate.kz kbaigarin@nu.edu.kz, +7(7172) 68-9878
	Gulmira Sergazina, former Director of the Department on Climate Change of the Ministry of Energy of the RK	g.sergazina@energo.gov.kz , +7(7172) 740258
	Ainur Sospanova, Director of the Department of RES Development of the Ministry of Energy of the RK	a.sospanova@energo.gov.kz, +7 (7172) 74 02 58
	Ainur Kopbayeva, Department on Climate Change of the Ministry of Energy of the RK	a.kopbayeva@energo.gov.kz
	Irina Yesserkepova, Deputy Head of Kazakh scientific institute on ecology and climate	iyesserkepova@mail.ru, +7 7272 55 84 24
	Saulet Sakenov, manager of UNDP project National Communication of RK under UNFCCC	saulet.sakenov@undp.org
	Saken Boisholanov, Institute of Geography Ministry of Education and Science RK	saken_baisholan@mail.ru
	Aiymgul Keremry, Nazarbayev University	aiymgul.kerimray@nu.edu.kz
	Valentina Kryukova , Climate change Coordination Centre	valentina@climate.kz

Evaluation of benefits of the technologies in question, current status and ambitions was the next step. Table 1.4 "**Benefits of no till**, **diversification of crop production** c**urrent status and ambitions"** describes benefits of no till and diversification of crop production, current status and ambitions.

Table 1.4 Current status and expected benefits from the implementation of no till, diversification of crop production technologies

Benefits from this technology	
Climate change mitigation	Reduction of greenhouse gas emissions
Climate change adaptation	Reduction of climate risks, increasing carbon pickup, which contributes to reduced global warming
Social development	Increase in the stability of the rural population, creation of new jobs and increase in the economic welfare of the population
Environmental protection	Sustainable use of natural resources is achieved through preventive measures against land degradation, soil and water pollution, and biodiversity conservation
Economic development	Increasing the sustainability of agriculture, including income, reduction of the consumption of fossil fuels as well as fertilizers and pesticides, which are import components.
Current status of technology at country level	close to deployment in the market
Other explanations in support of prioritisation of this technology	The technology has a great replicability potential in the country and reduces the need for the import of food resources
Ambition - Scale of implementation of prioritised technology	
Proposed scale of technology implementation in country to deliver the socio-economic and environmental benefits in country sector or area	Elaboration of priority benefits in terms of environmental, social and economic conditions The ambition of TAP is to contribute to the NDC as a measure to prepare the country for climate change and reduce climate risks

The next step was the selection of the most preferred measures for the technologies (Tables 1, 2). The final set of measures is based on the discussion with the stakeholders, which addressed the objectives of the relevant country programs run by stakeholders. The effectiveness of measures was reviewed on the basis of the following criteria:

- The efficiency of the action to achieve this effectiveness, i.e. does the action enable implementation at the lowest cost in terms of human and financial resources?
- Possible positive or negative interactions or conflicts with other measures, in particular policies, in the sector or county, which could affect the measure's effectiveness and efficiency.
- Suitability of the action within the country or sector context; for instance, based on good practice examples the action can be effective, but local acceptance of the action in the country may be lower than observed elsewhere.
- The costs and benefits of the measures, as previously identified in the TNA report on barrier analysis and enabling framework (see section 6.3 of BAEF guidebook)
- The effectiveness of the measures toward technology implementation, i.e. how strongly is a measure expected to lead to the goal of technology implementation?

Table 1 (Annex 1) shows the results of the selected activities to be included in the Action Plan, and Table 1.5 shows the results of the final set of measures that should be included as actions.

Table 1.5. Final selection of measures for no till, diversification of crop production to be included as actions in TAP

Categories	Identified measures to overcome barriers	Measures selected as Actions for inclusion in TAP
Economic and financial	Expand access to finance	Expand access to finance
Market conditions	Improve access to products and service	Improve access to products and service
Legal and regulatory	Improve policy and enabling environment and strengthen a regulatory framework	Improve policy and enabling environment and strengthen a regulatory framework
Network structures	Strengthen the network of farmers and stakeholders	Strengthen the network of farmers and stakeholders
Institutional and organizational capacity	Improve the system of scientific research, development of training programs for higher education institutions, the system of advanced training of existing specialists	Improve the system of scientific research, development of training programs for higher education institutions, the system of advanced training of existing specialists
Human skills	Expand capacity building and cooperation initiatives with a focus on climate-friendly technologies	Expand capacity building and cooperation initiatives with a focus on climate-friendly technologies
Social, cultural and behavioral		
Information and awareness	Increase the interest of the media in promoting climate-friendly technologies together with research organizations, experts, producers of agricultural machinery and other stakeholders	Increase the interest of the media in promoting climate-friendly technologies together with research organizations, experts, producers of agricultural machinery and other stakeholders
Technical	Need to boost technical expertise	Boost technical expertise

The next step was to determine the actions for the selected activities. Activities identified for the implementation of the Action Plan (Table 1.5) include broad conceptual actions and more specific activities to be cut in size in the course of planning and implementing TAP. Summary

information on actions and their descriptions for no till technologies and diversification of crop production is provided in Table**1.6 Identification and description of specific Activities to support Actions and Table 1.7 Action implementation for no till, diversification of crop production**

Table 1.6 Identification and description of specific activities for no till, diversification of crop production to support TAP actions

Summary of Actions	
Action 1:	**Expand access to finance** through identifying commercial, near-commercial and non-commercial/donor resources available to deliver no till and crop production efforts. Evaluation and development of subsidies and other initiatives for the technologies. Setting up special tools for risk management and mitigation to ensure the implementation of technologies, consolidation of financial service providers and developers, identifying activities for the gaps identified. To develop and implement a system of economic incentives for farmers and a system of private funds, and grants for climate-friendly technologies
Action 2:	**Improve Policy and Enabling Environment** through improving legislation, marketing of products and services, and access to funds
Action 3:	**Improve the system of scientific research and training**
Action 4:	**Strengthening the media interest** in promoting climate-friendly technologies by way of building a database; improving administrative procedures; identifying benefits and other reference materials in order to increase public awareness

The following **Table 1.7 Action implementation** contains the description of main steps to implement the technologies.

Table 1.7 Actions and activities to be undertaken in the implementation of the no till, diversification of crop production technologies

	Action 1: Expand access to finance
Activity 1.1	Meetings with stakeholders in order to discuss current policies and problems of funding climate-friendly technologies
Activity 1.2	Analysis of current funding and evaluation of potential costs of technology deployment.
Activity 1.3	Identification of commercial, near-commercial and non-commercial/donor sources of funding available to support activities, projects and other initiatives
Activity 1.4	Development of the concept of funding technology deployment
Activity 1.5	Meeting with stakeholders for presentation of the Funding Concept
	Action 2: Improve Policy and Enabling Environment
Activity 2.1	Analysis of the current legislation
Activity 2.2	Development of the proposals to promote legislation and regulatory requirements
Activity 2.3	Development of the Concept to improve laws and regulations
Activity 2.4	Organizing and holding a seminar for stakeholders to discuss current policies and problems, and amendments to improve legislation
Activity 2.5	Supporting the process of amending the legislation and regulatory measures
	Action 3: ***Institutional and organizational capacity***
Activity 3.1	Meeting with stakeholders to discuss the dissemination of climate-friendly technologies (no till and diversification of crop production) in agriculture, support with research and training programs, proposals and measures to improve research
Activity 3.2	Develop the Program, action plan and electronic map of crops on a scientifically sound basis of the cultivation areas and crop rotation patterns for soil and climate zones of Kazakhstan and encompassing the issues of plant breeding and food security of the country
Activity 3.3	Social and economic evaluation of the sustainability of middle and small-sized farms based on transition to no-till and diversification of crop production. Study of the sales market and recommendations
Activity 3.4	Build and support a network for farmers
Activity 3.5	Trainings for stakeholders, specialists and farmers in order to cover issues of application of climate-friendly technologies (no till and diversification of crop production), supported by

	research and training
	Action 4: Increasing the media's interest and public awareness
Activity 4.1	Develop study program and them broadcast by TV Creation of broadcasts TV with discuss of benefit friendly climate technologies and needs solve the problem of climate change for farmers

Table 1.8. Planning table - characterisation of activities for implementation of actions for no till, diversification of crop production technologies

Action	**Remove economic and financial barriers**									
Activities	**Planning (Step 3 & 4.1)**				**Implementation (Step 3 & 4.1)**				**Costs and funding needs (Step 4.2)**	
	Start (Step 3)	Comp-lete (Step 3)	Who (Step 3)	Capacity needs (Step 4.1)	Start (Step 3)	Comple-te (Step 3)	Who (Step 3)	Capacity needs (Step 4.1)	Costs(Step 4.2), $USA	Who will fund (Step 4.3)
Action 1	**Improve Policy and Enabling Environment, Strengthen regulatory framework**									
1.1 Conduct a financial and regulatory analysis of efficiency of technology dissemination in Kazakhstan (report, economic and legal assessment and proposals, concept with justified proposals to improve legislative and legal requirements, supporting the process of adoption of legislative requirements by the government)	2019 Feb.	2019 June	MA ME MF MID IO	PM FP	2019 July	2020 Nov	MA ME MF MID R&D, PS IO	PM, FP NE IE	250,000	Ministries and donor
1.2. Organize the workshops on activity 1.1	2019 Mach	2019 Apr	MA ME MF MID IO	PM FP	2019 Oct	2020 Nov	MA ME MF MID IO	PM, FP, NE, IE	60,000	Ministries and donor
1.3. Develop the Program, action plan and electronic map of crops on a scientifically sound basis of the cultivation areas and crop rotation patterns for soil and climate zones of Kazakhstan and encompassing the issues of plant breeding and food security of the country	2019 Mach	2019 May	MA ME MF MID IO	PM FP	2019 June	2022 Nov	MA ME MF MID IO R&D, PS	PM FP NE, IE	450,000	Ministries and donor private sector
1.4. Organize and conduct workshops on activity 1.3	2019 Mach	2019 Apr	MA ME, MF MID, IO	PM, FP	2019 Oct	2021 Nov	MA ME, MF MID, IO	PM FP NE, IE	60,000	Ministries and donor
1.5. Social and economic evaluation of the sustainability of middle and small-sized farms based on transition to no-till and diversification of crop production. Study of the sales market and recommendations	2019 Mach	2021 May	MA ME MF MID, IO	PM FP	2019 June	2020 Nov	MA ME,MF MID, IO R&D, PS	PM FP NE, IE	200,000	Ministries and donor PS
1.6. Develop a training and research program for universities in order to advise	2019 Mach	2021 May	MA ME	PM FP	2019 June	2021 Nov	MA ME, MF	PM FP	50,000	Ministries and donor

specialists			MF, MID IO				MID, IO, R&D, PS	NE, IE		PS
Action 2	Expand Institutional and organizational capacity									
2.1. Build and support a network for farmers	2020 Feb.	2020 Mach	MA ME MF, MID IO	PM FP	2020 Apr	2022 Nov	MA, ME MF, MID IO, R&D PS	PM FP NE,IE	100,000	Ministries and donor, PS
.2.2. Trainings for stakeholders, specialists and farmers in order to cover issues of application of climate-friendly technologies (no till and diversification of crop production), supported by research and training	2019	2022 Mach	MA ME MF MID IO	PM FP	2019 Nov	2022 Nov	MA ME MF MID IO, R&D, PS	PM FP NE, IE	220,000	Ministries and donor PS
Action 3		**Increasing the media's interest and public awareness**								
3.1 Develop study program and them broadcast by TV Creation of broadcasts TV with discuss of benefit friendly climate technologies and needs solve the problem of climate change for farmers	2020 Feb.	2020 Mach	MA ME MF MID IO	PM FP	2020 Apr	2022 Nov	MA ME MF MID IO	PM FP NE, IE	450,000	Ministries and donor

Based on the *Guidance for Preparing a Technology Action Plan*, 2016[8], this stage is considered to be a general strategic document, therefore, it is necessary to review and evaluate actions related to risks; in addition, actions should include monitoring and evaluation of unforeseen circumstances. Table 2 (Appendix 1) "Overview of the Risk Categories and Potential Contingencies" below shows possible risks with uncertainties that are not exhaustive and a description of actions to mitigate potential risks that provide the flexibility to implement the action plan.

In Table 1.12., a brief overview of TAP is the results of the technology dissemination activities. This is a condensed plan of the dissemination (transfer) of priority technologies, which will contribute to the social, environmental and economic development of the country, as well as mitigation and adaptation to climate change. It consists of specific actions contemplated for these technologies. The main actions of this plan are the efforts to improve the financial and regulatory framework and strengthen institutional conditions.

Table 2 (Annex 1) Overview of Risk Categories and Potential Contingencies contains possible risks with uncertainties that are not exhaustive and a description of mitigation actions that provide the flexibility to implement the action plan

Table 1.12. **TAP Summary overview** shows the results of technology dissemination actions. This is a condensed plan of the dissemination (transfer) of priority technologies, which will contribute to the social, environmental and economic development of the country, as well as mitigation and adaptation to climate change. It consists of specific actions contemplated for no-till and diversification of crop production. The main actions of this plan are the efforts to improve the financial and regulatory framework and strengthen institutional conditions.

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[8] http://www.tech-action.org/Publications/TNA-Guidebooks, the Plan action for Adaptation at

Table 1.9 TAP Summary overview for no till, diversification of crop production

Sector	**Agricultural sector**								
Sub-sector	**Plant growing**								
Technology	**No till, diversification of crop production**								
Ambition	Implementation of technology in steppe zone of Kazakhstan, will bring environmental, social and economic benefits The ambition of the TAP is contribution to fulfilment of Kazakhstan NDCs as preparation measures of the country to climate change and reduces climate risks								
Benefits	**climate change mitigation**	GHG emissions reduction							
	climate change adaptation	Reducing of climate risks and agriculture sector vulnerability, increase steppe zone communities resilience to climate change							
	social development	Use of technologies in the steppe zone of Kazakhstan, enjoying benefits, support the sustainability of rural communities, creation of new workplaces, increasing the economic stability and wellbeing of people							
	environmental protection	Sustainable use of natural resources is achieved by preventing soil degradation and soil and water pollution, preserving biodiversity, reducing groundwater pollution , increasing carbon absorption and reducing of global warming;							
	economic development	Improving sustainability of agriculture, including revenues ;reducing dependence on fossil fuels, as well as fertilizers and pesticides, which are imported components; creation of conditions for development of small and medium-sized farms							
Action	**Activities to support Action**	**Responsible body and focal point preparation**	**Responsible body and focal point implementation**	**Time frame**		**Capacity needs**		**Cost summary, $ USA**	**Sources of Funding**	**Risks**
				start preparation	**complete implementation**	**preparation**	**implementation**			
1. **Expanding use of financial instruments and financial resources, improve legal and regulatory framework**	1.1. **Conduct a financial and regulatory analysis of efficiency of technology dissemination in Kazakhstan (report, economic and legal assessment and proposals, concept with justified proposals to improve legislative and legal requirements, supporting the process of adoption of legislative requirements by the government)**	MA	MA, IE, NE	2019	2020	PF FP	PM, FP	250, 000	PG/ITA PS	Process depeds on financing and compliance with the legislative norms for the introduction of technologies Low interest from local participants
	1.2. Organize seminars in order to discuss proposals to improve financial and legislative requirements for introduction of climate-friendly technologies	MA	MA, IE, NE	2019	2019	PM, FP	PM,FP	60, 000	PG/ITA	

	1.3. Develop the Program, action plan and electronic map of crops on a scientifically sound basis of the cultivation areas and crop rotation patterns for soil and climate zones of Kazakhstan and encompassing the issues of plant breeding and food security of the country.	MA	MA, IE,NE	2019	2022	PM, FP	PM, FP	450,000	PG/ITA	Long state procedures and bureaucracy leading to slow endorsements of proposed recommend-dations
	1.4. Organize workshops on activity 1.3	MA	MA, IE, NE	2019 Oct	2022 Nov	PM, FP	PM, FP	60,000	PG/ITA	Weak collaboration of local authorities and communities
	1.5. Social and economic evaluation of the sustainability of middle and small-sized farms based on transition to no-till and diversification of crop production. Study of the sales market and recommendations	MA	MA, IE, NE	2019 June	2022 Nov	MA ME MF MID IO	PM, FP	200,000	PG/ITA	Weak collaboration of local authorities and local communities
	1.6. Develop a training and research program for universities in order to advise specialists	MA	MA, IE, NE	2019 June	2021 Nov	MA,ME MF, MI IO	PM, FP	50,000	PG/ITA	
2.Expand Capacity Building Initiatives and Collaboration	**2.1. Build and support a network for farmers**	MA	MA, IE, NE	2020 Apr	2022 Nov	MA, ME, MF, MI, IO	PM, FP	100,000	PG/ITA	Weak collaboration of local authorities and communities
	2.2 Trainings for stakeholders, specialists and farmers in order to cover issues of application of climate-friendly technologies (no till and diversification of crop production), supported by research and training programs	MA	MA, IE, NE	2019 Nov	2022 Nov	MA, ME, MF, MI,IO	PM, FP	220,000	PG/ITA	
Increasing the media's interest and public awareness	**3.1 Develop a training program with videos to be TV broadcasted with discussions of the importance of using no-till practices and diversification of crop production**	MA	MA, IE, NE	2020 Apr	2022 Nov	MA, ME,MF, MI IO	PM, FP	450,000	PG/ITA	Weak collaboration of local authorities and local communities

CHAPTER 3. Technologies Action Plan in water sector

3.1. Action plan for drip irrigation technologies

Drip irrigation is a most suitable technology in the areas with limited or irregular water supply for agricultural use. The technology uses less water than sprinkler irrigation, because water is delivered immediately to the plants with drip irrigation. Furthermore the drip irrigation systems do not depend on rain or wind (as the sprinkler technologies do). Only individual cases of drip irrigation technology use by farmers are seen in Kazakhstan.

Beneficiaries include all water users in the company, who use water for irrigation regardless of ownership type.

This technology is very diverse, but the costs for the drip irrigation systems are within the limits of 800 USD to 2500 USD per hectare depending on the type of equipment used, automated materials and devices, as well as required labour. The list of technology suppliers is quite extensive, in addition, there is also a national supplier on the market.

According to the Ministry of Agriculture (2014), in 2012 the share of irrigation technologies from the total irrigated area was as follows: 93% (furrow breaks), 5% (sprinkling); And 2% (drip irrigation). In addition, the furrow technology has a water efficiency of 70% (30% loss), sprinkling technology - 80% and drip irrigation technology - 92%. Thus, large additional losses are obtained as a result of the application of the furrow system in irrigation. Replacing 10% of the furrow irrigation with drip irrigation leads to a total water saving of approximately 1% and a change in the structure of crops will further increase the amount of water saving.

An important factor affecting the demand for water in the agricultural sector is the composition of the crops. There is a big difference in how much water is used by different crops. In irrigated regions of Kazakhstan, rice, cotton and perennial grasses are the crops with the highest water consumption; they also occupy large parts of the irrigated area (9%, 14%, and 18%, respectively).

Of these crops, rice currently has the highest demand for water.

With water-conservation technologies in action and measures to restore channels, the area of irrigated land may be increased by 75% to 1.8 million ha.

Once implemented, drip irrigation will provide the following:

Economic benefits:

- Increased sustainability of agriculture, including income and reduced climate risks;
- Rational use of water resources and fertilizers

Environmental benefits:

- Prevention of soil degradation and salination, contamination of groundwater, preservation of biodiversity, etc.
- Reduction of greenhouse emissions and increase in carbon pickup, which will reduce the risks of global warming;
- Reduction in degradation of pastures and soil erosion, and increase in soil fertility

Social benefits:

- Improved sustainability and welfare of rural communities;
- Better well-being of people;
- New jobs and increased economic stability

Adaptation benefits:

- Contribution to planning NDCs as responses to climate changes;
- contributes to the improvement of regulatory requirements at the local level, by farmers;

- significant source of information in planning the work of Ministries and reporting on adaptation responses as part of the Paris Agreement ratified by Kazakhstan on the 4th of November 2016.
- improves the coordination and cooperation between the stakeholders at different levels;
- enhancing knowledge and qualifications of the process participants, strengthening the capacity of research institutions.

Favorable business environment for the drip irrigation practices is

- Stimulation of local production, which is economically viable and ensures food security.
- Promotion of production and trade standards, quality assurance, which ensures the promotion of high-quality products and high requirements for the manufacturer and consumer.
- Ensuring farmers' access to funding of the use of climate-friendly technologies.
- Legislation supports a drip irrigation technology, which ensures water conservation, supports diversification of crop production, reduces soil salinity, promotes sustainable agricultural practices, and conservation of natural resources and healthy society.
- Associations of producers and consumers share interests in promoting superior level production, consumption and product quality. Producers and consumers are developing measures to protect their rights to a superior level of production, consumption and quality.
- Providing support for scientific research in favor of superior and high-quality production, and stronger professional potential of producers.

Services are available for technology transfer, among which the most important are:

- Financial services provided by banks, credit organizations, access to credit.
- Access to information, knowledge and skills; business consultations, climate change, climate-friendly technologies and their advantage.
- Within the country, scientific and innovative activities are being promoted, with the technical and research potential of RIs and universities in growth.
- Public services to support the development of the sector of water saving and energy-saving technologies. Production and testing of breeds (hybrids), fertilizers and herbicides and agricultural machinery for use in national climatic conditions.
- Supporting the development of infrastructure for storage, processing, transportation of logistics products. Providing training for technical specialists.

Overview of barriers and measures of drip irrigation technology you can find in table 2.2. Composition of the working group is listed below in Table. 2.

Table 2. Starting point information for TAP 0f drip irrigation

Prioritised technology for this TAP	Drip irrigation technologies	
Stakeholders involved	**Name & Institute**	**Contact information (email, tel.)**
	Kanat Baigarin, National Focal Point and NU Vice President	kbaigarin@climate.kz ;kbaigarin@nu.edu.kz, +7(7172) 68-9878
	Gulmira Sergazina, former Director of the Department on Climate Change of the Ministry of Energy of the RK	g.sergazina@energo.gov.kz +7(7172) 740258
	Ainur Sospanova, Director of the Department of RES Development of the Ministry of Energy of the RK	a.sospanova@energo.gov.kz, +7 (7172) 74 02 58

	Irina Yesserkepova, Deputy Head of Kazakh scientific institute on ecology and climate	iyesserkepova@mail.ru, +7 7272 55 84 24
	Saulet Sakenov, manager of UNDP project National Communication of RK under UNFCCC	saulet.sakenov@undp.org
	Saken Boisholanov, Institute of Geography Ministry of Education and Science RK	saken_baisholan@mail.ru.
	Aiymgul Keremry, Nazarbayev University	aimgul.kerimray@nu.edu.kz
	Valentina Kryukova, Climate change Coordination Centre	valentina@climate.kz
Benefits from this technology		
Climate change mitigation	Reduction of greenhouse gas emissions	
Climate change adaptation	Increased sustainability of agriculture, including income and reduced climate risks; rational use of water resources and fertilizers; replacement of furrow irrigation (10%) with drip irrigation will save 1% of the total volume of water	
Social development	Increased sustainability of rural communities, creation of new jobs	
Environmental protection	Sustainable use of natural resources by preventing soil degradation and salinization; reducing water and soil pollution, reducing water consumption, conserving biodiversity, etc.	
Economic development	Boosting income by increasing profitability	
Current status of technology at country level	Close to deployment in the market	
Other explanations in support of prioritisation of this technology	The technologies have great potential for application in the country and reduce water dependence	
Ambition - Scale of implementation of prioritised technology (drip irrigation)		
Proposed scale of technology implementation in country to deliver the socio-economic and environmental benefits in country sector or area	Sustainable use of natural resources, prevention of soil degradation and salination, reduction of groundwater contamination, biodiversity conservation, increasing the viability of rural communities and creating new jobs by supporting people on land, increasing the area of irrigated land by 14% by 2020, by 13% by 2025	

Table 2.2. Overview of barriers and measures to overcome these (drip irrigation)

Categories	Identified barriers	Measures to overcome barriers
Economic and financial	Limited access to financial resources	Improve access to financial resources
Market conditions	Inadequate market structure	Improve access to products and services
Legal and regulatory	Imperfect legal and regulatory framework	Improve national legislation
Network structures	Professional network for technologies is in place but is not effective	Strengthen a network of farmers and stakeholders
Institutional and organizational capacity	Lack of *Institutional and organizational capacity* support	Develop studies into the deployment of technological models of climate-friendly technologies for water supply, in rural areas Deliver trainings to promote and update programs for sustainable agriculture management. Develop cooperation mechanism that will remove barriers between stakeholders in the use of the technology and creation of a feedback mechanism Increase the efficiency of the educational process at colleges and universities in the field of climate-friendly technologies, and expansion of training for farmers Research and assess the effectiveness of climate-friendly technologies for Kazakhstan for different crops, soils and climatic conditions to sustain farms
Human skills	The need to promote training programs for colleges and universities with a focus on climate-friendly technologies in agriculture	Expand capacity-building and cooperation initiatives (oriented at climate-friendly technologies)
Social, cultural and behavioural	Many farmers resist new technologies	Increase public access to various climate-friendly technologies
Information and awareness	Lack of appropriate outreach campaigns for the public and farmers through print and electronic media	Raise public awareness and building confidence in new technologies for the development of traditions, and habits Strengthen measures to inform the rural population in order to address the problems of saving water resources, implementing projects, publishing recommendations, brochures, etc. Involve research structures, NGOs, mass media and other stakeholders in the deployment of drip irrigation
Technical	**Inadequate level of professional expertise**	Develop training systems for specialists and farmers

The next step was the selection of the most preferred measures on drip irrigation practices (Table 2.3). Measures were selected just like for the previous technology. Table 3 (Annex 1) shows the results of the activities to be included in the Action Plan, and Table 2.5 shows the final selection results, which are to be included as action in TAP for the drip irrigation practice.

Table 2.3. Final selection of measures to be included as actions in TAP (drip irrigation)

Categories	Identified measures to overcome barriers	Measures selected as Actions for inclusion in TAP
Economic and financial	Expand access to finance	Expand access to finance

Market conditions	Improve access to products and services	Improve access to products and services
Legal and regulatory	Improve policy and enabling environment and strengthen a regulatory framework	Improve policy and enabling environment and strengthen a regulatory framework
Network structures	Strengthen the network of farmers and stakeholders	Strengthen the network of farmers and stakeholders
Institutional and organizational capacity	• Improve the system of research provision • Deliver trainings, promote and update the programs for ensuring sustainable management of the agriculture.	• Improve the system of research provision • Deliver trainings, promote and update the programs for ensuring sustainable management of the agriculture.
Human skills	Expand capacity building and cooperation initiatives with a focus on climate-friendly technologies	Expand capacity building and cooperation initiatives with a focus on climate-friendly technologies
Social, cultural and behavioral		
Information and awareness	Collect and share information	Collect and share information
Technical	Inadequate level of professional expertise	Develop training systems for specialists and farmers

Table 2.4 contains identified Actions and description of specific Activities to support implementation of technologies

Table 2.4 Identification and description of specific Activities to support Actions (drip irrigation)

Summary of Actions (Step 2.2)	
Action 1:	**Expand access to finance** through identifying commercial, near-commercial and non-commercial/donor resources available to deliver drip irrigation technologies. Evaluation of subsidies and other initiatives for the drip irrigation practices. Setting up special tools for risk management and mitigation to ensure the implementation of technologies. Consolidation of financial service providers and developers, taking measures in response to identified gaps. Development and deployment of a system of economic incentives, private funds, and grants for the introduction of climate-friendly technologies by farmers
Action 2:	**Improve Policy and Enabling Environment** through improving legislation, reduction of administrative procedures, marketing of products and services, and access to funds
Action 3:	Improve the system of scientific research
Action 4:	**Enhancing knowledge and qualification**
Action 5:	**Implement Information Gathering and Sharing** through the creation of a database: promotion of simplified procedures, identified benefits and provision of reference materials in order to increase public awareness

The following **Table 2.5 Action implementation** contains the description of main steps to implement the technologies.

Table 2.5 *Drip irrigation* technology Actions and Activities to be implemented

	Action 1: Expand access to finance
Activity 1.1	Meetings with stakeholders to discuss current policies and problems of funding climate-friendly technologies
Activity 1.2	Analysis of the existing funding and assessment of potential costs of the technology deployment
Activity 1.3	Identification of commercial, near-commercial and non-commercial/donor sources of funding available to support activities, projects and other initiatives
Activity 1.4	Development of the concept of funding technology deployment
Activity 1.5	Meeting with stakeholders for presentation of the Funding Concept
	Action 2: Improve Policy and Enabling Environment
Activity 2.1	Analysis of the current legislation
Activity 2.2	Development of the proposals to promote legislation and regulatory requirements
Activity 2.3	Development of the Concept to improve laws and regulations
Activity 2.4	Organizing and holding a seminar for stakeholders to discuss current policies and problems, and amendments to improve legislation
Activity 2.5	Supporting the process of amending the legislation and regulatory measures
	Action 3: *Institutional and organizational capacity*
Activity 3.1	Meeting with stakeholders in order to discuss the dissemination of climate-friendly technologies (drip irrigation) in order to increase the provision of research and improve such research
Activity 3.2	Develop an electronic map of scientifically sound structures of cultivation areas with drip irrigation practices and diversification of crops used for soil and climate conditions of Kazakhstan and tracking the changes
Activity 3.3	Social and economic evaluation of the sustainability of farming businesses in the case of drip irrigation and crop diversification introduced
Activity 3.4	Build and support a network for farmers
Activity 3.5	Develop a training and consultation program for farmers, local administration and other stakeholders; organize and conduct trainings for farmers and local administration
	Action 4: Increasing the media's interest and public awareness
Activity 4.1	Develop a training program and make sure it is broadcasted on TV, with TV discussions on climate-friendly technologies and ways to resolve climate issues

Table 2.6. Planning table - characterisation of activities for implementation of actions for drip irrigation technology

	Remove economic and financial barriers									
	Planning (Step 3 & 4.1)				**Implementation (Step 3 & 4.1)**				**Costs and funding needs (Step 4.2)**	
	Start (Step 3)	Comple te (Step 3)	Who (Step 3)	Capacity needs (Step 4.1)	Start (Step 3)	Comple- te (Step 3)	Who (Step 3)	Capacity needs (Step 4.1)	Costs (Step 4.2),$ USA	Who will fund (Step 4.3)
Action 1:	**Improve Policy and Enabling Environment,** Strengthen regulatory framework									
1.1 Conduct financial and regulatory analysis in order to deploy an effective mechanism of technology dissemination (report, economic and regulatory analyses, the concept of adoption and justification of regulatory requirements, support for the adoption of changes in law in Government and Parliament)	2019 Feb.	2019 Feb.	MA ME MF MF MI IO	PM FP	2019 Nov	2021 Nov	MA ME MF MI IO I&D PS	PM, FP, NE, IE	140,000	Ministries and donor
1.2. Organize and hold two workshops on activity 1.1	2019 Mach	2019 Mach	MA, ME MF, MF MI, IO	PM, FP	2019 Nov	2021 Nov	MA, ME MF, MF MI, IO	PM, FP, IE, NE	60,000	Ministries and donor
1.3.. Develop an electronic map of scientifically sound structures of cultivation areas with drip irrigation practices and diversification of crops used for soil and climate conditions of Kazakhstan and tracking the changes	2019 Mach	2019 May	MA, ME MF, MF MI, IO	Project management, Financing planning	2019 June	2021 Dec	MA, ME MF, MF MI, IO R&D PS	PM, FP, IE, NE	370,000	Ministries and donor
1.4. Social and economic evaluation of the sustainability of farming businesses in the case of drip irrigation and crop	2019 Mach	2021 May	MA, ME MF, MF MI, IO	PM, FP,	2019 June	2020 Nov	MA, ME MF, MF MI, IO R&D PS	PM, FP, NE, IE	250,000	Ministries and donor

diversification introduced										
1.5. Organize workshops on activity 1.3 and 1.4	2019 Mach	2019 Mach	MA, ME MF, MF MI, IO	PM, FP	2019 Nov	2021 Nov	MA, ME MF, MF MI, IO R&D, PS	PM, FP, NE, IE	60,000	Ministries and donor
Action 2	**Expand Capacity Building Initiatives and Collaboration**									
2.1. Develop a training and consultation program for farmers, local administration and other stakeholders; organize and conduct trainings for farmers and local administration	2020 Feb.	2020 Mach	MA, ME MF, MF MI, IO	PM, FP	2020 Apr	2023 Nov	MA, ME MF, MF MI, IO R&D PS	PM, FP	320,000	Ministries and donor
4.2. Build a network and website for farmers	2020 Feb.	2020 Mach	MA, ME MF, MF MI, IO	PM, FP	2020 Apr	2022 Nov	MA, ME MF, MF MI, IO R&D, PS	PM, FP, NE, IE	70,000	Ministries and donor
Action 3	**Increasing the media's interest impact assessment and vulnerability to climate change**									
3.**1 Develop a training program and make sure it is broadcasted on TV, with TV discussions on climate-friendly technologies and ways to resolve climate issues**	2020 Feb.	2020 Mach	MA, ME MF, MF MI, IO	Project management, Financing planning	2020 Apr	2023 Nov	MA, ME MF, MF MI, IO R&D, PS	PM, FP, IE, NE	400,000	Ministries and donor Private sector
5.1 **Organize and hold workshops for media and local stakeholders**	2020 Feb.	2020 Mach	MA, ME MF, MF MI, IO	Project management, Financing planning	2020 Apr	2022 Nov	MA, ME MF, MF MI, IO R&D, PS	PM, FP, IE, NE	70,000	Ministries and donor

Based on the *Guidance for Preparing a Technology Action Plan*, 2016[9], adaptation action plan at this stage is considered to be a general strategic document; therefore, it is necessary to review and evaluate actions related to risks as well as envisage monitoring and evaluation of contingencies.

Table 2.7/ "Overview of the Risk Categories and Potential Contingencies" below contains information on the possible risks with uncertainties that are not exhaustive and a description of mitigation actions that provide the flexibility to implement the action plan.

[9] http://www.tech-action.org/Publications/TNA-Guidebooks, the Plan action for Adaptation at

Table 2.7. Overview of risk categories and possible contingencies (Step 5) for drip irrigation and diversification of crop production technologies

Type of risk	Related to Action or Activity	Description of risk	Contingency actions	
11.Cost Risks	All types of activities	An activity costs more than originally planned	***Time interval for M&E:***	Annually
			M&E responsibility:	Ministries, International organizations, Banks
			Contingency measures needed:	This might involve adding 25% to a construction estimate or 15% to the estimate for the cost of running a meeting of the public and private sectors in-country to discuss how to improve "doing business conditions"
			Responsibility contingency measure:	
			Timing contingency measure:	0-5 years
2 Scheduling Risks	All types of activities	An activity takes longer to complete than originally planned	***Time interval for M&E:***	Annually
			M&E responsibility:	Ministries, International organizations, Banks
			Contingency measures needed:	Allow for step-by-step schedule slippage. Identify critical path items, whose delay stalls all progress on an Activity or even and Action Item
			Responsibility contingency measure:	Risks identified during the preparation of the TAP can be adequately handled if spotted during implementation of the actions, and. Unexpected risks and their consequences can be adequately spotted and handled.
			Timing contingency measure:	0-5 years
3 Performance Risks	All types of activities	A technology or human resource does not perform as planned or environmental and social benefits not being delivered	***Time interval for M&E:***	Once 6 months
			M&E responsibility:	Ministries, International organizations, Banks
			Contingency measures needed:	This is the most difficult contingency to plan for, and it is wise to have backup plans.

			Responsibility contingency measure:	Business (Suppliers)
			Timing contingency measure:	0-5 year
etc.			***Time interval for M&E:***	
			M&E responsibility:	
			Contingency measures needed:	
			Responsibility contingency measure:	
			Timing contingency measure:	

Table 2.8. TAP Summary overview for drip irrigation technology

Sector	Agricultural sector								
Sub-sector	Water sector								
Technology	**Drip irrigation**								
Ambition	Development of priority benefits in terms of environmental, social and economic conditions The ambition of the TAP is contribution to NDCs as preparation measures of the country to climate change and reduces climatically risks in the irrigated zone								
Benefits	**Climate change mitigation**	GHG emissions reduction							
	Climate change adaptation	Increasing sustainability of agriculture, including income, reduction of water consumption and climate risks							
	Social development	Increasing the sustainability of rural communities;improving the health of people; creation of new jobs, boosting economic stability and welfare of people							
	Environmental protection	Increasing the sustainability of rural communities, prevention of soil degradation and salination, reduction of groundwater contamination, biodiversity conservation, improving people's wellbeing, creation of new jobs and boosting economic stability and welfare							
	Economic development	Increasing sustainability of agriculture, including income, creation of new jobs and boosting economic stability and welfare, reduction of fuel, fertilizer and pesticide consumption							
Action	**Activities to support Action**	**Responsible body and focal point preparation**	**Responsible body and focal point implementation**	**Time frame**		**Capacity needs**		**Cost summary, $USA**	**Sources of Funding**	**Risks**
				start preparation	**Comple-te implementation**	**preparation**	**implementation**			
1. **Improve legal and regulatory framework**	1.1. Conduct financial and regulatory analysis in order to deploy an effective mechanism of technology dissemination (report, economic and regulatory analyses, the concept of adoption and justification of regulatory requirements, support for the adoption of changes in law in Government and Parliament)	MA ME, MNE MF IO,	MA, IE,NE	2019	2020	PM, FP	PM, FP	140, 000	PG/ITA	Long state procedures to approve recommendations Demand becomes dependent on subsidies; subsidies have to be slowly phased out after the first 5-7 years
	1.2. Organize and hold two workshops on discussing report proposed financial support improvements	MA, IO and etc.,	MA, IE,NE	2019	2019	PM, FP	PM, FP	70, 000	PG/ITA	
	1.3. Develop an electronic map of scientifically sound structures of	MA, ME, MNE,	MA, IE,NE	2018	2019	PM, FP	PM, FP	250,000	PG/ITA	Local sup-pliers do not see the benefits

	cultivation areas with drip irrigation practices and diversification of crops used for soil and climate conditions of Kazakhstan and tracking the changes	MID, MF IO								from participation
	1.4. Social and economic evaluation of the sustainability of farming businesses in the case of drip irrigation and crop diversification introduced	MA, ME, MNE, MID, MF IO	MA, IE,NE	2018	2019	PM, FP	PM, FP	250,000	PG/ITA	Local participant do not see the benefits from participation
	1.5. Organize and hold workshops on best practice for activity 1.3 and 1.4.	MA, ME, R&D, IE,NE	MA, IE,NE	2018	2019	PM, FP	PM, FP	60,000	PG/ITA	Local participants do not see the benefits from technologies
2.**Expand Capacity Building Initiatives and Collaboration**	2.1. Develop a training and consultation program for RIs, local administration and other stakeholders in cooperation with international and local consultancies. Conduct trainings for authorities, other institutes and private sector	MA, ME, IO	MA, IE,NE	2018	2021	PM, FP	PM, FP	120,000	PG/ITA	Weak collaboration of local authorities and local communities
	2.2. Develop a demonstration program tool for calculating the benefits of drip irrigation and crop diversification with agricultural technologies and cost estimation to be demonstrated	MA, ME, IO	MA, IE,NE	2018	2020	PM, FP	PM, FP	250,000	PG/ITA	Local suppliers do not see the benefits from projects
	2.3. Compile and distribute existing site-specific pre-feasibility data to identify, promote social, economic& financial and environmental benefits	MA, ME, MNE, MH, MID, R&D	MA, IE,NE	2019	2024	PM, FP	PM, FP	150,000	PG/ITA PS, Regional budget	Absence of qualified specialists and lack of funding

3.2 Action plan for introduction of technology hydrological phenomena

In the recent decades, the danger of disasters has increased and it is expected that more extreme meteorological conditions in the future will increase the number and scale of disasters. The impact of extreme weather and climate extremes are socio-economic risks and statistics show that extreme weather conditions are increasingly affecting the economies of Central Asia. The main sectors of the economies of the region countries are directly affected by meteorological, hydrological and climate-related hazards, such as heat waves, forest fires, droughts, floods, etc. According to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC), the frequency and extent of exposure to natural hazards is increasing due to climate variability and change.

During the period 1969 - 2012, 340 natural hydro meteorological phenomena were registered in Kazakhstan. Of all types of spontaneous hydro meteorological phenomena, floods on mountain rivers (41%), floods on lowland rivers (33%), river congestion and related spills and flooding (9%), mudflows (9%), and extreme low water availability (7%) (Table 2.11).

The tasks of organizations involved in forecasting and reporting on natural phenomena are to increase the effectiveness of the early warning system of the threat of natural hydrometeorological phenomena and to promptly respond to the warning received. Early warning allows you to take action to avoid risk or reduce risk and prepare for an effective response. The existing methods and means of disaster risk reduction, and in particular climate risk management, provide ample opportunities for a significant reduction in risks and adaptation to climate change.

The key problem is that a country should have real-time or near-real-time data on phenomena occurring both on its territory and outside it. The availability of these data and access to them in real time or near real time is the main factor in the effectiveness of early warning systems and measures in response to natural disasters, which is a challenge for Kazakhstan.

Table 3. 1 Starting point information for TAP technology of hydrological phenomena

Table 3. Starting point information for TAP (information from earlier TNA stages)		
Prioritised technology for this TAP	**technology of hydrological phenomena**	
Stakeholders involved	**Name & Institute**	**Contact information (email, tel.)**
	Kanat Baigarin, National Focal Point and NU Vice President	;kbaigarin@nu.edu.kz, +7(7172) 68-9878
	Gulmira Sergazina, former Director of the Department on Climate Change of the Ministry of Energy of the Republic of Kazakhstan	g.sergazina@energo.gov.kz,+7(7172) 740258
	Ainur Sospanova, Director of the Department of RES Development of the Ministry of Energy of the Republic of Kazakhstan	a.sospanova@energo.gov.kz,+7 (7172) 74 02 58
	Irina Yesserkepova, Deputy Head of Kazakh scientific institute on ecology and climate	iyesserkepova@mail.ru +7 7272 55 84 24
	Lidiya Nikiforova, head of manage the units of the Centre for Scientific	zg1_meteokaz@mail.ru

	Research of Kazgidromet	
	Paiyzkhan Kozhakhmetov, Head of Centre Scientific Researches of Kazgidromet	zg1_meteokaz@mail.ru
add rows if needed	Saulet Sakenov, manager UNDP project National communication under UNFCC	Saulet.sakenov@undp.org, +7 7172 696550
	Yerlan Zhumabayev, Portfolio Project Manager Water Transformed "Saustainable Water Solutions for Climate Change Adaptation and DDR" UNDP	Yerlan.Zhumabayev@undp.org, +7 7172 696550

Benefits from this technology	
Climate change mitigation	Reduction of greenhouse gash
Climate change adaptation	Timely warning of population on climate risks, Decrease in communities vulnerability to climate change risks
Social development	Reduction of the impact of climate change, and reduction of the damage will enable businesses and society to maintain activity and even increase revenues
Environmental protection	The technology serves as a tool for other technologies (flood management, water management, information and preventive measures to reduce climate risks and damage)
Economic development	This technology requires qualified specialists to be in place. Investments are necessary in order to develop the network of hydrometeorological monitoring, update tools and methods of forecasting. The deployment of technologies will mobilize investments in information technologies, insurance level, as well as in agriculture and the water sector
Current status of technology at country level	The current system of forecasting and warning of the threat of extreme hydrometeorological phenomena and early response to prevention requires more efficiency and modernization. Existing disaster forecasting methods and tools do not make it possible to reduce climate risks and adapt to climate change
Other explanations in support of prioritisation of this technology	The technology has a great replicability potential in the country and strongly reduces the need to import resources.

Ambition - Scale of implementation of prioritised technology of hydrological phenomena	
Proposed scale of technology implementation in country to deliver the socio-economic and environmental benefits in country sector or area	This project is integrated with the national policy of population protection and damage reduction, which includes the following activities: management of natural disasters and assessment of climate change vulnerabilities; development of information systems and early warning systems; integration of risk and disaster management into a broader national program for poverty reduction; development of communities and the environmental protection. The program is intended for the territory of Kazakhstan.

Table 3.2. Overview of barriers and measures to overcome of technology hydrological phenomena

Categories	Identified barriers	Measures to overcome barriers
Economic and financial	Lack of inadequate access to financial resources;	Expand access to finance
Market conditions		
Legal and regulatory	Insufficient legal and regulatory framework	Improving the policy and creating an enabling environment, strengthening the regulatory framework
Network structures		
Institutional and organizational	Lack of coordination between relevant institutions, lack of a	Development of research programs in order to improve delivery of forecasts of extreme

capacity	research hydrometeorological institute in the country	hydrometeorological phenomena, study and simulate impacts and vulnerability to climate change
Human skills	Lack of qualified personnel	Increasing expertise and qualifications
Social, cultural and behavioral		
Information and awareness	Inadequate information	Raising public awareness and increasing the media's interest in promotion of prevention and preparedness for natural disaster risks, and dissemination of information on impact assessment and vulnerability to climate change
Technical	Lack of models, and links between the models	Promotion of tools, devices and development of local research works

Further we made a choice of the most priority measures for drip irrigation technologies (Table 3.3). The selection of measures was made as in previous. In Table 4 (Annex 1) shows the results of arrangement of measures for inclusion in the Action Plan and next Table 3.3 contents the results of final selection of measures to be included as actions in TAP.

Table 3.3. Final selection of measures to be included as actions in TAP

Categories	Identified measures to overcome barriers	Measures selected as Actions for inclusion in TAP
Economic and financial	Expand access to finance	Expand access to finance
Market conditions		
Legal and regulatory	Improve policy and enabling environment and strengthen a regulatory framework	Improve policy and enabling environment and strengthen a regulatory framework
Network structures		
Institutional and organizational capacity	Develop research programs in order to improve the delivery of forecasts of extreme hydrometeorological phenomena, study and simulate impacts and vulnerability to climate change	Develop research programs in order to improve the delivery of forecasts of extreme hydrometeorological phenomena, study and simulate impacts and vulnerability to climate change
Human skills	Increase expertise and qualifications	Increase expertise and qualifications
Social, cultural and behavioral	0	
Information and awareness	Raise public awareness and increase the media's interest in promotion of prevention and preparedness for natural disaster risks, and dissemination of information on impact assessment and vulnerability to climate change	Raise public awareness and increase the media's interest in promotion of prevention and preparedness for natural disaster risks, and dissemination of information on impact assessment and vulnerability to climate change
Technical	Promote tools, devices and develop local research efforts	Promote tools, devices and develop local research efforts

Table 3.4. Identification and description of specific Activities to support Actions

Action 1:	**Expand access to finance**. Identification of commercial, near-commercial and non-commercial/donor sources in order to support activities, projects and other initiatives Development of the concept of improvement of funding.
Action 2:	**Improve Policy and Enabling Environment.** Analysis of current legislation and development of the proposals on how to improve it. Enhanced access to financial products, hydrometeorological product and services
Action 3:	**Expand Capacity Building Initiatives.** Develop research programs to improve the delivery of forecast of hazardous hydrometeorological phenomena, study and simulate the impact and vulnerability to climate change. Support and develop research programs to research and forecast disasters, assess impact and vulnerability to climate change, evaluate measures of adaptation and their effectiveness at the national level in various sectors and climatic zones of the country. Develop a data management system to support the relationship between different models of analysis and prediction of extreme phenomena
Action 4:	Organize trainings for specialists. Participate in international seminars or trainings
Action 6	**Public awareness.** Organize trainings for media, specialists. Publish brochures, articles
Activities for Action implementation	
	Action 1: Expand access to finance
Activity 1.1	Meeting with stakeholders in order to discuss current policies and problems with the forecast of natural disaster risks
Activity 1.2	Analysis of the current funding and evaluation of potential costs of the technology deployment
Activity 1.3	Identification of commercial, near-commercial and non-commercial/donor sources available to support activities, projects and other initiatives
Activity 1.4	Development of the funding concept for delivery of the technology.
Activity 1.4	Meeting with stakeholders for presentation of the Funding Concept
	Action 2: Improve Policy and Enabling Environment
Activity 2.1	Analyze current legislation
Activity 2.2	Develop proposals to enhance legislation and the Concept for Legislation Enhancement
Activity 2.4	Conduct a workshop for stakeholders in order to discuss current policy issues and the Concept for Policy Improvement. Support for the process of having the Concept endorsed.
	Action 3: Develop research programs
Activity 3.1	Adapt and deploy modern effective numerical systems for short-term, long-term and seasonal hydrological forecasts
Activity 3.2	Clarify the main hydrographic and morphometric properties at the locations of hydrometeorological surveys using GIS
Activity 3.3	Adapt and deploy effective numerical weather prediction systems for short-term and long-term forecast (WRF, etc.)..
	Action 4: Enhancing knowledge and qualification
Activity 4.1	Develop a training and consultation program for specialists. Organize and conduct trainings.
Activity 4.2	Organize workshops with expert guests in hydro-simulation
Activity 4.3	Engage specialists in international organizations' trainings
	Action 5: Promoting tool, devices 0
Activity 5.2	Purchase of licenses for models
	Action 6: Public awareness
Activity 6.1	Launch a series of TV shows with discussions and videos about the problems of climate change and severe weather phenomena
Activity 6.2	Participation of media representatives in international meetings

Table 3.5. Planning table - characterisation of activities for implementation of actions for hydrological phenomena technology

	Remove economic and financial barriers									
	Planning (Step 3 & 4.1)				**Implementation (Step 3 & 4.1)**				**Costs and funding needs (Step 4.2)**	
	Start (Step 3)	Comp-lete (Step 3)	Who (Step 3)	Capacity needs (Step 4.1)	Start (Step 3)	Comple-te (Step 3)	Who (Step 3)	Capacity needs (Step 4.1)	Costs(Step 4.2), $USA	Who will fund (Step 4.3)
Action 1:	**Improve Policy and Enabling Environment, Strengthen regulatory framework**									
1.1 Conduct financial and regulatory analysis in order to deploy an effective mechanism of technology dissemination (report, economic and regulatory analyses, the concept of adoption and justification of regulatory requirements, support for the adoption of changes in law in Government and Parliament)	2019 Feb.	2019 Feb.	ME MA, MF,MNE IO	PM, FP	2019 Nov	2019 Nov	ME MA, MF,MNE IO	PM, FP, IE, NE	140,000	Ministries and donor
1.2. Organize and hold two workshops on activity 1.1	2019 Mach	2019 Mach	ME MA, MF,MNE IO	PM, FP	2019 Nov	2019 Nov	ME MA, MF,MNE IO	PM, FP, NE, IE	60,000	Ministries and donor
Action 2	**Expand Capacity Building Initiatives and Collaboration**									
2.1. Adapt and deploy modern effective numerical systems for short-term, long-term and seasonal hydrological forecasts	2019 Mach	2019 May	ME MA, MF,MNE IO	PM, FP	2019 June	2021 Dec	ME MA, MF,MNE IO	PM, FP, NE, IE	370,000	Ministries and donor
2.2. Clarify the main hydrographic and morphometric properties at the locations of hydrometeorological surveys using GIS	2019 Mach	2019 May	ME MA, MF,MNE IO	PM, FP	2019 June	2021 Dec	ME MA, MF,MNE IO	PM, FP, NE, IE	300,000	Ministries and donor
2.3. Adapt and deploy effective numerical weather prediction systems for short-term and long-term forecast (WRF, etc.)..	2019 Mach	2019 May	ME MA, MF,MNE IO	PM, FP	2019 June	2021 Dec	ME MA, MF,MNE IO	PM, FP, NE, IE	350,000	Ministries and donor
2.4. Develop a training and	2020	2020	ME	PM, FP	2020	2023	ME	PM, FP, IE,	120,000	Ministries

consultation program for specialists. Organize and conduct trainings.	Feb.	Mach	MA, MF,MNE IO		Apr	Nov	MA, MF,MNE IO	NE		and donor
2.5. Participation in international workshops	2020 Feb.	2020 Mach	ME MA, MF,MNE IO	PM, FP	2020 Apr	2022 Nov	ME MA, MF,MNE IO	PM, FP, NE, IE	20,000	Ministries and donor
2.6 Launch a series of TV shows with discussions and videos about the problems of climate change and severe weather phenomena	2020 Feb.	2020 Mach	ME MA, MF,MNE IO	PM, FP	2020 Apr	2023 Nov	ME MA, MF,MNE IO	PM, FP, NE, IE	300,000	Ministries and donor
2.7 Organization and hold workshops media and local stakeholders	2020 Feb.	2020 Mach	ME MA, MF,MNE IO	PM, FP	2020 Apr	2022 Nov	ME MA, MF,MNE IO	PM, FP, NE, IE	70,000	Ministries and donor

Table 3.6. Overview of risk categories and possible contingencies

Type of risk	Related to Action or Activity	Description of risk	Contingency actions	
11.Cost Risks	All types of activities	An activity costs more than originally planned	***Time interval for M&E:***	Annually
			M&E responsibility:	Ministries, International organizations, Banks
			Contingency measures needed:	This might involve adding 15% to the estimate for the cost of running a meeting of the public and private sectors in-country to discuss how to improve "doing business conditions"
			Responsibility contingency measure:	
			Timing contingency measure:	0-5 years
2 Scheduling Risks	All types of activities	An activity takes longer to complete than originally planned	***Time interval for M&E:***	Annually
			M&E responsibility:	Ministries, International organizations, Banks
			Contingency measures needed:	Allow for step-by-step schedule slippage. Identify critical path items, whose delay stalls all progress on an Activity or even and Action Item
			Responsibility contingency measure:	Risks identified during the preparation of the TAP can be adequately handled if spotted during implementation of the actions, and. Unexpected risks and their consequences can be adequately spotted and handled.
			Timing contingency measure:	0-5 years
3 Performance Risks	All types of activities	A technology or human resource does not perform as planned or environmental and social benefits not being delivered	***Time interval for M&E:***	Once 6 months
			M&E responsibility:	Ministries, International organizations, Banks
			Contingency measures needed:	This is the most difficult contingency to plan for, and it is wise to have backup plans.

			Responsibility contingency measure:	Business (Suppliers)
			Timing contingency measure:	0-5 year
etc.			***Time interval for M&E:***	
			M&E responsibility:	
			Contingency measures needed:	
			Responsibility contingency measure:	
			Timing contingency measure:	

Table 3.7 TAP Summary overview for technology hydrological phenomena

Sector	Water sector								
Sub-sector	Water sector								
Technology	**Technology of hydrological phenomena**								
Ambition	The project aims to protect the population and reduce damage, encompassing such actions as improvement of the management of natural disasters and assessment of the risks of vulnerability to climate change, development of information systems and an early warning system, to be integrated with the program of risk and disaster management and poverty reduction and is the country's contribution to NDCs as preparatory measures to climate change and risk reduction								
Benefits	**Climate change mitigation**	GHG emissions reduction							
	Climate change adaptation	Timely warning of population on climate risks, decrease in communities vulnerability to climate change risks							
	Social development	Increasing the stability of rural communities							
	Environmental protection	Sustainable use of natural resources is achieved through preventive measures to prevent dangerous and natural phenomena, Reduction of damage from natural disasters of water and soil pollution, conservation of biodiversity, etc.							
	Economic development	Ensuring the sustainability of the economy, preventing damage to life and health of the population, and reducing climate risks; rational use of economic, natural and human resources brings benefits							
Action	**Activities to support Action**	**Responsible body and focal point prepara-tion**	**Responsible body and focal point implementation**	**Time frame**		**Capacity needs**		**Cost summary, 4**	**Sources of Funding**	**Risks**
				start preparation	**Comple-te impleme-ntation**	**Prepara-tion**	**implementation**			
1. **Improve legis-lative, regulatory and financial frameworks**	1.1. Conduct financial and regulatory analysis in order to deploy an effective mechanism of technology dissemination (report, economic and regulatory analyses, the concept of adoption and justification of regulatory requirements, support for the adoption of changes in law in Government and Parliament)	ME IO	ME, IE, NE	2019	2020	PM, FP	PM, FP, NE, IE	140, 000	PG/ITA	Long state procedures and bureaucracy leading to slow endorsements of proposed recommendations
	1.2. Organize and hold two workshops on discussing report proposed financial support improvements	ME, IO	ME, IE, NE	2019	2019	PM, FP	PM, FP, NE, IE	70, 000	PG/ITA	

3.**Expand Capacity Building Initiatives and Collaboration**	2.1. Adapt and deploy modern effective numerical systems for short-term, long-term and seasonal hydrological forecasts	ME, IO	ME, IE, NE	2019	2021	PM, FP	PM, FP, NE, IE	370,000	PG/ITA	
	2.2. Clarify the main hydrographic and morphometric properties at the locations of hydrometeorological surveys using GIS -	ME, IO	ME, IE, NE	2019	2021	PM, FP	PM, FP, NE, IE	300,000	PG/ITA	
	2.3. Adapt and deploy effective numerical weather prediction systems for short-term and long-term forecast (WRF, etc.)..	ME, IO	ME, IE, NE	2019	2021	PM, FP	PM, FP, NE, IE	350,000	PG/ITA	
	2.4. Develop a training and consultation program for specialists. Organize and conduct trainings.	ME, IO	ME, IE, NE	2020	2023	PM, FP	PM, FP, NE, IE	120,000	PG/ITA	
	2.5. Participation in international workshops	ME, IO	ME, IE, NE	2020	2023	PM, FP	PM, FP, NE, IE	20,000	PG/ITA	
	2.6 Launch a series of TV shows with discussions and videos about the problems of climate change and severe weather phenomena c	ME, IO	ME, IE, NE	2020	2023	PM, FP	PM, FP, NE, IE	300,000	PG/ITA	
	2.7 Organization and hold workshops media and local stakeholders	ME, IO	ME, IE, NE	2020	2023	PM, FP	PM, FP, NE, IE	70,000	PG/ITA	

CHAPTER 4 Project Ideas for the agricultural and water sectors

Projects ideas are a finalizing stage of the Technology Action Plan. Project ideas were developed based on the guideline Enhancing Implementation of Technology Needs Assessments Guidance for Preparing a Technology Action Plan[10] and Technology Needs Assessment Guidance Note. Evaluations Measures For Inclusion in a Technology Action Plan, 2017[11], for the two most vulnerable sectors – agriculture and water sector.

Sharp continental climate of the country and extreme aridity, lack of water resources, especially in the southern regions, increase economic and environmental risks. High temperatures led to negative consequences in 2012; due to a severe drought in Kazakhstan farmers lost almost 50% of the grain harvest.

Kazakhstan is a large producer and exporter of wheat, which is grown mainly in the north/north-east and across a significant part of the western and central regions. In addition to the traditional technology, energy-saving technologies are used including no till. The Government of Kazakhstan encourages diversification of crop production as fodder, grain and oilseeds.

The main consumer of water is agriculture (irrigated agriculture), with its needs growing during the warm part of the year. The most common irrigation method today is furrow irrigation, while drip irrigation is one of the most common water-saving technologies. Assessment of the possibility of boosting irrigated agriculture shows that there are reserves available for its development, and that potential may be realized with the introduction of water-saving technologies.

In recent decades, the danger of extreme water and weather phenomena has increased, and in the future the number and scale of natural disasters is expected to go up. The impact of extreme weather phenomena and climate – the social and economic risks and statistics – indicates that such weather conditions increasingly affect the economies of countries. One of the important elements of adaptation to climate change is the system of prevention of extreme hydrological phenomena, which is able to prevent negative consequences and get society ready in advance to take measures to reduce those negative consequences. Therefore, the idea of a project with a system for preventing extreme hydrological phenomena is included in the report.

The project ideas developed and proposed in this report are as follows:

1. No till and diversification of crop production,
2. Drip irrigation and
3. Extreme hydrological phenomena.

The basis of the first project idea is that the joint implementation of these technologies will strengthen the process of climate change adaptation, and both of these are aimed at sustainable management of agriculture. All the technologies proposed share common barriers and measures aimed at eliminating these barriers and, in general, at sustainable management of agriculture and introduction of climate-friendly technologies.

The main objective of the project ideas proposed is to demonstrate effective methods of adaptation in the agricultural sector; adapt to climate change; mitigate the negative effects of climate change; and support and improve the productivity of agriculture.

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10 http://unfccc.int/ttclear/misc_/StaticFiles/gnwoerk_static/TEC_column_M/33933c6ccb7744bc8fd643feb0f8032a/82af010d04f14a84b9d24c5379514053.pdf

11 http://www.tech-action.org/Publications/TNA-Guidebooks

Table 4.1.Project Idea for no till, diversification of crop production and drip irrigation technologies

	Project Idea for no till, diversification of crop production and drip irrigation technologies			
Introduction	Agro-industrial complex is one of the important sectors of the economy, which constitutes the food and economic security of the country. The industry is facing the following challenges: inadequate rates of diversification of cultivation areas, irrational use of agricultural land, non-observance of scientifically sound crop rotations, insufficient development of seed breeding, use of chemicals (fertilizers, pesticides, etc.) by farmers, low technical and technological fit out of farmers, non-compliance with the requirements of applicable technologies, standards, certification and quality assurance systems, low availability of subsidies for most farmers, poor linkage of subsidies to the end results and specialization of regions, and low efficiency of subsidies per hectare. Currently, effective technologies are transferred from abroad as part of individual investment projects, with lack of a systematic approach to selection, testing, adaptation and dissemination of technology solutions. The main gaps in this respect are: 1. Lack of objective information on the most urgent objectives, technologies, and approaches to dealing with them. 2. Lack of a technology forecast, which would concentrate resources on prospective objectives in partnership with foreign organizations. The main consumer of water is agriculture (68%). Irrigated agriculture is the main consumer of water resources. Its needs grow during the warm part of the year. The most common irrigation method today is surface irrigation. Yet, drip irrigation is one of the most common water-saving technologies helping achieve 45-50% savings of water amidst the growing deficit of irrigation water.			
Objective	The purpose of the project aligns with state programs, and serves to: • enhance access to financial resources and improve legislation for climate-friendly technologies; • develop programs for dissemination of no-till practices, diversification of crop farming and drip irrigation with action plans and an electronic map developed on a scientifically sound basis of cultivation areas and crop rotation patterns for soil and climate zones in Kazakhstan, encompassing the issues of plant breeding and food security of the country; • improve access to research, trainings and increase public awareness of climate-friendly technologies These purposes and objectives align with the objectives adopted in national programs.			
Relationship to the country's sustainable development priorities?	The goals and objectives of the project correspond to the national priorities of the country's sustainable development and the Program for Development of the Agroindustrial Complex in the Republic of Kazakhstan for 2013-2021: reduce water consumption for irrigation per 1 ha by 20% by 2015 (reduce from 9180 m3 in 2015 to 7348 m3); reduce the area of cultivation of grain crops (wheat) from 11771,1 thousand ha (2015) to 10132 thousand ha (2021), and rice from 98.7 thousand ha to 84 thousand ha (2021))			
Project Deliverables	1. Access to financial resources improved, regulatory framework improved and endorsed; 2. Programs developed and approved, maps accessible for public use; 3. Social and economic evaluation of the sustainability of farming businesses conducted, tool for assessment of benefits of climate-friendly technologies developed, with an open access to the content Seminars, trainings conducted, training program on TV launched, curricula developed for trainings			
Project Scope and Possible Implementation	Project is designed for crop producing regions of Kazakhstan and irrigated areas.			
Responsibilities and Coordination	Ministry of agriculture, Ministry of Energy			
Participants of project	Ministry of agriculture, Ministry of Energy, Ministry of Economy, Ministry of Finance, Kazakh Scientific-research institutes**,** Farmers union of Kazakhstan, Farmers, NGO, International organization.			
Project activities	**Timelines**	**Budget/Resource requirements, $USD**:	**Measurement/ evaluation**	Possible complications/Challenges
Action 1. Conduct financial and regulatory analysis in		450,000	Laws and rules should encourage the	• Lack of funds for

order to deploy an effective mechanism of dissemination of no-till and diversifying crop production. Develop a report with an economic and regulatory analysis; prepare the concept with justification of changes in the legal framework, supporting the adoption of changes in law in Government and Parliament).	2019-2021	National and international funds The sources of funding can be public and private funds as well as investments.	financing of the climate-friendly technologies	implementation of a full-scale task; • Prices fluctuation in the market.
Action 2 Organize two workshops on activity 1.1	2018-2019	60,000 National and international funds	Workshops conducted	Lack of funds or interest for implementation of task
Action 3 Develop the Program, action plan and electronic map of crops on a scientifically sound basis of the cultivation areas and crop rotation patterns for soil and climate zones of Kazakhstan and encompassing the issues of plant breeding and food security of the country.	2019-2022	350,000	Program, activities, and map developed and made accessible for the public	Lack of budget and qualified staff
Action 4 Undertake social and economic evaluation of the sustainability of farm businesses for deploying climate-friendly technologies, Develop a tool for evaluation of benefits and costs of deployment of climate-friendly technologies. Study of the sales market in order to diversify crop production.	2019-2022	350,000	Report and tool developed and made accessible	Lack of budget and qualified staff
Action 5 Training and research programs developed for universities, stakeholder, and farmers		75,000	Programme is developed and publicly available	Lack of budget and qualified staff
Action 6 Meetings, workshops, training programs for stakeholders, local administration, and farmers with presentation of what research has been done on promotion of climate-friendly technologies	2019-2022	350,000	Meetings conducted	Lack of funds or interest to implement the task
Action 7 Create videos about the features of use of climate-friendly technologies supported with discussions	2020-2023	300,000	Video training developed and broadcasting	Lack of funds or interest to realize the task
Action 8 Build a network and develop a website	2020-2023	120,000	Network and website is developed and provided information support	Lack of funds or interested participants
Action 9 Meetings with stakeholders to discuss dissemination of climate-friendly technologies (no till and diversification) in agriculture, support them by scientific research and study programs and proposals and measures to improve support of scientific research		150,000	Meetings conducted	Lack of funds or interest for implementation of task

Table 4.2.Project Idea for technology of hydrological phenomena

	Project Idea for technology of hydrological phenomena			
Introduction	Kazakhstan is prone to a wide range of natural disasters originating from dangerous hydrological phenomena. According to the Committee on Emergency Situations, about 600 major floods have been recorded in Kazakhstan since 1991, having affected tens of thousands of people. An important goal of Kazakhstan's hydrometeorological service is to communicate warnings about dangerous and extreme natural phenomena and their development to the Emergency Committee, state authorities and administrations of the regions. This information is necessary for making effective decisions to prevent and eliminate the consequences of emergencies. The main indicator of the effectiveness of the hydrometeorological service is high accuracy of storm warnings and forecasts. In order to improve the quality of forecasting, it is necessary to develop new and improve existing techniques of forecasting. The following directions are planned: Forecasting climate conditions. Development of techniques for hydrologic forecasts, calculations and evaluations, including numerical forecast methods (short-term and mid-term forecasting, one month and season forecasts, forecasting climate changes). The development of numerical forecast techniques will give consumers better information. Particular attention will be paid to the development of systems for early detection and forecasting of extreme hydrometeorological phenomena that can lead to significant negative social, economic and environmental consequences. The software will improve the accuracy of hydrometeorological analysis, and will increase the quality and quantity of graphic materials and improve the quality of the forecast An important component of improving the quality of forecast is professional skills training. In Kazakhstan, there is no training center for hydrometeorology in order to improve the skills of professional staff so that they can study and implement modern methods of science and technology..			
Objective	Improving the accuracy, quality and lead time of forecasts and storm warnings, reducing damage and climate risks, preventing victims			
Relationship to the country's sustainable development priorities	Project goals align with the Strategy-2050			
Project Deliverables	1. Economic and legal assessment undertaken in order to improve funding and ways to communicate information to consumers. 2. Modern effective numerical system for short-term, long-term and seasonal hydrological forecasting adapted and deployed. 3. The main hydrographic and morphometric properties of the hydrometeorological survey location in the GIS system clarified. 4. An effective numerical weather prediction system for short-term and long-term forecast (WRF, etc.) adapted and deployed. Training program developed, trainings delivered to specialists, stakeholders, and media, international workshops attended 5. Project is being implemented at the national level for the territory of Kazakhstan			
Project Scope and Possible Implementation	The project is delivered at the national level across Kazakhstan			
Responsibilities and Coordination	Ministry of Energy (Kazgidromet),)			
Participants of project	Ministry of Internal Affairs (Emergency committee) Ministry of agriculture (Committee on water resources), Ministry of Education and Science (Institute of Geography), International organization.			
Project activities	**Timelines**	**Budget/Resource requirements:**	**Measurement.**	**Possible complications/Challenges**
Action 1. Conduct financial and regulatory analysis in order to deploy an effective mechanism of technology dissemination (report, economic and regulatory analyses, the concept of adoption and justification of regulatory requirements, support for the adoption of	2019-2020	250,000 $USD National and international funds	Laws and financing conception is approved by governmental	•Lack of funds for implementation of a full-scale task; •Prices fluctuation in the market.

changes in law in Government and Parliament). Improve the ways to communicate information to consumers. Organize and conduct seminars.				
Action 2. Adapt and deploy modern effective numerical systems for short-term, long-term and seasonal hydrological forecast	2019-2020	USD 370,000 National and international funds	Model is worked, Archive is replenished.	Lack of funds for implementation of a full-scale task
Action 3. Clarify the main hydrographic and morphometric properties at the locations of hydrometeorological surveys using GIS-technologies	2019-2021	USD 300,000 National and international funds	Model is worked, Archive is replenished	Lack of funds for implementation of a full-scale task
Action 4. Adapt and deploy effective numerical weather prediction systems for short-term and long-term forecast (WRF, etc.).	2019-2021	USD 350,000 National and international funds	Model is worked, Archive is replenished	Lack of funds for implementation of a full-scale task
Action 5 Develop a training and consultation program for specialists. Organize and conduct trainings for specialists.	2020	USD 150,000 National and international funds	Programme and training are available	Lack of funds for implementation of a full-scale task
Action 6. Launch a series of TV shows with discussions and videos about the problems of climate change and severe weather phenomena. Organize and conduct seminars for media and stakeholders.	2020-2023	USD370,000	Workshop is conducted Video have been developed and are broadcasted	Lack of funds for implementation of a full-scale task
Action 7. Participate in international workshops	2029-2021	USD 20,000		Lack of funds for implementation of a full-scale task

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ANNEX

Table 1 Arrangement of measures for no till and diversification for inclusion in the Action Plan

Measures to overcome barriers	Considerations	Assessment	Ranking
1 Expand access to finance	Cost-effectiveness	yes	3 This measure contributes to a better mutual understanding between finance providers and promoters of climate friendly technology and demonstrate advantages of the technology to achievement of national targets on sustainable development and reduction of climate risks
	Efficiency	yes	
	Interactions with other measures	yes	
	Suitability	yes	
	Benefits & costs	yes	
2 Improve access to products and services	Cost-effectiveness	yes	1 Better access to products and services of technologies are particularly helpful for a wider scale implementation of the technology for a larger group of households.
	Efficiency	yes	
	Interactions with other measures	yes	
	Suitability	yes	
	Benefits & costs	indirect	
3 Improve policy and enabling environment and strengthen regulatory framework	Cost-effectiveness	yes	3 Better access to products and services of technologies are particularly helpful for a wider scale implementation of the technology for a larger group of households.
	Efficiency	yes	
	Interactions with other measures	yes	
	Suitability	yes	
	Benefits & costs	yes	
Enhance networking of farmers chain and interesting actors	Cost-effectiveness		1 This measure contributes to promote the climate friendly technologies and level up of knowledge for a wider scale implementation of the technology for a larger group of households and create of lobby to insert of technologies
	Efficiency	yes	
	Interactions with other measures	yes	
	Suitability	yes	
	Benefits & costs	indirect	
5 Improvement of the system scientific researches, programs for agricultural higher education institutions, the system of retraining and training of existing specialists	Cost-effectiveness	yes	2 This measure contributes to improve the quality of technology implementation and training, sustainable socio-economic development of country
	Efficiency	yes	
	Interactions with other measures	yes	
	Suitability	yes	
	Benefits & costs	indirect	

6. Expand Capacity Building Initiatives and Collaboration (focused on climate friendly technology)	Cost-effectiveness	yes	2 Capacity building and cooperation on techno-logy enhance knowledge and help accelerate the implementation of technologies
	Efficiency	yes	
	Interactions with other measures	yes	
	Suitability	yes	
	Benefits & costs	indirect	
		indirect	
7. Strengthening the media interest in the promotion of climate-friendly technologies with the participation of research organizations, experts, manufacturers of agricultural machinery, the positive influence of climate	Cost-effectiveness	yes	1 Mass media and developed programs will help to expand the number of supporters of technology
	Efficiency	yes	
	Interactions with other measures	yes	
	Suitability	yes	
	Benefits & costs	indirect	

Table 2. Overview of risk categories and possible contingencies (Step 5) for no till and diversification technologies

Type of risk	Related to Action or Activity	Description of risk	Contingency actions	
1.Cost Risks	All types of activities	An activity costs more than originally planned	***Time interval for M&E:***	Annually
			M&E responsibility:	Ministries, International organizations, Banks
			Contingency measures needed:	This might involve adding 25% to a construction estimate or 15% to the estimate for the cost of running a meeting of the public and private sectors in-country to discuss how to improve "doing business conditions"
			Responsibility contingency measure:	
			Timing contingency measure:	0-5 years
2 Scheduling Risks	All types of activities	An activity takes longer to complete than originally planned	***Time interval for M&E:***	Annually
			M&E responsibility:	Ministries, International organizations, Banks
			Contingency measures needed:	Allow for step-by-step schedule slippage. Identify critical path items, whose delay stalls all progress on an Activity or even and Action Item
			Responsibility contingency measure:	Risks identified during the preparation of the TAP can be adequately handled if spotted during implementation of the actions, and. Unexpected risks and their consequences can be adequately spotted and handled.
			Timing contingency measure:	0-5 year
3 Performance Risks	All types of activities	A technology or human resource does not perform as planned or environmental and social benefits not being delivered	***Time interval for M&E:***	Once 6 months
			M&E responsibility:	Ministries, International organizations, Banks
			Contingency measures needed:	This is the most difficult contingency to plan for, and it is wise to have backup plans.
			Responsibility contingency measure:	Business (Suppliers)

			Timing contingency measure:	0-5 year
etc.			***Time interval for M&E:***	
			M&E responsibility:	
			Contingency measures needed:	
			Responsibility contingency measure:	
			Timing contingency measure:	

Table 3. Framework for ranking measures for inclusion as Actions in TAP for drip irrigation)

Measures to overcome barriers	Considerations	Assessment	Ranking
1 Expand access to finance	Cost-effectiveness	yes	3 This measure contributes to a better mutual understanding between finance providers and promoters of climate friendly technology and demonstrate advantages of the technology to achievement of national targets on sustainable development and reduction of climate risks
	Efficiency	yes	
	Interactions with other measures	yes	
	Suitability	yes	
	Benefits & costs	yes	
2 Improve access to products and services	Cost-effectiveness	yes	1 Better access to products and services of technologies are particularly helpful for a wider scale implementation of the technology for a larger group of households.
	Efficiency	yes	
	Interactions with other measures	yes	
	Suitability	yes	
	Benefits & costs	indirect	
3 Improve policy and enabling environment and strengthen regulatory framework	Cost-effectiveness	yes	3 This measure contributes to promote the climate friendly technologies and demonstrate advantages to funding them and improve sustainable food security and reduction of climate risks
	Efficiency	yes	
	Interactions with other measures	yes	
	Suitability	yes	
	Benefits & costs	yes	
4 Enhance networking of farmers chain and interesting actors	Cost-effectiveness		1 This measure contributes to promote the climate friendly technologies and level up of knowledge for a wider scale implementation of the technology for a larger group of households and create of lobby to insert of technologies
	Efficiency	yes	
	Interactions with other measures	yes	
	Suitability	yes	
	Benefits & costs	indirect	
5.1 Research to introduction of technological methods, models to ensure management water resources, climate-friendly	Cost-effectiveness	yes	2 This measure contributes to promote the climate friendly

technologies in rural areas s			technologies and level up of knowledge for a wider scale implementation of the technology for a larger group of households and create of lobby to insert of technologies
	Efficiency	yes	
	Interactions with other measures	yes	
	Suitability	yes	
	Benefits & costs	indirect	
5,2 Conducting trainings to promote and update the programs for providing of sustainable agricultural management Expand Capacity Building Initiatives and Collaboration (focused on climate friendly technology	Cost-effectiveness	yes	2 This measure contributes to promote the climate friendly technologies and level up of knowledge for a wider scale implementation of the technology for a larger group of households and create of lobby to insert of technologies
	Efficiency	yes	
	Interactions with other measures	yes	
	Suitability	yes	
	Benefits & costs	**indirect**	
5.3.Elaborate cooperation mechanism, which will allow eliminate barriers among stakeholders to use the technology and create the feedback mechanism	Cost-effectiveness	yes	This measure contributes to promote the climate friendly technologies
	Efficiency	yes	
	Interactions with other measures	yes	
	Suitability	yes	
	Benefits & costs	**indirect**	
5.4.Increase of efficiency of the training process in colleges and universities in the sphere of technologies favorable to climate change, expansion of trainings for farmers	Cost-effectiveness	yes	This measure contributes to promote the climate friendly technologies and level up of knowledge for a wider scale implementation of the technology for a larger group of households and create of lobby to insert of technologies
	Efficiency	yes	
	Interactions with other measures	yes	
	Suitability	yes	
	Benefits & costs	**indirect**	
5.5. Reseaches on adaptation, improvement and evaluation of efficiency of drip irrigation technologies for Kazakhstan for different cultures, soils and climatic conditions to ensure farms	Cost-effectiveness	yes	This measure contributes to promote the climate friendly technologies and level up of knowledge for a wider scale implementation of the technology for a larger group of households and create of lobby to insert of technologies
	Efficiency	yes	
	Interactions with other measures	yes	
	Suitability	yes	
	Benefits & costs	**indirect**	

6. Expand Capacity Building Initiatives and Collaboration (focused on climate friendly technology	Cost-effectiveness	yes	This measure contributes to promote the climate friendly technologies with suppor of administration
	Efficiency	yes	
	Interactions with other measures	yes	
	Suitability	yes	
	Benefits & costs	**indirect**	
7. Enhance public acceptance of different technologies for climate change	Cost-effectiveness	yes	This measure contributes to promote the climate friendly technologies and level up of knowledge for a wider scale implementation of the technology for a larger group of households and create of lobby to insert of technologies
	Efficiency	yes	
	Interactions with other measures	yes	
	Suitability	yes	
	Benefits & costs	**indirect**	
8. Increased public awareness and strengthening confidence in the new technologies for development of traditions, habits	Cost-effectiveness	yes	This measure contributes to promote the climate friendly technologies and level up of knowledge for a wider scale implementation of the technology for a larger group of households and create of lobby to insert of technologies
	Efficiency	yes	
	Interactions with other measures	yes	
	Suitability	yes	
	Benefits & costs	**indirect**	
9.Strengthen measures on informing the rural population to solve the tasks of water resources saving, projects implementation, publishing recommendations, brochures, etc.	Cost-effectiveness	yes	This measure contributes to promote the climate friendly technologies and level up of knowledge for a wider scale implementation of the technology for a larger group of households and create of lobby to insert of technologies
	Efficiency	yes	
	Interactions with other measures	yes	
	Suitability	yes	
	Benefits & costs	**indirect**	
10.Involvement of research structures, NGOs, mass media and other stakeholders to solve the tasks of introducing drip irrigation	Cost-effectiveness	yes	This measure contributes to promote the climate friendly technologies and level up of knowledge for a wider scale implementation of the technology for a larger group of households and create of lobby to insert of technologies
	Efficiency	yes	
	Interactions with other measures	yes	
	Suitability	yes	
	Benefits & costs	**indirect**	
11.Enhance training for specialist and farmers	Cost-effectiveness	yes	
	Efficiency	yes	

	Interactions with other measures	yes	
	Suitability	yes	
	Benefits & costs	**indirect**	
Add rows as needed			

Table 4. Framework for ranking measures for inclusion as Actions in TAP technology hydrological phenomena

Measures to overcome barriers	Considerations	Assessment	Ranking
1 Expand access to finance	Cost-effectiveness	yes	3 Better access to finance for technology is particularly helpful for a wider scale implementation of the technology, esp.
	Efficiency	yes	
	Interactions with other measures	yes	
	Suitability	yes	
	Benefits & costs	inderect	
2 Improve policy and enabling environment, strengthen regulatory framework	Cost-effectiveness	yes	2 Improving policy and better regulation will facilitate the introduction and implementation of technology
	Efficiency	yes	
	Interactions with other measures	yes	
	Suitability	yes	
	Benefits & costs	inderect	
3 Development of research programs to improve the forecast hazardous of hydrometeorological events, the study and modeling of impacts and vulnerability to climate change	Cost-effectiveness	yes	2 access to research programs improving for technology is particularly helpful for a wider scale implementation of the technology, esp
	Efficiency	yes	
	Interactions with other measures	yes	
	Suitability	yes	
	Benefits & costs	inderect	
4 Enhancing knowledge and qualification	Cost-effectiveness	yes	2 Better access to knowledge of technology is particularly helpful for a wider scale implementation of the technology, esp
	Efficiency	yes	
	Interactions with other measures	yes	
	Suitability	yes	
	Benefits & costs	inderect	
5 Increasing the media's interest in promoting the prevention and preparedness to natural disasters risks, disseminating information on impact assessment and vulnerability to climate change	Cost-effectiveness	yes	1 Better access to knowledge and knowledge of technology is particularly helpful for a wider scale implementation of the technology, esp
	Efficiency	yes	
	Interactions with other measures	yes	

	Suitability	yes	
	Benefits & costs	inderect	
6 Promoting tool, devices and development locally research works	Cost-effectiveness	yes	2 Better access to tools, devices and research works give increased forecast quality and reduction of climate risk
	Efficiency	yes	
	Interactions with other measures	yes	
	Suitability	yes	
	Benefits & costs	inderect	

Table 5. Cost estimates the capacity building initiatives to realize actions of Technology Action Plan (stuff project)

Staff / person	**Expected time (hours)**	**Costs / hour**	**total labour costs**	**travel costs**	**total , USA USD**
Manager	150	100	15000	50	15050
Assistant	150	25	3300	50	3350
Expert	140	65	9100	50	9150
Consultants					
consultant1	120	40	4800	50	4850
Consultant 2	120	30	3600	50	3650
Total					***36050***

Table 6. Cost estimates the capacity building initiatives to realize actions of Technology Action Plan (workshop)

Meetings & Round Table	**Room/ equipment**	**Food /drinks**	**Accommodation**	**Travel cost**	**Translation, Stationery and etc**	**total**
Round Table 1 day /30persons	1200	1600	1000	900	1,200	5,900
Other Costs						
DSA (international &CIS)					6666	6666
Unforeseen 10%					1300	1300
total						***13866***