THE REPUBLIC OF AZERBAIJAN

THE MINISTRY OF ECOLOGY AND NATURAL RESOURCES

Technological Action Plan (TAP)

FOR ADAPTATION TECHNOLOGIES

October 2012

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AIT Asian Institute of Technology

LIST OF ABBREVIATIONS

AIT	Asian Institute of Technology
GEF	Global Environmental Facility
GCF	Green Climate Fund
IFAD	International Fund for Agricultural Development
ICA	Implementing Credit Agency
MoF	Ministry of Finance
MEC	Ministry of Emergency Cases
MED	Ministry of Economic Development
MENR	Ministry of Ecology and Natural Resources
MoA	Ministry of Agriculture
MoT	Ministry of Taxes
NGO	Non-governmental Organization
OSC	Open Stock Company
TAP	Technological Action Plan
TNA	Technological Needs Assessment
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
URC	UNEP Riso Center
WB	World Bank
SFSE	State Fund for Support to Entrepreneurship under MED

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EXECUTIVE SUMMARY

This report is the next step of the TNA/TAP project in Azerbaijan and aims to outline technological action plans for technology application and diffusion.

For the organization of the TAP process, a sectoral/technology working group representing relevant stakeholders was formed. National consultants have applied a participatory approach during the stakeholder consultation process.

Both agriculture and water are vulnerable sectors to climate change. Based on vulnerability assessments provided in the Second National Communication of Azerbaijan to UNFCC, these sectors have been identified as the most vulnerable sectors.

Agriculture is a strategic sector for the country and a key component of the non-oil economy. While the agricultural sector accounts for only 7% of GDP it is a key employer, providing income and employment for about 40% of the total workforce. The agricultural sector plays an important role in food security and in improving the socio-economic condition in rural regions.

Main aspects of agricultural development are more specifically represented by the "Azerbaijan State Programme on Reliable Food Supply of Population" (2009-2015). Its Action Plan consists of 12 main goals including improving land and water use efficiency, plant protection services and crop production. However, the programme lacks in aspects related to future tendencies of climate change in spite of the fact that climate change projections have already been provided in the Second National Communication of Azerbaijan to UNFCCC.

The government of Azerbaijan has strict policy and strategy for the improvement of qualitative and quantitative indicators of water resources in different state programmes. The most important measures have already been identified under these programmes and strategies.

Although the government has not defined the strategy for prioritized technologies in these sub-sectors, there are some existing initiatives to promote use of different technologies in the irrigation sector, drinking water supply and reclamation and reuse of wastewater.

Measures for overcoming existing barriers of prioritized technologies have been grouped as follows:

- Policy/regulatory
- Economic/financial
- Technological
- Information/capacity building
- Other measures

Technological Action Plans have been prepared for each technology. During the preparation of TAP, measures have been assessed taking into account their priorities, time scale, related stakeholders, key indicators for measuring implementation and funding resources.

There are several cross-cutting issues that constitute common barriers for all prioritized technologies, such as need for fiscal support mechanisms, strengthening capacity of R & D institutions, stakeholder consultation and access to information at different levels. These issues result in insufficient development of climate change mitigation technologies in the country and create common barriers to their implementation.

CHAPTER 1. THE AGRICULTURAL SECTOR

1.1. Action at sectoral level

Agriculture is the sector of the economy most dependent on climate conditions. A slight change in climate conditions makes a considerable impact on agricultural production.

Most of Azerbaijan's territory is characterized by high warming resources, mild winter conditions, moisture shortage in the summer and continuous droughts. Of the total 11 main types of climate, 8 types are found in Azerbaijan -- from semi-desert and dry land climate extending into lowlands and foothill areas to mountain tundra climate in high mountainous zones (Second National Communication, 2010).

The key documents setting out the government policies for the country, agriculture, rural and agro-industry development include:

(i) the State Programme on Socio-Economic Development of the Regions of Azerbaijan for 2009-2013;

(ii) the State Programme on Poverty Reduction and Sustainable Development for 2008-2015;

(iii) the State Programme on Reliable food supply to the population for 2008-2015;

(iv) "Azerbaijan-2020: glance to future" Development Conception.

Main aspects of agricultural development are more specifically represented by the "Azerbaijan State Programme on Reliable Food Supply of Population" (2009-2015). Its Action Plan consists of 12 main goals including improving land and water use efficiency, plant protection services and crop production. However, the programme lacks in aspects related to future tendencies of climate change in spite of the fact that climate change projections have already been provided in the Second National Communication of Azerbaijan to UNFCCC. Therefore, necessary actions need to be taken in order to overcome existing barriers to the implementation of prioritized technologies.

General barriers to deployment of prioritized technologies under agricultural sector could be summarized as follows:

- *Economic/financial barriers:* weak access to acceptable financial means, weak access to markets, expensive feasibility study, lack of fiscal support to R & D institutions, high investment costs;
- *Policy/regulatory barriers:* no specific subsidy mechanism to promote application of technologies, improper pricing mechanism;
- *Technological barriers:* lack of technological knowledge and skills, weak access to agricultural machinery;
- *Information/capacity barriers*: weak capacity of research institutions, weak agricultural extension services, low level of awareness of economic and ecological advantages;
- *Social barriers*: unfamiliarity with new technology and small-scale lands.

Measures to overcome these barriers and technological action plans have been provided separately for each prioritized technology in the chapters below.

1.2. Action plan for introduction of crop species resistant to expected climate change technology

The introduction of new cultivated species and improved crop varieties is a technology aimed at enhancing plant productivity, quality, health and nutritional value and/or building crop resilience to diseases, pest organisms and environmental stresses.

Crop diversification refers to the addition of new crops or cropping systems to agricultural production on a particular farm, taking into account the different returns from value-added crops with

complementary marketing opportunities.

Such technology will be applied mainly in arid and semi-arid zones of the country. Assessment of vulnerability should be provided in areas with the highest risk to negative impacts of climate change (Food Security and Agriculture Highlights: Azerbaijan, 2011). Agricultural research institutions must be involved in the process in order to provide analyses and experiments with new species.

Main barriers of technology diffusion could be summarized as follows:

Barriers	**Introduction of crop species resistant to expected climate change**
Economic/financial	- Weak access to acceptable financial means, weak access to markets, high transaction costs
Policy/regulatory	- No subsidy mechanism to promote use of technology
Technology	- Weak capacity of research institutions
Information/capacity	- Weak agricultural extension services
	- Low level of awareness of economic and ecological advantages
Social	- Unfamiliarity with new technology

During the preparation of TAP, measures have been assessed taking into account their priorities, time scale, related stakeholders, key indicators for measuring implementation and funding resources.

Subsidy mechanisms are effective tools to promote and stimulate application of the technologies. At the same time, this measure is a significant tool in overcoming financial barrier to technology deployment. There is a positive example for stimulation of initiatives in Azerbaijan using specific subsidy, mostly applied in the agricultural sector. Similar mechanisms, with different features adjusted to the type of adaptive technology, could be developed by the government to stimulate initiatives in related fields.

Capacity building measures include activities related to awareness raising and increase of knowledge/skills of all related stakeholders such as decision-makers, technology users, and service providers of the applied technology. These activities include organization of round-table discussions, training sessions, workshops, seminars and study tours during the project implementation period.

“Information campaign on the advantages of applied technology” is the measure used to address the barrier “Low level of awareness of economic and ecological advantages”. It is considered an effective tool to raise awareness level on the advantages of the technology. This includes dissemination of information on technology advantages, as well as current opportunities for national and local decision makers and local communities (technology users), through mass media, publications, organization of workshops and seminars.

TAP for the introduction of crops resistant to climate change technology is provided in table 1.

Table 1: TAP for introduction of crop species resistant to expected climate change technology

#	Measures	Priority	Why it is important	Time scale	Related stakeholders, implementers	Key indicators	Risks	Funding sources	Costs
Economic/financial									
1	Develop mechanism for provision of long-term and low-interest loans, as well as grants through state, private and international funds	High	- Create access to financial sources	0-5 years	MED, MoA	- Easy access to funds created for farmers	- Low interest of financial institutions - Insufficient State funds	State, International	$ 200,000
2	Develop specific subsidy mechanism to promote application of the technology	Medium	- Promote wide application of technology	5-10 years	MoA, MoF, MED	- new set of package to support local farmers during application of new species	- State procedures may be slow to endorse proposed recommendations	State, International	$ 100,000
Technology									
3	Technical support to R & D institutions	High	- Improve technical capacity of R & D institutions	5-10 years	MED, MoA	- Improved capacity of R & D institutions	- No major risk	State, International	$ 500,000
4	Strengthen international research network programmes	Medium	- Share best practices and experiences	5-10 years	MoA, National Academy of Sciences	- National R & D institutions actively participate in international research network	- No major risk	State, International	$ 40,000
Information/capacity									
5	Organize specific capacity building programmes (trainings, seminars, workshops) for local farmers	High	- Increase capacities	0-10 years	MoA, NGOs	- Increased capacity	- No major risk	State, International	$ 600,000
6	Develop and conduct information campaigns on the advantages of	High	- Raise awareness	0-5 years	MoA, NGOs	- Awareness level on	- No major risk	State, Internatio	$ 500,000

#	Measures	Priority	Why it is important	Time scale	Related stakeholders, implementers	Key indicators	Risks	Funding sources	Costs
	applied technology		level			advantages of new technology increase by 50%		nal	
7	Develop mechanism for support to agricultural extension services	High	- Increase quality of agricultural extension services	0-10 years	MoA, MED, MoF, NGOs	- Capacity and quality of current extension service providers improved	- Weak collaboration with existing extension service providers	State, Internatio nal	$ 800,000
Other measures									
8	Donor coordination in order to enhance support to R & D project initiatives related to the technology	Medium	- Coordinate various donor initiatives - Demonstrate practical application of the technology	0-10 years	MED, MoA	- Donor coordination meetings organized at least once a year	- Weak collaboration of related organizations	State, Internatio nal	$ 100,000
9	Develop mechanism for implementation of demonstrative pilot projects	High	- Demonstrate practical advantages	0-5 years	MED, MoA	- Practical knowledge and skills of farmers increased	- Lack of funds	State, Internatio nal	$ 600,000

1.3. Action plan for enhancing the application of windbreaks technology

The practice of agro-forestry was applied in Azerbaijan during former Soviet times. Currently, this practice is not applied by most private land-owners due to lack of knowledge. Agro-forestry has a broad application potential and provides a range of advantages, including the maximum use of the land and increased land-use efficiency, increased productivity of the land, protection and improvement of soils and water sources, and so on (Goal and objectives of windbreaks, lecture).

Agro-forestry systems take advantage of trees in many ways: to hold the soil, which increases fertility through nitrogen fixation, or through bringing minerals from deep in the soil and depositing them by leaf-fall, as well as to provide shade, construction materials, foods and fuel.

Such technology will be applied mainly in regions with high risk of erosion. Assessment of vulnerability should be provided in areas with the highest risk to negative impacts of climate change. Agricultural research institutions must be involved in the process in order to provide comprehensive analyses and feasibility studies related to application of agro-forestry system.

There are no specific programmes or strategies in Azerbaijan related to application of windbreaks technologies at cultivated lands. Some local-level and small-scale actions for the promotion of technology application have been initiated under different development projects, supported by international organizations. For instance, the German International Corporation has supported development of concept for windbreak application and the conducting of a feasibility study in one of the agricultural regions of Azerbaijan.

Main barriers of technology diffusion identified during barriers analysis could be listed as follows:

Barriers	**Enhancing the application of windbreaks**
Economic/financial	- Weak access to acceptable financial means - Weak access to markets - Lack of fiscal support to R & D institutions
Policy/regulatory	- No specific subsidy mechanism to promote application of new crop varieties
Information/capacity	- Weak capacity of research institutions - Weak agricultural extension services - Low level of awareness of economic and ecological advantages
Social	- Unfamiliarity with new technology - Small-scale lands

During the preparation of TAP, measures have been assessed taking into account their priorities, time scale, related stakeholders, key indicators for measuring implementation and funding resources. Most actions for diffusion of windbreaks technology are similar to those related to introduction of new crop species resistant to forecasted climate change.

TAP for the technology is provided in table 2.

Table 2: TAP for enhancing the application of windbreaks technology

#	Measures	Priority	Why it is important	Time scale	Related stakeholders, implementers	Key indicators	Risks	Funding sources	Costs
Economic/financial									
1	Develop mechanism for provision of long-term and low-interest loans, as well as grants through state, private and international funds	High	- Create access to financial sources	0-5 years	MED, MoA	- Easy access to funds created for farmers	- Low interest of financial institutions - Insufficient State funds	State, International	$ 200, 000
2	Develop specific subsidy mechanism to promote application of the technology	Medium	- Promote wide application of technology	5-10 years	MoA, MoF, MED	- new set of package to support local farmers during application of windbreaks	- State procedures may be slow to endorse proposed recommendations	State, International	$ 100,000
Technology									
3	Technical support to R & D institutions	High	- Improve technical capacity of R & D institutions	5-10 years	MED, MoA	- Improved capacity of R & D institutions	- No major risk	State, International	$ 500,000
Information/capacity									
4	Organize specific capacity building programmes (trainings, seminars, workshops) for local farmers	High	- Increase capacities	0-10 years	MoA, NGOs	- Increased capacity	- No major risk	State, International	$ 600,000
5	Develop and conduct information campaigns on the advantages of applied technology	High	- Raise awareness level	0-5 years	MoA, NGOs	- Awareness level on advantages of new technology increase by 50%	- No major risk	State, International	$ 500,000
6	Develop mechanism for support to	High	- Increase	0-10 years	MoA, MED,	- Capacity	- Weak	State,	$ 800,000

#	Measures	Priority	Why it is important	Time scale	Related stakeholders, implementers	Key indicators	Risks	Funding sources	Costs
	agricultural extension services		quality of agricultural extension services		MoF, NGOs	and quality of current extension service providers improved	collaboration with existing extension service providers	Internatio nal	
Other measures									
7	Develop mechanism for implementation of demonstrative pilot projects	High	- Demonstrate practical advantages	0-5 years	MED, MoA	- Practical knowledge and skills of farmers increased	- Lack of funds	State, Internatio nal	$ 800,000

1.4. Action plan for application of water saving technologies at irrigated lands

Efficient use of irrigation water will be very important due to expected water scarcity forecasted in light of climate change. Drip irrigation can help use water efficiently. Sprinkler systems will eliminate water conveyance channels, thereby reducing water loss. Secondary benefits from improved crop productivity include income generation, employment opportunities and food security.

Application of this technology successfully lines with the country's economic, social and environmental development priorities. Moreover, it contributes to food security priority, by increasing productivity and land fertility, as well as leading to increase of income of rural population and reducing out-migration.

The application of drip/sprinkler irrigation is practiced in Azerbaijan, but is not widely applied by local farmers. The main reason for this being high investment costs and lack of knowledge and skills on advantages of the technology. The technology could be successfully applied at agricultural lands with irrigation water scarcity, as well as areas with potential risks to droughts and high temperatures.

There are no specific programmes or strategies in Azerbaijan related to application of water saving technologies at cultivated lands. Some local-level and small-scale actions for technology application have been initiated by large-scale private sector entities.

Main barriers of technology diffusion could be listed as follows:

Barriers	**Application of water saving technologies at irrigated lands**
Economic/financial	- Low prices for irrigation water - Improper pricing mechanism for use of irrigation water
Policy/regulatory	- Weak access to acceptable financial means - High investment costs
Technology	- Lack of technological knowledge and skills
Information/capacity	- Weak agricultural extension services - Low level of awareness of economic and ecological advantages
Social	- Unfamiliarity with new technology - Small-scale lands

During the preparation of TAP, measures have been assessed taking into account their priorities, time scale, related stakeholders, key indicators for measuring implementation and funding resources.

TAP for the technology is provided in table 3.

Table 3: TAP for application of water saving technologies at irrigated lands

#	Measures	Priority	Why it is important	Time scale	Related stakeholders, implementers	Key indicators	Risks	Funding sources	Costs
Policy/regulatory									
1	Regulate tariff system for irrigation water	High	- Tariff system needs to be improved for use of irrigation water	0-5 years	National Parliament, MED, Tariff Council, Amelioration and Water Farms OSC	- Tariff system regulated	- State procedures may be slow to endorse proposed recommendations	State	$ 250,000
2	Develop mechanism for distribution and pricing of irrigation water	High	- New working mechanism needed for distribution and pricing of irrigation water	0-5 years	MED, Amelioration and Water Farms OSC	- Working mechanism for distribution and pricing of irrigation water created	- State procedures may be slow to endorse proposed recommendations	State	$ 100,000
3	Develop specific subsidy mechanism to promote application of the technology	Medium	- New initiatives need financial support	5-10 years	MoA, MoF, MED	- New set of package to support local farmers during application of new species	- Lack of funds	State, International	$ 200,000
4	Develop specific tax and customs regulations to promote technology import and production	Medium	- Private sector initiatives promoted	5-10 years	MED, MoT	- Enabling framework for technology import and local production created	- State procedures may be slow to endorse proposed recommendations	State	$ 150,000
Economic/financial									
5	Develop mechanism for provision of long-term and low-interest	High	- Create access to	0-5 years	MED, MoA	- Easy access to funds	- Low interest of financial	State, Internati	$ 200,000

#	Measures	Priority	Why it is important	Time scale	Related stakeholders, implementers	Key indicators	Risks	Funding sources	Costs
	loans, as well as grants through state, private and international funds		financial sources			created for farmers	institutions - Insufficient State funds	onal	
Technology									
6	Technical support to R & D institutions	High	- Improve technical capacity of R & D institutions	5-10 years	MED, MoA	- Improved capacity of R & D institutions	- No major risk	State, Internatio nal	$ 500,000
7	Strengthen international research network programmes	Medium	- Share best practices and experiences	5-10 years	MoA, National Academy of Sciences	- National R & D institutions actively participate in international research network	- No major risk	State, Internatio nal	$ 40,000
Information/capacity									
8	Organize specific capacity building programmes (trainings, seminars, workshops) for local farmers	High	- Increase capacities	0-10 years	MoA, NGOs	- Increased capacity	- No major risk	State, Internatio nal	$ 600,000
9	Develop and conduct information campaigns on the advantages of applied technology	High	- Raise awareness level	0-5 years	MoA, NGOs	- Awareness level on advantages of new technology increase by 50%	- No major risk	State, Internatio nal	$ 500,000
10	Develop mechanism for support to agricultural extension services	High	- Increase quality of agricultural extension services	0-10 years	MoA, MED, MoF, NGOs	- Capacity and quality of current extension service providers improved	- Weak collaboration with existing extension service providers	State, Internatio nal	$ 800,000
Other measures									
11	Donor coordination in order to enhance support to R & D project	Medium	- Coordinate various	0-10 years	MED, MoA	- Donor coordination	- Weak collaboration	State, Internatio	$ 800,000

#	Measures	Priority	Why it is important	Time scale	Related stakeholders, implementers	Key indicators	Risks	Funding sources	Costs
	initiatives related to the technology		donor initiatives - Demonstrate practical application of the technology			meetings organized at least once a year	of related organizations	nal	
12	Develop mechanism for implementation of demonstrative pilot projects	High	- Demonstrate practical advantages	0-5 years	MED, MoA	- Practical knowledge and skills of farmers increased	- Lack of funds	State, Internatio nal	$ 500,000

1.5. Action plan for application of conservative cultivation technologies

Conservation tillage practices reduce risk from drought by reducing soil erosion, enhancing moisture retention and minimizing soil impaction. In combination, these factors improve resilience to climatic effects of drought and floods. Improved soil nutrient recycling may also help combat crop pests and diseases. Conservation tillage benefits farming by minimizing erosion, increasing soil fertility and improving yield.

Conservation Agriculture is not only a technical procedure, but it can also be considered as an approach aimed at environment protection. Conservation Agriculture is based on reduced tillage or zero tillage. This process is intended to reduce greenhouse gas emissions (steam water, methane, carbon dioxide – CO^2) and to sequester increased carbon in soils.

This technology is very untraditional for local communities in Azerbaijan as there was no practice of it in the past. There is only one initiative implemented under a small-scale project, but local farmers have shown great interest towards this new technology.

There are no specific programmes or strategies in Azerbaijan related to application of conservative cultivation technologies at cultivated lands. Some local-level and small-scale actions for promotion of technology application have been initiated under different development projects supported by international organizations.

Main barriers of technology diffusion could be listed as follows:

Barriers	**Application of conservative cultivation**
Economic/financial	- Weak access to acceptable financial means - High investment costs - Expensive feasibility study
Policy/regulatory	- No specific subsidy mechanism to promote application of new crop varieties
Technological	- Weak access to agricultural machinery
Information/capacity	- Low level of awareness of economic and ecological advantages - Weak agricultural extension services
Social	- Unfamiliarity with new technology - Small-scale lands

During the preparation of TAP, measures have been assessed taking into account their priorities, time scale, related stakeholders, key indicators for measuring implementation and funding resources.

TAP for the technology is provided in table 4.

Table 4: TAP for application of conservative cultivation technologies

#	Measures	Priority	Why it is important	Time scale	Related stakeholders, implementers	Key indicators	Risks	Funding sources	Costs
Economic/financial									
1	Develop mechanism for provision of long-term and low-interest loans, as well as grants through state, private and international funds	High	- Create access to financial sources	0-5 years	MED, MoA, MoF	- Easy access to funds created for farmers	- Low interest of financial institutions - Insufficient State funds	State, International	$ 200,000
2	Develop specific subsidy mechanism to improve access to agricultural machinery	Medium	- Promote wide application of technology	5-10 years	MoA, MoF, MED	- new set of package to support local farmers during technology	- State procedures may be slow to endorse proposed recommendations	State, International	$ 700,000
Information/capacity building									
3	Organize specific capacity building programmes (trainings, seminars, workshops) for local farmers	High	- Increase capacities	0-10 years	MoA, NGOs	- Increased capacity	- No major risk	State, International	$ 600,000
4	Develop and conduct information campaigns on the advantages of applied technology	High	- Raise awareness level	0-5 years	MoA, NGOs	- Awareness level on advantages of new technology increase by 50%	- No major risk	State, International	$ 500,000
5	Develop mechanism to support agricultural extension services	High	- Increase quality of agricultural extension services	0-10 years	MoA, MED, MoF, NGOs	- Capacity and quality of current extension service providers improved	- Weak collaboration with existing extension service providers	State, International	$ 800,000
6	Technical support to R & D	High	- Improve	5-10 years	MED, MoA	- Improved	- No major	State,	$ 500,000

#	Measures	Priority	Why it is important	Time scale	Related stakeholders, implementers	Key indicators	Risks	Funding sources	Costs
	institutions		technical capacity of R & D institutions			capacity of R & D institutions	risk	Internatio nal	
Other measures									
7	Develop mechanism for implementation of demonstrative pilot projects	High	- Demonstrate practical advantages	0-5 years	MED, MoA	- Practical knowledge and skills of farmers increased	- Lack of funds	State, Internatio nal	$ 950,000

CHAPTER 2. WATER SECTOR

2.1. Action at sectoral level

The water sector is considered to be one of the vulnerable sectors in light of climate change. For Azerbaijan, a country facing water shortage, implementation of adaptive measures in order to adapt to forecasted climate change tendencies is very important. Based on these factors, the water sector has been considered as one of the prioritized sectors for adaptation to climate change during the Technological Needs Assessment process.

Although the government has not defined the strategy for prioritized technologies for this sub-sector, there are some existing initiatives to promote use of water adaptation technologies in the areas of irrigation water use, drinking water supply and sanitation; however all initiatives are very limited.

Measures for overcoming existing barriers of prioritized technologies have been grouped as follows:

- Policy/regulatory
- Economic/financial
- Information/capacity building
- Technological
- Other measures

These measures include the activities, timelines, stakeholders, and indicators (both qualitative and quantitative) to facilitate the implementation of the technology.

2.2. Action plan for rainwater collection from ground surfaces—small reservoirs and micro-catchments technology

Application of rainwater collection technology lines with the country's social, economic and environmental development priorities. With regard to the country's social development priorities, application of the technology provides water to a population where the demand for water and sanitation is high and existing resources are limited. For economic development priorities, it should be noted that lack of adequate water supply during drought and seasonal dry periods could halt economic development and hinder human health and well-being.

Access to a convenient supply of stored rainwater can decrease travel time to remote water sources, increase agricultural productivity and reduce depletion of groundwater resources. Increasing the availability of irrigation water during the dry season and even during short dry spells has been shown to yield large increases in agricultural production.

There are no specific programmes or strategies in Azerbaijan related to application of rainwater collection from ground surfaces—small reservoirs and micro-catchments technology.

Main barriers of technology diffusion could be listed as follows:

Barriers	**Application of small reservoirs and micro-catchments technology**
Economic/financial	- Insufficient governmental support for enhancement research activities - High capital costs for large-scale projects - Weak access to financial sources
Policy/regulatory	- Weak institutional basis and lack of coordination - Lack of stakeholder network for the development and transfer of the technology - Non-existence of mechanism for customs regulations for stimulation of import of necessary technology

Technological	- Difficulties in identification of suitable site and scale of rainwater reservoirs or tanks
Information/capacity	- Weak capacity and lack of skills of existing research institutions
Social	- Unfamiliarity with new technology - Possible conflicts between communities on water access rights

During the preparation of TAP, measures have been assessed taking into account their priorities, time scale, related stakeholders, key indicators for measuring implementation and funding resources.

TAP for the technology is provided in table 5.

Table 5: TAP for rainwater collection from ground surfaces—small reservoirs and micro-catchments technology

#	Measures	Priority	Why it is important	Time scale	Related stakeholders, implementers	Key indicators	Risks	Funding sources	Costs
Policy/regulatory									
1	Develop supportive policies for local deployment of the technology	High	- Promote application of technology in areas with water scarcity	0-3 years	MENR, SWA, Azersu JSC, Amelioration JSC, National Parliament, NGOs, local authorities	- Developed/ implemented supportive policies for technology deployment	- State procedures may be slow to endorse proposed recommendations	State Funds	$ 150,000
Economic/financial									
2	Develop mechanism for provision of long-term and low-interest loans, as well as grants through state, private and international funds	High	- Create access to financial sources	0-5 years	MED, MENR, SWA, Azersu JSC, Amelioration JSC, local authorities	- Easy access to funds created for farmers	- Low interest of financial institutions - Insufficient State funds	State, International	$ 200,000
Information/capacity									
3	Capacity building for water management, operation and protection	High	- Increase capacities	0-10 years	MED, MENR, SWA, Azersu JSC, Amelioration JSC, local authorities	- Increased capacity	- No major risk	State, International	$ 600,000
4	Develop and conduct information campaigns on the advantages of applied technology	High	- Raise awareness level	0-5 years	MED, MENR, SWA, Azersu JSC, Amelioration JSC, local authorities	- Awareness level on advantages of new technology increase by 50%	- No major risk	State, International	$ 500,000
Other measures									
5	Develop mechanism for implementation of demonstrative pilot projects	High	- Demonstrate practical advantages	0-5 years	MENR, SWA, Azersu JSC, Amelioration JSC, local authorities	- Practical knowledge and skills of farmers increased	- Lack of funds	State, International	$ 700,000

2.3. Action plan for flood warning technology

Flood warning technology can improve security of the water supply and significantly reduce the effects of flooding, and their negative social and economic impacts. The cost of this technology is by far less than the economic damages that floods cause to the country.

Application of this technology lines with the country's social, economic and environmental development priorities. With regard to the country's social development priorities, this technology increases the livelihood of the population by reducing flood damage risks.

The summary of an enabling framework and related stakeholders needed to overcome the barriers of each technology is outlined in previous parts of this report. Overall, possible solutions for addressing the economic barriers include allocating funds for maintenance programs and research works and waiving copyright fees. For the capacity barriers, the possible solutions are listed as follows:

- Promoting the utilization and exchange of the data and research outcomes among stakeholders;
- Providing an accessible database free of charge;
- Developing data verification and screening systems with low uncertainty;
- Developing data standardization and data collection procedures;
- Providing training programs for data administrators to enable accurate data collection;
- Providing governmental scholarships or training programs to increase the number of skillful human resources in the fields of mathematic program development and GIS;
- Promoting international collaboration in conducting research for technology transfer.

The capability development of sensor webs emphasizes increasing the number of experts and practitioners, especially for governmental sectors. Device purchasing and maintenance are the major areas requiring technology investments.

There are no specific programmes or strategies in Azerbaijan related to application of flood warning technology.

Main barriers of technology diffusion could be listed as follows:

Barriers	**Application of flood warning technology**
Economic/financial	- High investment cost for surveying devices - High operating cost - Lack of funds
Policy/regulatory	- Lack of coordination among relevant institutions - Non-existence of mechanism for customs regulations for stimulation of import of necessary technology
Technological	- Lack of data and data management system - Lack of data linkage among the models - Lack of system to automatically analyze a situation to support a command
Information/capacity	- Lack of experts to develop programs for automatic analysis, processing, and interpreting images - Lack of research works including short-range run-off models and short-range weather forecast models

During the preparation of TAP, measures have been assessed taking into account their priorities, time scale, related stakeholders, key indicators for measuring implementation and funding resources.

TAP for the technology is provided in table 6.

Table 6: TAP for flood warning technology

#	Measures	Priority	Why it is important	Time scale	Related stakeholders, implementers	Key indicators	Risks	Funding sources	Costs
Policy/regulatory									
1	Clearly determining policy/agreement from state management in order to create understanding among agencies involved in data collection, co-ownership, and data sharing (urgent)	High	- Institutional basis improved	0-3 years	National Parliament, MENR, SWA, local authorities	- The number of data agreements	- State procedures may be slow to endorse proposed recommendations	State	$ 100,000
Economic/financial									
2	Investing in the procurement of high-quality devices used in conducting water source surveys	High	- Out-dated technology used	2 years	MED, MOF, MENR, SWA, NGOs, local authorities	- The budget ratio spent on the procurement of survey devices	- Insufficient State funds	State	$ 250,000
3	Determining a long-term budget plan to cover maintenance	High	- Lack of financial support during maintenance	2 years	MED, MOF, MENR, SWA, NGOs, local authorities	- Improved budget plan for maintenance	- Insufficient State funds	State	$ 60,000
Technology									
4	Promoting devices and supporting locally-developed devices/research works	High	- Need for modern technologies	0-4 years	National Academy of Sciences, MENR, SWA, NGOs, local authorities	- Improved capacity of R & D institutions	- No major risk	State, International	$ 200,000
5	Promoting research works in collaboration with foreign agencies/private companies in order to receive and transfer the technologies	High	- Need for modern technologies	0-4 years	National Academy of Sciences, MENR, SWA, NGOs, local authorities	- Improved capacity of R & D institutions	- No major risk	State, International	$ 60,000
Information/capacity									

#	Measures	Priority	Why it is important	Time scale	Related stakeholders, implementers	Key indicators	Risks	Funding sources	Costs
6	Enhancing the performance of data administrative officers to ensure they can collect and prepare data according to the standard before distributing the data	High	- There is need for capacity improvement	3 years	MENR, SWA, NGOs, local authorities	- The number of personnel capable of transferring knowledge on data collection and preparation	- No major risk	State, International	$ 200,000
7	Providing knowledge and understanding on how the system operates to both managers and operators, in order to set an efficient line of command	High	- There is need for capacity improvement	3 years	MENR, SWA, NGOs, local authorities	- The number of trainings/meetings	- No major risk	State, International	$ 250,000
8	Developing governmental personnel involved in R & D in mathematic programs/geo-informatics	High	- There is need for capacity improvement	5 years	MENR, SWA, NGOs, local authorities	- The number of personnel in the fields of mathematic programs/geo-informatics	- Weak collaboration of personnel	State, International	$ 150,000
Other measures									
9	Develop mechanism for implementation of demonstrative pilot projects	High	- Demonstrate practical advantages	0-5 years	Local authorities, International and National donors, NGOs	- Practical knowledge and skills of farmers increased	- Lack of funds	State, International	$ 900,000

2.4. Action plan for water reclamation and reuse technology

Application of water reclamation and reuse technology lines with the country's social, economic and environmental development priorities. With regard to the country's economic development priorities, it should be noted that lack of adequate water supply during drought and seasonal dry periods could halt economic development and hinder human health and well-being. Water reclamation and reuse can help to address local demands for technical water use, decrease travel time to remote water sources, increase agricultural productivity and reduce depletion of groundwater resources.

The water and nutrients that can be recovered from wastewater are simply too valuable to waste in areas where resources are limited. For this reason, it is very common for farmers in developing countries to supplement their crop irrigation supplies with wastewater. In fact, except for a handful of cases where applications such as natural filtration systems for water reclamation, sewage reclamation for industrial uses, or direct potable reuse have been implemented, almost all water reclamation and reuse in developing countries is dedicated to agricultural irrigation. Not only does this practice increase the volume of water available for crops and utilize the nutrients in wastewater in a beneficial way, it also contributes to greater quality of human life by increasing household water availability.

There are no specific programmes or strategies in Azerbaijan related to application of water reclamation and reuse technology.

Main barriers of technology diffusion could be listed as follows:

Barriers	**Application of water reclamation and reuse technology**
Economic/financial	- High capital costs - Inadequate financial initiatives
Policy/regulatory	- Weak regulatory and legislative framework - Non-existence of mechanism for customs regulations for stimulation of import of technology - Weak institutional basis - Lack of coordination among relevant institutions
Technological	- Weak access to high priority technology
Information/capacity	- Limited awareness and lack of capacity of local authorities, communal units and residents on advantages of the technology
Social	- Unfamiliarity with the technology

During the preparation of TAP, measures have been assessed taking into account their priorities, time scale, related stakeholders, key indicators for measuring implementation and funding resources.

TAP for the technology is provided in table 7.

Table 7: TAP for water reclamation and reuse technology

#	Measures	Priority	Why it is important	Time scale	Related stakeholders, implementers	Key indicators	Risks	Funding sources	Costs
Policy/regulatory									
1	Support policies for local deployment of the technology	High	- Promote application of technology in areas with water scarcity	0-3 years	MENR, SWA, Azersu JSC, Amelioration JSC, National Parliament, NGOs, local authorities	- Developed/implemented supportive policies	- State procedures may be slow to endorse proposed recommendations	State Funds	$ 100,000
Economic/financial									
2	Develop mechanism for provision of long-term and low-interest loans, as well as grants through state, private and international funds	High	- Create access to financial sources	0-5 years	MED, MENR, SWA, Azersu JSC, Amelioration JSC, local authorities	- Easy access to funds created for farmers	- Low interest of financial institutions - Insufficient State funds	State, International	$ 80,000
Information/capacity building									
3	Capacity building for waste water reclamation and reuse	High	- Increase capacities	0-10 years	MED, MENR, SWA, Azersu JSC, Amelioration JSC, local authorities	- Increased capacity	- No major risk	State, International	$ 300,000
4	Develop and conduct information campaigns on the advantages of applied technology	High	- Raise awareness level	0-5 years	MED, MENR, SWA, Azersu JSC, Amelioration JSC, local authorities	- Awareness level on advantages of new technology increase by 50%	- No major risk	State, International	$ 200,000
Other measures									
5	Develop mechanism for implementation of demonstrative pilot projects	High	- Demonstrate practical advantages	0-5 years	MENR, SWA, Azersu JSC, Amelioration JSC, local authorities	- Practical knowledge and skills of farmers increased	- Lack of funds	State, International	$ 400,000

2.5. Action plan for reducing water leakages in water management facilities technology

Management, detection and repair of small leaks in a distribution system are critical functions of system operation and maintenance, yet they are often neglected.

This technology can improve security of water supply. The cost of this technology is by far less than the economic damages to the country caused by water losses in the water supply system.

Application of this technology lines with the country's social, economic and environmental development priorities. With regard to the country's social development priorities, it increases the livelihood of the population by reducing water scarcity risks.

A warmer climate is highly likely to result in more frequent droughts. Additionally, population growth will push many countries into water stress and water scarcity in the coming decades. Detection and repair of leaks in water systems is an important part of comprehensive strategies to reduce pressure on existing water resources.

There are no specific programmes or strategies in Azerbaijan related to application of reducing water leakages in water management facilities technology.

Main barriers of technology diffusion could be listed as follows:

Barriers	**Application of reducing water leakages in water management facilities technology**
Economic/financial	- High capital costs - Inadequate financial initiatives
Policy/regulatory	- Weak regulatory and legislative framework - Weak institutional basis - Lack of coordination among relevant institutions - Non-existence of mechanism for customs regulations for stimulation of import of necessary technology
Technological	- Weak access to high priority technology
Information/capacity	- Low awareness and lack of capacity of local authorities, communal units and residents on advantages of the technology

During the preparation of TAP, measures have been assessed taking into account their priorities, time scale, related stakeholders, key indicators for measuring implementation and funding resources.

TAP for the technology is provided in table 8.

Table 8: TAP for reducing water leakages in water management facilities technology

#	Measures	Priority	Why it is important	Time scale	Related stakeholders, implementers	Key indicators	Risks	Funding sources	Costs
Policy/regulatory									
1	Provision of policies and legal frameworks that facilitate application of leakage management programs to either be created or aligned, in order to ensure efficient use of water resources	High	- Improve legislative base	3 years	National Parliament, MENR, SWA, NGOs, local authorities	- Legal basis will be created to apply the technology	- State procedures may be slow to endorse proposed recommendations	State	$ 100,000
Economic/financial									
2	Expanding financing opportunities and services for leakage management initiatives	High	- Need for financial support	2 years	MED, MOF, MENR, SWA, NGOs, local authorities	- The budget ratio spent on the procurement of survey devices	- Insufficient State funds	State	$ 250,000
3	Determining a long-term budget plan to cover maintenance	High	- Lack of financial support during maintenance	2 years	MED, MOF, MENR, SWA, NGOs, local authorities	- Improved budget plan for maintenance	- Insufficient State funds	State	$ 60,000
Technology									
4	Promoting devices and supporting locally-developed devices/research works	High	- Need for modern technologies	0-4 years	National Academy of Sciences, MENR, SWA, NGOs, local authorities	- Improved capacity of R & D institutions	- No major risk	State, International	$ 100,000
5	Promoting research works in collaboration with foreign agencies/private companies in order to receive and transfer the technologies	High	- Need for modern technologies	0-4 years	National Academy of Sciences, MENR, SWA, NGOs, local authorities	- Improved capacity of R & D institutions	- No major risk	State, International	$ 60,000
Information/capacity building									

#	Measures	Priority	Why it is important	Time scale	Related stakeholders, implementers	Key indicators	Risks	Funding sources	Costs
6	Enhancing the performance of data administrative officers to ensure they can collect and prepare data according to the standard before distributing the data	High	- There is need for capacity improvement	3 years	MENR, SWA, NGOs, local authorities	- The number of personnel capable of transferring knowledge on data collection and preparation	- No major risk	State, International	$ 200,000
7	Strengthening capacity and supporting national and local institutions to improve effectiveness in regulating and managing water losses, including leakage detection and management	High	- There is need for capacity improvement	3 years	MENR, SWA, NGOs, local authorities	- The number of trainings/meetings	- No major risk	State, International	$ 250,000
8	Improving the capability of utilities and potential users to understand and access leak management services	High	- There is need for capacity improvement	5 years	MENR, SWA, NGOs, local authorities	- The number of personnel in the fields of mathematic programs/geo-informatics	- Weak collaboration of personnel	State, International	$ 150,000
Other measures									
9	Implementation of demonstrative pilot projects	High	- Demonstrate practical advantages	0-5 years	Local authorities, International and National donors, NGOs	- Practical knowledge and skills of farmers increased	- Lack of funds	State, International	$ 600,000

CHAPTER 3. CROSS-CUTTING ISSUES

There are several cross-cutting issues that constitute common barriers for prioritized technologies under the agricultural and water sectors. These issues result in insufficient development of climate change adaptation technologies in the country and create common barriers to their implementation.

More focus on climate change adaptation issues

Although there are several development programmes related to the agricultural and water sectors, almost all of them are lacking in aspects related to climate change adaptation actions. It is primarily poor knowledge and weak capacity of ongoing and forecasted climate change consequences, on the part of governmental specialists, that is responsible for this lack of programme planning and development. Adaptation actions in light of climate change should be considered at the national level as one of the future threats creating obstacles to the country's development strategy.

Strengthening capacity of R & D institutions

Improved capacity of R & D institutions with targeted programs and effective coordination with ongoing programs is significant for the successful deployment and dissemination of high priority technologies. The National Academy of Sciences and relevant R & D institutions within the Ministry of Agriculture must be strengthened in order to address the needs of study, testing, design adaptation, and other innovations. Expert support for these technologies should include, information provision, skills and capacity building training. Additionally, all R & D institutions are in need of up-to-date technical capacity to be able to provide comprehensive research.

Stakeholder Coordination

Better coordination between the donor agencies, private sector initiatives and NGOs is needed for application of technologies. This is an opportunity for improving the quality of the projects and achieving better joint results. The quality of pilot projects can be significantly improved with stronger coordination and emphasizing of information and outreach components. This will help to collect, analyze and disseminate the practical information, thereby increasing general awareness of the population and the decision makers who would be willing to take the necessary policy measures.

Access to information at different levels

There is a general lack of practical information about the selected technologies, including their principles of operation, costs and benefits, operation and maintenance guidelines and selection criteria. This is mainly a result of the lack of access to information of local farmers living in remote rural areas.

Strengthening of R & D institutions and extension service providers could partly address this problem, through the dedicated data repositories and websites, as well as through more knowledgeable experts. To obtain adequate information and learning materials, international cooperation needs to be strengthened.

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Annex I. List of stakeholders involved and their contacts

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