GHANA

TECHNOLOGY ACTION PLAN

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TNA Project Team

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Dr. George Owusu Essegbey
Lead Expert
February 2013

FOREWORD

Technology Needs Assessment (TNA) is generally aimed at enhancing adaptation to climate change in Ghana. A national stakeholder consultation process, resulted in the selection of the agriculture and water sectors. The two sectors are closely linked since water availability in various forms support agricultural production and ensures food security. On the other hand, a well managed agricultural system also supports water availability.

For these sectors to be resilient to the impact of climate change, there is the need to transfer and diffuse technology to the actors in these sectors for adaptation and use. Appropriate measures therefore need to be put in place to address barriers in the TNA process.

Further, the TNA process requires the formulation of a Technology Action Plan (TAP). The TAP takes account of national projects which have been executed in the past in line with national aspirations for adaptation to climate change, as well as the prevailing national development framework and relevant sector policies.

In the TAP, two technologies in each of the sectors were prioritized. For the water sector, the prioritized technologies are (1) Rainwater collection from ground surfaces and post-construction support for community managed water systems. There were also two prioritized technologies for the agriculture sector namely (i) Integrated Nutrient Management and Community Based Extension Agents.

After identifying the prioritized technologies, well-designed plans were proposed by stakeholders. These were target groups to receive the technologies, the cost of diffusion, agro-ecological zone and the cost.

In the water sector, stakeholders projected that the prioritized technologies will be deployed to 600 savannah communities nationwide at an estimated cost of thirty one point two million United States Dollars ($31.2 million).

With regards to the agriculture sector, it is planned that the identified technologies will be deployed to all 100 farmers in each of the 500 selected communities nationwide. The total estimated cost is twenty two point three million United States dollars (S$22.3).

It is hoped that the cost of the proposed technologies will not in itself constitute a barrier to the transfer and diffusion of the technologies and that, development partners and friends of Ghana will ensure enough resources for the TAP to be implemented.

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20th March, 2013

LIST OF ABBREVIATION AND ACRONYMS

AUC	-	African Union Commission
CAADP	-	Comprehensive African Agriculture Development Programme
CBEA	-	Community Based Extension Agents
CSIR	-	Council for Scientific Industrial Research
CWSA	-	Community Water and Sanitation Agency
ECOWAS	-	Economic Community of West Africa State
FASDEP	-	Food and Agriculture Sector Development Policy
GDP	-	Gross Domestic Product
GSGDA	-	Ghana Shared Growth and Development Agenda
INM	-	Integrated Nutrient Management
ISFM	-	Integrated Soil Fertility Management
IWRM	-	Integrated Water Resources Management
METASIP	-	Medium Term Agricultural Sector Investment Plan
MoFA	-	Ministry of Food And Agriculture
MWRWH	-	Ministry of Water Resources, Works and Housing
NCCAS	-	National Climate Change Adaptation Strategy
NGOs	-	Non ï Governmental Organizations
PCS	-	Post - Construction Support
R&D	-	Research and Development
SADA	-	Savanna Accelerated Development Authority
STI	-	Science, Technology and Innovation
TAP	-	Technology Action Plan
TNA	-	Technology Needs Assessment
WRC	-	Water Resources Commission

TABLE OF CONTENT

List of Tables

Executive Summary

The Technology Needs Assessment (TNA) Project in Ghana is generally aimed at enhancing adaptation to climate change. Through the stakeholder consultation process, the water and agriculture sectors were selected for the project. The two sectors are inter-linked as the availability of water in its various forms support agricultural practices. On the other hand, agriculture which is the backbone of the national economy also stimulates efforts to ensure sustainable water availability. For Ghana, the negative climate change impact in the two sectors ï water and agriculture ï needs to be effectively combated to assure and sustain socio-economic development. This rationale therefore informs the preparation of the Technology Action Plan (TAP).

In the two sectors, there is an urgent need for the transfer and diffusion of technologies, which will enhance resilience to climate change impacts. The Technology Action Plan basically derives from the technology selection and prioritization as outlined in the TNA process and the subsequent barrier analysis. In addition, the TAP also builds on some projects which have been executed in the past in line with the national aspirations for adaptation to climate change. In this regard, two of the prioritized technologies for each sector are focused on in this TAP.

For the water sector, these are:

(i) Rainwater collection from ground surfaces and

(ii) Post construction support for community managed water systems.

The TAP component for the agriculture sector focuses on the following two of the prioritised technologies for diffusion:

(i) Integrated Nutrient Management (INM)

(ii) Community Based Extension Agents (CBEA)

The technology of the Rainwater Collection from Ground Surfaces covers collection, storage and use of rainfall that lands on the ground as opposed to collection from roofs with the intention for multi-purpose use in the communities. In many water-poor areas, small-scale runoff collection infrastructure can contribute greatly to the volume of freshwater available for human use and

other multi-purpose uses. The transfer and diffusion of this technology is envisaged for the 100 Savannah communities in Ghana. The total cost of the project is estimated at $22.2 million.

For the Rainwater Collection from Ground Surfaces, the diffusion of this technology comes against certain economic and financial barriers as well as non-financial barriers. Economic and financial barriers were mainly the high construction and maintenance cost and high cost of feasibility studies. The non-financial barriers relate to institutional and technical barriers. Institutional barriers identified included lack of community ownership of the water system, conflicting sectoral policies on the promotion of the technology and inadequate integration of the technology in policy plans. The technical barriers included the inadequate expertise in the various communities. All these barriers result in the weakening of the driving mechanisms from government agencies in pushing for the widespread adoption of the technology.

The Post-Construction Support (PCS) technology is aimed at increasing the success and sustainability of community-managed water systems. This is even true for those systems that are implemented according to all the currently recognized best practices of the demand-driven, community-managed model. PCS is typically carried out through government programs, municipalities and other bodies that provide community-managed water systems. It is a technology intended for diffusion in a sample of some 500 communities nationwide at an estimated cost of $9.0 million.

The main economic and financial barrier for the Post-Construction Support (PCS) technology is inadequacy of funds available to communities for emergency repairs and general maintenance of their water systems. This results directly from high maintenance costs and inadequate access of communities to financial resources. The institutional barriers to the diffusion of this technology are conflicting sectoral policies resulting in lack of co-ordination in the implementation of the technology, ineffective management teams at the community level as result of inadequate involvement of communities in implementation of technology and also weak local or district level institutions incapable of effectively driving the management process.

The Integrated Nutrient Management (INM) is also referred to as Integrated Soil Fertility Management (ISFM). The technology aims at making efficient use of both synthetic and natural plant nutrient (organic) sources to enhance soil fertility towards improving and preserving soil productivity. The success of INM relies on the appropriate application and conservation of nutrients and transfer of knowledge to farmers. It is proposed that INM is transferred and diffused as a project nationwide. The target is to diffuse the technology to 100,000 farmers in all the regions to enhance soil fertility management in response to climate change adaptation. The estimated budget is $9.3.

There are general barriers to the diffusion to the INM and CBEA technologies similar to those in the water sector. In respect of the INM, there are sometimes technical deficiencies on the part of the specialists in the agricultural institutions as well as attitudinal problems. Socio-cultural practices are also major barriers. A typical example is the practice of bush-burning that deplete soil nutrients in many cases on the arable lands. The review of government policy on pricing of commodities (both local and imported) is a basic necessity for reducing the cost of chemical fertilizers and improving incomes from agricultural production. However, there is the need for a national programme on the transfer and diffusion of INM technology.

The Community Based Extension Agents (CBEA) is a rural agricultural extension model based on the idea of providing specialised and intensive technical training to identified people in rural communities to promote a variety of technologies and offer technical services with support and review from an extension organization. The CBEA is a demand-driven model, which provides opportunity for farmersô groups or communities to contact the service provider for specific information and related services. The community based extension model can contribute to climate change adaptation through the training of service providers in climate data collection; analysis and dissemination within their areas of operation to enable communities select appropriate response strategies. TAP proposes the diffusion of CBEA in 500 selected communities in the regions to improve the diverse agricultural practices including crop farming, livestock rearing and fishing. The estimated budget is $13 million.

Inadequate extension service to farmers resulting in non-application of improved farming practices is the base problem, which the CBEA technology addresses. There are the usual

economic and non-economic barriers. The economic and financial barrier to the smooth promotion and diffusion of this technology revolves around lack of motivation for available agriculture extension personnel. Closely associated with this is the absence or inadequacy of financial benefits for the job the agents do within their communities and absence of tools and equipment to enable them perform their duties satisfactorily. Closely associated with the above is inadequate training for the agents. However, the CBEA transfer and diffusion project has the potential to address some of these barriers.

Action plans have been elaborated for the four prioritised technologies. The process of elaboration of the action plans involved a consultation process which ensured that the key stakeholders participated in the decisions made on the plans. The lead agencies of the Ghana Irrigation Development Authority, the Water Resources Commission, the farmers, researchers and civil society organizations, were represented at the stakeholders workshop organized to deliberate on the technology action plans. (See Annex 1 for the list of participants of the workshop.) The experts presented the drafts of the plans and the working groups formed for the two sectors namely, water and agriculture, discussed the action plans and revised appropriately. The experts later finalized the plans.

It is envisaged that the technology transfer and diffusion of these four prioritised technologies in the water and agricultural sectors will be done in the appropriate phases. However, there are cross-cutting issues, which need to be considered as generally applying to the technology transfer and diffusion process.

An important measure that cuts across is the review of national policies to address various issues including market competition, financial regulations, socio-cultural practices and beliefs. For example, financial measures hinge mainly on the need for government action to reduce cost of supply of inputs or materials and equipment for the technologies. This can be done at the macro level through reduction in interest rates to less than 20%, reduction of import duties, stabilization of the exchange rate and institution of tax relief incentives to suppliers of these materials and equipment.

Introduction

The relevant national development documents underscore the need to ensure that the TAP resonates with national development strategies. For example, the Ghana Shared Growth and Development Agenda (GSGDA) provides the reference point for elaboration of sector-specific policies and programmes. It underscores the application and development of Science, Technology and Innovation (STI) in socio-economic activities (Government of Ghana, 2010). The sustainable exploitation and management of Ghanaôs natural resources such as water and the structural transformation of the economy through industrialization based on modernized agriculture are key policy thrusts elaborated in the GSGDA. The overall thrust of national development of Ghana underscores the importance of the prioritization of the water and agriculture sectors for climate change adaptation for the TNA Project.

There is also the National Climate Change Adaptation Strategy (NCCAS), which encapsulates the national aspirations for adaptation (EPA & UNDP, 2011). According to the NCCAS, the overall goal is to enhance Ghanaôs current and future development by strengthening its adaptive capacity with regard to climate change impacts and building the resilience of the society and ecosystems. These national documents further amplify the prioritisation achieved in the TNA process and underscore the design and implementation of action plans for the transfer and diffusion of the prioritized technologies.

1 Technology Action Plan for the Water Sector

The water sector is important for its impact across sectors of the economy. It is important for agriculture, industry and health. Ghana is generally well-endowed in water resources with abundance of freshwater bodies and the national territorial marine waters of the Gulf of Guinea. The inland water resources of the country including one of the largest man-made lakes in the world ï the Volta Lake and the rivers Pra, Ankobra, Tano, Birim and Densu cover about 5% of the total land area (11,800 km^2) (Environmental Protection Agency, 2005). This provides the basis for socio-economic activities for the rural people.

However, harnessing the resources of these water bodies for agriculture through irrigation is very limited and therefore rainfall remains the underpinning factor in farming. The range of annual rainfall of 1,000 mm in the North of the country and 2,250 mm in the South-West fairly supports a diversity of farming activities (Environmental Protection Agency, 2005). Nevertheless the seasonality of the rains and the challenge of climate change demands adaptation measures that strengthen resilience of the dependent communities.

1.1 Actions at Sectoral Level

The National Water Policy projects the vision of ensuring potable water supply to all human settlements irrespective of their location (Ministry of Water Resources, Works and Housing, 2007). Ghana is said to be on the way of achieving the MDG of halving the percentage of population with access to safe-drinking water by 2015. The current drive of the Community Water and Sanitation Agency (CWSA) to supply water to rural and small town communities has greatly increased the pace of water provisioning outside of urban areas. However the reliance on water bodies such as lakes and rivers is under pressure as the changes in climactic conditions and human socio-economic practices are affecting these water bodies and undermining their sustainability. There is therefore the need to adopt technologies that will enhance resilience of vulnerable communities and promote effective adaptation behaviors to climate change. Over the years, various policies, legislations and programmes have been formulated to create the conditions for sustainable exploitation and management of Ghanaôs water resources. Table 1.1 gives an overview of the policies and laws existing in the water sector, when enacted and the gist of their contents.

Table 1.1 The Existing Policies and Laws in the Water Sector

Existing Policies/ Laws	When Enacted	Main Content
Water Resources Commission Act, 1996 ï Act 522	1996	The Act provides for the establishment of the WRC. It spells out the composition and functions of the Commission on the regulations and management of the utilization of water resources in Ghana and related matters.
Water Use Regulations Legislative	2001	The L.I. sets out regulations for the issuance of water use permits or grant of water rights for various water uses including domestic, commercial, industrial and agricultural water uses. The provisions of LI 1692 cover

Instrument L.I. 1692 (2001)		various aspects such as water uses that should be permitted, the application procedure, water use in cases of conflict between and among users and monitoring of water use activities.
National Water Policy	2007	Ghanaôs water vision 2025 is to ñpromote an efficient and effective management system and environmentally sound development of all water resources in Ghana.ò The overall goal of the National Water Policy is to "achieve sustainable development, management and use of Ghana's water resources to improve health and livelihoods, reduce vulnerability while assuring good governance for present and future generations". This will be achieved by addressing relevant issues under water resources management, urban water supply and community water and sanitation.
Gender and Water Resources Management Strategy (2011 ï 2015)	2011	The Strategy is to institutionalize gender equity and sensitivity/responsiveness as an essential tool for achieving the sustainable use, management and development of the Ghanaôs water resources. It seeks to implement a sustainable and responsible water resources management system where women and men staff and the women and men of the basin or catchment areas can derive the full and equitable benefits and rights from Ghanaôs water resources.
Riparian Buffer Zone Policy	2012	The policy is aimed at protecting Ghanaôs water bodies by developing and maintaining buffer zones round them.

Source: Ministry of Water Resources, Works and Housing, 2007; WRC, 2011; WRC, 2012

The various policies of the water sector have provided the basis for the formulation and initiation of specific programmes or projects to enhance adaptation in Ghana. An example is the Project on Climate Change Adaptation through Integrated Water Resources Management (IWRM) in the three Northern Regions of Ghana. The DANIDA-sponsored project was meant to address floods and drought disasters on the biophysical environment, and to collate indigenous knowledge on adaptation. The project focused on promoting adaptive and coping strategies for water resources use and management to reduce livelihood vulnerability in the three northern regions. It was implemented from 2009 to 2011.

The Technology Action Plan proposed basically derives from the technology selection and prioritization as outlined in the TNA process and the subsequent barrier analysis. However, the TAP also builds on some of the projects which have been executed in the past such as the DANIDA-sponsored project. In this regard, two of the prioritized technologies for the water sector are developed further for action. These are:

(i) Rainwater collection from ground surfaces and

(ii) Post construction support for community managed water systems.

The technology of the Rainwater Collection from Ground Surfaces, which is currently being promoted on a limited scale in Ghana, covers collection, storage and use of rainfall that lands on the ground as opposed to collection from roofs with the intention for multi-purpose use in the communities. In many water-poor areas, small-scale runoff collection infrastructure can contribute greatly to the volume of freshwater available for human use and other multi-purpose uses including agricultural uses. The Post-Construction Support (PCS) technology is aimed at increasing the success and sustainability of community-managed water systems. This is important for all communities where water resources systems have been built. PCS is typically carried out through government programs, municipalities and other bodies that provide community-managed water systems. These two technologies ï the Rainwater Collection from Ground Surfaces and the PCS ï present a great opportunity for enhancing water security in the rural areas.

Generally, the barriers to the technologies could be categorized as Institutional, Technical, Socio-cultural and Economic/Financial. In the water sector, institutional barriers relate to inefficiencies in institutions set up for the purposes of harnessing and exploiting water resources of the country. There are sometimes technical deficiencies on the part of the specialists in the water institutions and these create barriers for the diffusion process. The socio-cultural practices especially as relates to peopleôs attitude and management culture of the water systems constitute barriers which need to be addressed. The economic and financial barriers are those that pertain to market inefficiencies and market failures. Against these barriers are measures that broadly include policy formulation and review, awareness creation and sensitization, capacity building and incentives for the relevant stakeholders.

1.2 Action Plan for Rainwater Collection from Ground Surfaces

1.2.1 Description of the Technology

The technology of the Rainwater Collection from Ground Surfaces covers collection, storage and use of rainfall that lands on the ground as opposed to collection from roofs with the intention for multi-purpose use in the communities. In many water-poor areas, small-scale runoff collection infrastructure can contribute greatly to the volume of freshwater available for human use and other multi-purpose uses. This is especially true in arid and semi-arid regions, where the little rainfall received is usually very intense and often seasonal (Elliot et. al, 2011). Because of this, runoff and river flows can be abundant for brief periods and non-existent throughout the rest of the year, as is the case in Northern Ghana.

Rainwater collection from ground surfaces is typically used in areas with seasonal rainfall to ensure that adequate water is available during the dry season. It is major adaptation intervention to make water available to communities in the dry season, particularly in the drier northern regions of Ghana. Several such systems exist in the country for domestic water supply, dry season agriculture and livestock watering but these are woefully inadequate at present. The technology has been recommended in the NCCAS and is very high on the governmentôs development policy and agenda. The water stored in these surface reservoirs is available in the dry period for irrigation, livestock watering and domestic needs. Experience in Ghana and elsewhere has shown that properly managed community dams are a big relief to communities vulnerable to water shortage in the dry season. Major environmental benefits of such reservoirs include the replenishment of nearby groundwater reserves and wells and the nourishment of neighbouring ecosystems

The technology consists essentially of collecting flows from a river, stream or other natural watercourse (sometimes called floodwater harvesting). This technique often includes an earthen or other structure to dam the watercourse and form ñsmall reservoirs.ò Rainwater collection from ground surfaces contributes to climate change adaptation at the community level by providing a convenient and reliable water supply during seasonal dry periods and droughts.

1.2.2 Target for Transfer and Diffusion

It is intended that the transfer and diffusion of the technology will be done within ten years phased into two five-year terms beginning from 2013. The target populations are the communities living mostly in the Savannah regions of Ghana where there is great need to ensure reliable water sources during the long crisis periods. Thus the three northern regions and some parts of Brong-Ahafo, Volta and Greater Accra Regions will form the target populations for the transfer and diffusion of the Rainwater Collection from Ground Surfaces technology. Specifically, it is envisaged that the project will provide 100 run-off storage facilities each of 1 million m^3 maximum storage capacity for 100 rural communities for multiple use of water.

1.2.3 Barriers to the Technology Diffusion

Fundamentally, the critical problem the technology addresses is the insufficiency of water to support livelihoods of rural communities resulting in poor community health and poor school attendance, particularly for the girl-child. The diffusion of this technology comes against certain economic and financial barriers as well as non-financial barriers.

Economic and financial barriers were mainly the high construction and maintenance cost and high cost of feasibility studies. The important root causes are few technical experts and artisans at the local level to undertake construction of the water system in a cost effective manner. In addition, high import tariffs (up to 20% depending on the item imported), high interest rates (above 20%) and unstable exchange rate (from cedi/dollar rate of about 1.64/1 in January 2012 to about 1.90/1 in December, 2012) result in high cost of production and imports of construction materials and equipment. Also there is not enough support from government (such as tax reduction incentives) to suppliers of these materials and equipment, particularly at the local level, resulting in inadequate supplies and high prices.

The non-financial barriers relate to institutional and technical barriers. Institutional barriers identified were lack of community ownership of the water system, conflicting sectoral policies on the promotion of the technology and inadequate integration of the technology in policy plans. This results in the weakening of the driving mechanisms from government agencies in pushing for the widespread adoption of the technology. In particular, conflicting or unharmonized

sectoral policies on the technology result in an uncoordinated effort in the promotion of the technology. Root causes of the institutional barriers are inadequate community development specialists and logistics to design and implement appropriate community educational and awareness-raising programs in beneficiary communities and incoherent government policy on climate change to drive the adoption of the technology. Lack of awareness raising in beneficiary communities means they are not animated enough to accept the technologies as their own ï a prerequisite to successful diffusion of the technology. In addition, the implementation of the national climate change policy needs to strengthen the strategies for diffusing adaptation technologies in the water sector.

Water systems provided for single use only (e.g. for domestic only and not also for agriculture) and inadequate capacity of users to manage the technology were some of the technical barriers to the technology. Provision of systems for single water use only means there is no flexibility in such systems to support other water uses that might contribute to the incomes of beneficiary communities later. In other words, the technology that supports multipurpose use by beneficiaries would be more likely to be readily accepted and maintained than that supporting single purpose use only. Sustainability of the technology would not be easily achieved if the communities do not have the necessary capacity both in terms of know-how and material resources to adequately manage it.

The poor environmental conditions resulting in poor quality of collected water, lack of cultural acceptance of change and bias against women and other vulnerable groups in the management and use of the water systems, are some of the socio-cultural barriers. Women are major stakeholders in water resources use and management. Socio-cultural biases against them in decision making and implementation in rural communities could result in the technology not benefiting them and other vulnerable groups in the communities. There is also the lack of cultural acceptance of change on the part of beneficiary communities which implies that these communities could resist the adoption of the technology for no technical reason. However, the root causes of the socio-cultural barriers are largely inadequate technical expertise and logistics at the local level to properly animate communities and raise their awareness.

1.2.4 Measures for the Rainwater Collection Technology

An important measure to address the barriers is the development and operationalization of a coherent project on climate change adaptation to diffuse the technology as a mechanism to increase the resilience of vulnerable communities to the impacts of climate change on water availability especially in the water-stressed Savannah regions of Ghana. The project needs to be holistically implemented across the various levels of governance and stakeholder institutions. TAP envisages the construction of multi-purpose dugouts where the emphasis is on domestic water use, watering of livestock and crop agriculture. The actual cost of the dugouts will depend on various factors such as the total population expected to benefit, the targeted irrigable area for crop agriculture and the type and population of livestock in the catchment area. The proposal as outlined in this TAP costs an estimated $100,000 for a dugout capacity of 1 million m^3 for a rural community of about 500 people. It is envisaged that a total of 100 communities will have these technologies built for them at a total cost of US $22.2 million.

One measure to overcome the institutional barriers is the recruitment and training of more community development specialists at the local level to animate and raise the awareness of communities sufficiently to enable them assume ownership of the deployed technology.

For technical measures, it would be necessary to improve the technical capacity of local skilled artisans through appropriate training so they could take into account the need for the technology to satisfy multiple and not just one need. In this regard, the project envisages training, equipping and incentivising maintenance corps (five skilled persons per facility) in the project communities.

Another measure is ensuring that the necessary expertise, specialists and logistics are available at the local level to provide the necessary training that will enable beneficiary communities manage the technology and derive optimum benefit from it.

To overcome the socio-cultural barriers, adequate resources would need to be provided at the respective levels for effective educational programs in the communities to be undertaken. In order to ensure synergistic action, the project activities need to be coordinated at the various levels of governance. The action plan based on the measures is presented in Table 1.2.

Table 1.2 Summary of Action Plan for Rainwater Collection Technology

Action/ Measure	*Why Action*	*Responsible Agent(s)/ Responsibilities*	*Period*	*Cost (USD)*	*Source of Funding*	*Indicator of Success*	*Challenges*
1. Provision of 100 Run-off storage facilities each of 1 million m^3 maximum storage capacity for 100 rural communities to provide water for multiple use	Communities in Northern and coastal Savannah need to ensure reliable water sources during the long crisis periods.	District Assemblies in collaboration with the MWRWH: *MWRWH – coordination and oversight* *District Assemblies – implementation in districts.*	2013 ï 2017	Average cost of $200,000 per facility Total: $20,000,000	Government of Ghana, Development partners, Savannah Accelerated Development Authority (SADA)	80% of the facilities completed within 5 years.	- Availability of feasible sites. -conflicts in ownership of the land for potential sites -Co-operation of beneficiary communities -
2. Ensuring post-construction management system ï sensitization, awareness creation, monitoring and coordination.	Post construction management has been a major weakness in the sustainability of existing facilities.	District Assemblies in collaboration with sector Ministry and Project Coordinating Unit: *PCU and district assemblies – awareness creation, monitoring*	2013 ï 2017	Average cost per facility of $10,000 Total: $1,000,000	Government of Ghana, Development partners, Savannah Accelerated Development Authority (SADA)	90% functional run-off storage facilities in the communities.	-Willingness of communities to manage the systems
3. Training, equipping and incentivising maintenance corps (5 skilled persons per	There is need for skilled manpower for the maintenance of	District Assemblies ï *training and implementation in the districts*	2013 ï 2017	Average cost per team is $12,000 Total:	Government of Ghana, Development partners, Savannah	90% functional run-off storage facilities in	- Availability people of minimum education (Junior High

facility)	the facilities.			$1,200,000	Accelerated Development Authority (SADA)	the communities.	School level) in the communities to be trained.
Total				$22,200,000			

1.3 Action Plan for Post Construction Support for Community-Managed Water Systems

1.3.1 Description of Technology

The Post-Construction Support (PCS) technology is aimed at increasing the success and sustainability of community-managed water systems. This is even true for those systems that are implemented according to all the currently recognized best practices of the ñdemand-drivenò, community-managed model. PCS is typically carried out through government programs, municipalities and other bodies that provide community-managed water systems. Thus, it is an orgware technology. Types of PCS include, but are not limited to:

- Technical training for water system operators;
- Technical and engineering support, including provision of technical manuals;
- Financial and accounting assistance (e.g. setting tariffs);
- Help with settling disputes (e.g. bill payment or water sources);
- Help with maintenance, repairs and finding spare parts;
- Assistance in finding external funding for O&M, expansion or repairs;
- Assistance in assessing the sufficiency of supply for expansion or in the case of drought;
- Start-up capital for emergency system repairs;
- Household visits to residents to discuss water system use (Elliot *et. al*, 2011).

PCS contributes to climate change adaptation at the community level through:

a) Diversification of community water supply;
b) Promotion of water conservation, and
c) Increased resilience to water quality degradation.

PCS can empower community water committees and operators to access the financial, management and technical resources that enable utility-managed supplies to prepare for and adapt to adverse precipitation conditions. PCS facilitates community ownership, management

and maintenance of water systems, promotes women participation in their management and improves system performance and sustainability.

1.3.2 Target for Transfer and Diffusion

Over the years, various types of water systems have been built in several communities in all the ten regions of Ghana. The action plan for the transfer and diffusion of the PCS technology, targets 500 communities in the country where there are various types of water systems. In most of the communities where there are these systems there are serious challenges with maintenance. It is intended that the transfer and diffusion of the technology will be done within a five-year period beginning from 2013 (to 2017).

1.3.3 Barriers to the Transfer and Diffusion of the Technology

The fundamental problem this technology provides solution to, is the poorly managed community water systems resulting in reduced accessibility of communities to good quality water, increased poverty and general poor community health and wellbeing. There are economic and socio-cultural constraints in the transfer and diffusion of this technology.

The main economic and financial barrier is inadequacy of funds available to communities for emergency repairs and general maintenance of their water systems. This results directly from high maintenance costs and inadequate access of communities to financial resources. The important root causes are the inadequate financial support from government and inadequate support of external agencies resulting in limited maintenance of the community water systems.

The institutional barriers to the diffusion of this technology are conflicting sectoral policies resulting in lack of co-ordination in the implementation of the technology, ineffective management teams at the community level as result of inadequate involvement of communities in implementation of technology and also weak local or district level institutions incapable of effectively driving the management process. Another institutional barrier is inadequate integration of the technology in policy plans resulting in insufficient support from government and other agencies in driving the processes for its implementation.

Technical barriers include untimely maintenance of water systems by communities due to lack of adequate capacity. The root causes of this barrier are inadequate technical and financial management expertise at the local level to empower communities to effectively manage the technology and make it sustainable.

There are also the socio-cultural barriers. These include community reluctance to self-manage their water systems and bias against women and other vulnerable groups in the management and use of the water systems. The root causes are inadequate community development specialists and logistics to design and implement appropriate community educational and awareness-raising programs in beneficiary communities.

1.3.4 Measures to address the Barriers

Financial measures hinged mainly on the need for government action to allocate national resources for repair and maintenance of the community water systems within a project framework based on the PCS technology. Stakeholders also need to source complementary resources especially external support for the effective implementation of the technology.

A key institutional measure identified was the development and operationalization of a coherent government policy action on climate change recognising the technology as an important mechanism to increase the resilience of vulnerable communities to the impacts of climate change on water availability. Such a policy action should provide sufficient institutional arrangement for sectoral policy harmonisation and strong local institutions to form, monitor and supervise management teams at the community level.

Technical measures should aim at ensuring that the necessary expertise and logistics are available at the local level to give communities the necessary training to enable them manage the technology adequately and derive optimum benefit from it. In addition, government should encourage the involvement of external agencies in the technology dissemination and sustenance.

Community development specialists would be required to properly animate communities and raise their awareness in order to overcome inappropriate socio-cultural practices. The various

measures constitute the basis for the action plan for the transfer and diffusion of the technology. This is summarised in Table 1.3.

Table 1.3 Summary of Action Plan for Post-Construction Support Technology

Action/ Measure	*Why Action*	*Responsible Agent*	*Period*	*Cost*	*Sources of Funding*	*Indicator of Success*	*Challenges to success*
Post construction support for 500 communities ï material inputs (e.g. cement, spare parts for pumps)	Communities nationwide need resources to properly manage and maintain water systems	District Assemblies in collaboration with the Ministry of Water Resources, Works and Housing (MWRWH): *District Assemblies – implementation at district level* *MWRWH: oversight and coordination of project implementation*	2013 ï 2017	$10,000 per community Total $5,000,000	Government of Ghana, development partners (multi & bilateral agencies), SADA, private sector and NGOs	80% of baseline documented systems being functional.	- Too few community- or district-based input suppliers resulting in scarcity and high cost of inputs
Enhancing technical capacity at district and community levels for maintenance of water systems ï	Need for skilled personnel to ensure effective maintenance	District assemblies, communities, Local government service and technical agencies:	2013 ï 2017	$5,000 per community Total	Government of Ghana, development partners (multi & bilateral agencies), SADA,	80% of baseline documented systems being functional.	-Unwillingness of communities to undergo technical training -Non availability of

recruitment, training, technical assistance		*MWRWH – technical assistance, training.* *Agents in districts – community mobilisation and project implementation*		$2,500,000	private sector and NGOs		requisite technical expertise to undertake training in the communities
Management systems including monitoring at all levels ï community, district, regional and national	There is need for management and monitoring systems to ensure effectiveness	National Project Coordination Unit, communities, district assemblies, regional authorities: *PCU – coordination and monitoring.* *Regional and local authorities – monitoring in communities*	2013 ï 2017	$3,000 per community Total - $1,500,000	Government of Ghana, development partners (multi & bilateral agencies), SADA, private sector and NGOs	Establishing PCS as a regular feature of building water systems for communities.	- Non availability of requisite technical expertise to undertake management training in the communities
Total				$9,000,000			

2 Technology Action Plan for the Agriculture Sector

The agriculture sector is the mainstay of countryôs economy especially in relation to the occupation provided for more than 60% of the population. For Ghana, the major sector vulnerable to climate change is agriculture. Based on a 20-year baseline climate observation, it is projected that yields of maize and other cereal crops, for example will reduce by 7% by 2050 (EPA, 2012). The impact of climate change on agriculture for Ghana is potentially damaging socio-economically. It is likely to jeopardize the employment of about 60% of the active population, the majority who are small scale rural farmers, resulting in unsustainable livelihoods (EPA, 2012).

2.1 Actions at the Sectoral Level

As in the water sector, there are general barriers in the agriculture sector that invariably constrain technology transfer and diffusion. Institutionally, there are the constraints of weak linkages between the national research system and the farmers, limited public funding for extension services and ineffective policies to promote agricultural activities. Economic and financial barriers pertain to the high prices of agricultural inputs on the open market. Socio-cultural practices of linked to belief systems sometimes constrain productivity and the cultural biases against women often reduces productivity on certain agricultural commodities. For example, socially, the cultivation of cash crops such as cocoa and coffee are considered male occupations. Yet, womenôs dedication and strength in cultivating food crops illustrate their potential for good cash crop farming. The transfer and diffusion of technologies and innovations generally requires that these broad categories of barriers be effectively addressed. In this regard, there are agriculture sector policies, which have in broad and specific terms aimed at addressing the challenges. Table 2.1 summarizes the main policies that have been pursued in the agriculture sector.

Table 2.1 The Existing Policies and Laws in the Agriculture Sector

Existing Policies/ Laws	When Enacted	Main Content
Food and Agriculture Sector Development Policy (FASDEP II)	2007	The national vision for the food and agriculture sector is a modernized agriculture for a structurally transformed economy and evident in food security, employment opportunities and reduced poverty. The current Food and Agricultural Sector Development Policy (FASDEP II) emphasizes the sustainable utilization of all resources and commercialization of activities in the agriculture sector with market-driven growth; enhancement of productivity of the commodity value chain, through the application of science and technology, with environmental sustainability is emphasized. Greater engagement of the private sector and collaboration with other development partners is pursued to facilitate implementation of the policy.
ECOWAS Agricultural Policy (ECOWAP)/ Comprehensive African Agriculture Development Programme (CAADP) Compact	2009	The Compact is to coordinate the support of the Ghana Government and the signatory partners (including the African Union/ NEPAD, ECOWAS, development partners and civil society) for the implementation of the Governmentôs FASDEP II through the Medium Term Agriculture Sector Investment Plan (METASIP) under a framework of a Sector Wide Approach and the ECOWAP/CAADP. The Government of Ghana confirms its commitment in the Compact to a modernized agriculture culminating in a structurally transformed economy and evident in food security, employment opportunities and reduced poverty. It underscores the promotion of sustainable agriculture development, thriving agribusiness, research and technology development, effective extension and other support services to farmers, processors and traders for improved livelihood.
Medium Term Agricultural Sector Investment Plan (METASIP)	2011	The purpose of METASIP is to accelerate growth and to transform agriculture in Ghana through modernization. It is a strategic framework to implement FASDEP II over the medium term 2011-2015 and for interventions for the agriculture sector to play its role in the national economy in the context of the Ghana Shared Growth and Development Agenda (GSGDA) which is the national programme of economic and social development policies. METASIP is also in fulfillment of Ghanaôs participation in agriculture related initiatives of ECOWAS and the Africa Union Commission (AUC) under the framework of the ECOWAS Agriculture Policy (ECOWAP) and the Comprehensive Africa Agriculture Development Programme (CAADP). The priorities outlined in the METASIP include food security and emergency preparedness, improved growth in incomes, sustainable management of land and environment, and science and technology applied in food and agriculture development.

National Fertilizer Policy for Ghana	(draft ï yet to be adopted)	The aim of the fertilizer policy is to develop and disseminate adequate quantity and quality of fertilizer products that are ñtimely, available and accessible to the farming population of Ghana, operating under a supportive public sector and safeguarding the environment. Overall, the goal is to promote a viable agro-industrial economy with this policy, recognizing that agriculture is one of the basis for structural transformation of the economy. The objectives include facilitating the mastering of scientific, technological and organizational capabilities for fertilizer production and its increased utilization in Ghana; and promote the culture of judicious use of fertilizer.

Source: MoFA, 2007; Government of Ghana, 2009; MoFA, 2011

The TAP component for the agriculture sector is set within the broad frameworks of these policy documents which in principle emphasise technology promotion, transfer and diffusion. Two of the prioritised technologies are selected for diffusion in the TAP namely:

i. Integrated Nutrient Management (INM)
ii. Community Based Extension Agents (CBEA).

Both technologies are currently being promoted in Ghana albeit on a limited scale. The Technology Action Plan of Ghana aims at boosting the promotion and adoption of these technologies in the country especially in the rural areas to enhance agricultural production.

There are general barriers to the diffusion to these technologies similar to those in the water sector. There are institutional barriers relating to inefficiencies in institutions set up for the purposes of diffusing these technologies. There are sometimes technical deficiencies on the part of the specialists in the agricultural institutions as well as attitudinal problems. Socio-cultural practices are major barriers in the agriculture sector. A typical example is the practice of bush-burning that deplete soil nutrients in many cases on the arable lands. The economic and financial barriers relate to market inefficiencies and market failures, which deny small-holder farmers sufficient incomes from their produce. The strategies of diffusion of the prioritized technologies will take these general barriers into account.

2.2 Action Plan for Integrated Nutrient Management (INM)

2.2.1 Description of Technology

The Integrated Nutrient Management is also referred to as Integrated Soil Fertility Management (ISFM). The technology aims at making efficient use of both synthetic and natural plant nutrient

(organic) sources to enhance soil fertility towards improving and preserving soil productivity. The success of INM relies on the appropriate application and conservation of nutrients and transfer of knowledge to farmers. The technology enables the adaptation of plant nutrient and soil fertility management within a farming system to site specific characteristics; an important ingredient for climate change adaptation.

Integrated soil fertility management in Ghana, has been widely promoted. There is availability of capacity for effective transfer of the technology to farmers. However the use of the technology is low compared to use of single nutrient sources.

2.2.2 Target for Transfer and Diffusion

This technology targets farmers in all the agro-ecological zones given that soil fertility management is a fundamental challenge for all farmers. The action plan targets about 100,000 farmers nationwide given that the successful adoption of the technology by the beneficiary farmers will have a demonstrable impact on the others. It is intended that the transfer and diffusion of the technology will be done within a five-year period beginning from 2013 to 2017.

2.2.3 Barriers against the diffusion of Integrated Nutrient Management

The fundamental problem the INM technology addresses is the inadequate nutrient for crop growth resulting in low productivity and production, low household food security, low income and persistent poverty. As expected, economic or financial barriers as well as non-financial barriers constrain the transfer and diffusion process.

The financial barriers to the promotion and diffusion of this technology are directly linked to the cost of chemical fertilizers, which is a direct result of pricing mechanism of the product. The pricing mechanism is due to government policy of privatization and high cost of credit. Currently, interest rates of most commercial banks in Ghana range from between 25 and 30 per cent despite the fact that the country has been running single digit inflation rates for more than 24 months. Others include low incomes of farmers which is the result of low prices for agricultural produce because of the absence of a sustainable pricing mechanism. The general

free-market economic philosophy of the country appears to impact negatively on the prices of various agricultural commodities.

The institutional barriers were mainly linked to inadequate availability of technical information and low access to extension service to end users of the technology. Closely linked to these are the current structure for extension service provision and the low ratio of extension staff to farmers. These are also as a result of government policy related to employment in the public sector.

Inadequate knowledge of farmers with regards to appropriate use of various sources of plant nutrients was identified as a major barrier. Currently, fertilizer consumption is one of the lowest in the developing world at 11.88 kg per hectare in 2009. This is a result of limited information from the extension service that also is limited in terms of technical capacities brought about by inadequate support from research because of the weak research extension linkages.

Socioï culturally, the main barrier is the misconception about the technology due to low awareness about its potential. Additionally, there is also the non-availability of diversified nutrient sources. The organic and in-organic nutrients need to be sourced appropriately for the different traditional farming systems.

2.2.4 Measures to Address Barriers

The review of government policy on pricing of commodities (both local and imported) is a basic necessity for reducing the cost of chemical fertilizers and improving incomes from agriculture produce. However, even as this is addressed in a specific policy initiative, there is the need for a national programme on the transfer and diffusion of INM technology. The other barriers can also be addressed within the programme framework.

Awareness creation and training of farmers using multiple communication tools and approaches are also leading measures under the non-financial measures. It goes to emphasize the point that knowledge and information flow to farmers are the critical measures for improving on their farming activities.

Review of the national policies with regards to extension service structure and staffing was also identified as necessary to enhancing service delivery to rural communities and farmers. The existing policy on the extension service limits the reach of the service to farmers in the remote areas. It is therefore important to review the policies to ensure that there is an increase in staffing levels at the districts such that farmers in the villages would benefit from extension services effectively.

Improvement in research and extension linkages to enable flow of relevant technical information from research to extension was also identified as an important measure. Currently there is some linkages between the agricultural research organizations and the extension system in Ghana particularly the Ministry of Food and Agriculture (MoFA). For example the CSIR-Crops Research Institute has a fairly strong link with MoFA through which it is able to extend its newly improved crop varieties to farmers. However, the linkages with the research organisations in Ghana will have to be strengthened to enhance the adoption of agricultural technologies in general by farmers. In the envisaged action plan for the diffusion of the INM technology, the research stakeholders will work in collaboration with the relevant organisations particularly the ministry and the district assemblies. The summary of the action plan is in Table 2.2.

Table 2.2 Summary of Action Plan for Integrated Nutrient Management (INM) Technology

Action/ Measure	*Why Action*	*Responsible Agents/ Responsibilities*	*Period*	*Cost*	*Source*	*Indicator of Success*	*Challenges*
Strengthening the extension service delivery on Integrated Nutrient Management for 100,000 farmers ï recruitment of staff, budgetary support to participating institutions, logistics (e.g. vehicles, motorbikes and bicycles)	The existing institutional framework is weak especially in relation to INM; soil fertility management has become a major constraint for farmers resulting in decreasing farm productivity	MMDAs in collaboration with MOFA: *MOFA – coordination, oversight of implementation* *MMDAs – implementing project in communities in the districts*	2013 ï 2017	$5,000,000	Government of Ghana, development partners (multi & bilateral agencies),private sector and NGOs	Extension services delivered to at least 50,000 farmers nationwide	Farmersô apathy to technologies; commitment of MOFA and MMDA collaborators; availability of the needed funding.
INM technology adaption for the respective ecosystems and dissemination	Research support is critical for effective INM dissemination	CSIR and universities in collaboration with MOFA directorates and MMDAS: *CSIR & universities – selection & adaption of INM technologies* *MOFA & MMDAs-*	2013 ï 2017	$2,000,000	Government of Ghana, development partners (multi & bilateral agencies), private sector and NGOs	50% of technologies extended to farmers sourced from the national research system.	Weak linkages between the national research system and farmers.

Action/ Measure	*Why Action*	*Responsible Agents/ Responsibilities*	*Period*	*Cost*	*Source*	*Indicator of Success*	*Challenges*
		dissemination					
Capacity building for extension officers and other staff	For effective extension of the technology, the extension staff need capacity building	MOFA technical directorate in collaboration with CSIR and universities and CSOs: *All agents work on capacity building*	2013 ï 2017	$500,000	Government of Ghana, development partners (multi & bilateral agencies), private sector	At least 50% of the extension services personnel trained	The commitment of the agric extension officers.
Training of farmers	Farmersô adoption of depends on the extent to which they are trained in the use of the technology.	MMDAs (extension service) in collaboration with the MOFA directorates, CSOs *All agents work on capacity building*	2013 ï 2017	$800,000	Government of Ghana, development partners (multi & bilateral agencies), private sector	80% of total farmer population reached using improved INM technologies.	Farmers having adequate time to learn the technology and be committed.
Research and Development for new INM innovations	Researchers in the local R&D institutions should support the transfer and diffusion process with continuous research	Research institutions/ universities in collaboration with MOFA Directorates: *Researchers conduct R&D to produce new INM innovations*	2013 ï 2017	$1,000,000	Government of Ghana, development partners (multi & bilateral agencies), private sector	At least 10 new INM technologies generated	Availability of resources for R&D.

Action/ Measure	*Why Action*	*Responsible Agents/ Responsibilities*	*Period*	*Cost*	*Source*	*Indicator of Success*	*Challenges*
Total				$9,300,000			

2.3 Action Plan for Community Based Extension Agents (CBEA)

2.3.1 Description of Technology

The Community Based Extension Agents (CBEA) is a rural agricultural extension model based on the idea of providing specialised and intensive technical training to identified people in living rural communities to promote a variety of technologies and offer technical services with support and review from an extension organization. The CBEA is a demand driven model; in that provide opportunity for farmersô groups or community to contact the service provider for specific information and related services. The community based extension model can contribute to climate change adaptation through the training of service providers in climate data collection; analysis and dissemination within their areas of operation to enable communities select appropriate response strategies.

The community based rural agricultural extension model was introduced in Ghana to complement the efforts of veterinary services in addressing livestock health problems in the absence of adequate qualified staff. The practice has since been expanded to include other technical areas including crop agronomy. It is also being used to promote climate change adaptation in parts of the northern region by CARE International, an NGO. The use of the model however remains on pilot basis with limited coverage.

2.3.2 Target for Transfer and Diffusion

The action plan targets the enhancement of extension service to 500 communities in selected districts across the country. It is intended that the transfer and diffusion of the technology will be done within a five-year period beginning from 2013 to 2017.

2.3.3 Barriers to Promotion and Diffusion of Community-Based Extension Agents

Inadequate extension service to farmers resulting in non-application of improved farming practices is the base problem, which the CBEA technology addresses. The direct result of these is low productivity and/or production resulting in household food insecurity, poverty and general

low standards of living in rural communities. There are the usual economic and non-economic barriers.

The economic and financial barrier to the smooth promotion and diffusion of this technology revolves around lack of motivation for available personnel. Closely associated with this is the absence or inadequacy of financial benefits for the job the agents do within their communities and absence of tools and equipment to enable them perform their duties satisfactorily. Closely associated with the above is inadequate training for the agents. The above are as a result of lack of budgetary allocation to support CBEA because it is not identified as an integral part of the national extension structure as a result of the existing national agriculture extension policy.

The main barrier is the absence of trained personnel as a result of lack of qualified persons to be trained, which is a direct result of poor quality of educational within rural communities. Rural-urban migration is also identified as a cause of non-availability of required personnel for training.

Non-appreciation of role of community based extension agents is a major barrier because of poor perception among community members due to low awareness about the importance of CBEA among rural communities which is also due to high dependence on regular extension service from national extension organization.

Institutionally, limited support from the national extension service was also indentified as a barrier. This is as a result of lack of budgetary allocation because CBEA is not an integral part of the national extension service delivery mechanism.

2.3.4 Measures to Address Barriers

Measures for improving the promotion and diffusion of were identified through stakeholder consultation and fine-tuned by consultant using own knowledge based on local experience. The measures were initially identified for each category of barriers and regrouped into economic and financial; and non-financial measures.

Central to addressing economic and financial barriers is the need to review current extension system to enable integration of CBEA into the national extension structure to enable budgetary allocation to support its implementation. Additional to this could be a mechanism for engaging with not-for-profit organisations (CSOs/ NGOs, Relief Agencies, Faith Based Organizations, and Farmer-Based Organizations, etc.) to support the role out of the technology specific locations in collaboration with the local/district administration structure. There is the need to provide necessary tools and equipment and establish a clear modality for providing remuneration to trained personnel. Additionally, resources including training facilities should be provided for continuous training of personnel.

There is the need to undertake sustained awareness creation on the benefits of CBEA among rural communities to remove misconceptions and encouragement of non-formal education among the adult population.

There is the need to review current extension structure and delivery mechanisms to include CBEA to enable its recognition and prioritization as major step towards addressing the wide gap between farmers and available extension staff. The national extension service should develop a comprehensive action plan for rolling out and supporting CBE in rural communities complete with training actions.

The envisaged action plan for the transfer and diffusion of the CBEA encapsulates a programme with the government partnering multi and bilateral agencies to promote extension services in the farming communities through the CBEA. This is summarized in Table 2.3.

Table 2.3 Summary of Action Plan for Community Based Extension Agents

Action/ Measure	*Why Action*	*Responsible Agents/ Responsibilities*	*Period*	*Cost*	*Source*	*Indicator of Success*	*Challenges*
Enhancing extension service to 500 communities in selected districts ï recruitment of staff, budgetary support for implementation, logistics (e.g. vehicles, motorbikes and bicycles)	The existing extension service is inadequate to support farming in many farming communities	MMDAs in collaboration with MOFA: *MOFA – coordination, oversight of project.* *MMDAs – implementation of project in districts*	2013 ï 2017	$5,000,000	Government of Ghana, development partners (multi & bilateral agencies), and private sector	Extension services delivered to at least 450 communities nationwide	Cooperation of the MMDA and MOFA in the project implementation
Capacity building for extension officers and other staff for the 500 communities	The CBEA concept is relatively different from the existing extension system and there is need for training.	MOFA technical directorate in collaboration with CSIR and universities: *All agents work together on capacity building*	2013 ï 2017	$2,000 per each extension officer/ staff Total - $1,000,000	Government of Ghana, development partners (multi & bilateral agencies), and private sector	About 100 extension officers trained (5 each for 20 districts)	Commitment of the extension officers and other staff.
Training of average 10 community agents in 500 communities	There is need to train the community agents to ensure effective extension service delivery	MMDAs (extension service) in collaboration with the MOFA directorates and CSOs: *MMDAs –*	2013 - 2017	$1,000 per community agent Total - $5,000,000	Government of Ghana, development partners (multi & bilateral agencies) and private sector	450 community agents trained	Availability and commitment of the 500 community agents

		mobilising CBEAs from communities. *MOFA – training CBEAs*					
Training of farmers by community agents in 500 communities	The trained community agents need to disseminate their knowledge and expertise to farmers in the respective communities	Community agents, MMDAs (extension service) in collaboration with the MOFA directorates and CSOs: *CBEAs – train farmers in communities.* *MOFA & MMDAs – provide support to CBEAs*	2013 - 2017	$4,000 per community in 500 communities Total ï 2,000,000	Government of Ghana, development partners (multi & bilateral agencies) and private sector	20 farmers trained in each community by the agents	Willingness of the farmers to learn from the CBEAs
Total				$13,000,000			

3 Cross-cutting Issues

Action plans have been elaborated for the four prioritised technologies. It is envisaged that the technology transfer and diffusion of these four prioritised technologies in the water and agricultural sectors will be done in the phases of two or three years targeting specific milestones. However, there are cross-cutting issues, which need to be considered as generally applying to the technology transfer and diffusion process.

An important measure that cuts across is the review of national policies to address price competitiveness. For example, financial measures hinge mainly on the need for government action to reduce cost of supply of inputs or materials and equipment for the technologies. This can be done at the macro level through reduction in interest rates to less than 20% , reduction of import duties, stabilization of the exchange rate and institution of tax relief incentives to suppliers of these materials and equipment.

Common barriers to the adoption of the technologies include

High maintenance cost of the technologies as a result of high cost of labour, technical services, equipment and materials;

Inadequate funding for sustaining the technologies due to insufficient public investment and private participation, including contributions from external agencies;

Inadequate community and local (district) level capacity, including technical and financial management expertise, to keep the technologies functional;

Limited integration of the technologies in policy plans resulting in their poor diffusion and adoption;

Lack of cultural acceptance of change so communities are not motivated to adopt the technologies wholeï heartedly;

Inadequate community development specialists and logistics to design and implement appropriate community educational and awareness-raising programs in beneficiary communities;

Incoherent government policy on climate change to drive the adoption of the technologies.

Each technology is community-based targeting those most vulnerable to the impacts of climate change on water resources. Another common feature is that all four technologies have been

classified as non-market publicly provided goods. Thus, government actions in promoting and facilitating the diffusion and adoption of these technologies are paramount. In addition, the capacities of beneficiary communities to adopt and manage the technologies both for their well-being and for sustainability are prerequisites.

Strengthening research and development (R&D) and extension linkages is also important to enable effective flow of information from research through extension to farmers. This is necessary to address the knowledge gap of the user communities. In both the sectors of water and agriculture, the national research system continues to work on prevailing technology needs. However, the gap between the system and the user ends is a major barrier to diffusion. This has to be addressed as a national policy.

Prioritization of climate change as an important development and cross-cutting issue, has implications for the sustainability of the food and agriculture sector; and subsequent development of strategies and /or mechanisms to increase productivity whilst building resilience within the sector. This will provide opportunity for prioritizing these technologies for promotion, adoption and uptake. It should lead to increased budgetary allocation in support of the diffusion of the technologies and the facilitation of the involvement of external agencies with requisite know-how and other resources.

Deepening of the national decentralization process to enable strengthening of decentralized departments including the extension services with well-qualified staff to provide necessary technical support to field extension agents to adequately animate and train farmers to derive optimum benefits from their undertakings. Additionally, the districts could, depending on their requirements, engage additional staff to boost current numbers or could establish operational MOUs with not-for-profit organizations to complement the government extension service delivery efforts. In the districts, the need for improving rural infrastructure (road, storage facilities etc.) is also necessary for reducing overhead costs that are pushed to the last consumer and enable farmers produce more to improve their earnings.

Stable macro-economy that continues to grow with a GDP rate of not less than 8 per cent with contributions from the agriculture not below current levels (27 ï 30 per cent) is also important. This will enable the continuous recognition of the importance of agriculture sector to the national development and will provide opportunity for addressing issues e.g. low extension staff numbers and inadequate budgetary allocations to the sector affecting the development of the sector. Indeed, African governments including Ghana have committed themselves to allocating not less than 10 per cent of annual budgetary allocations to agriculture. Achievement of this target could go a long way to address current issues relating to financing of the sector.

Besides, a major outcome in the Technology Needs Assessment for Ghana is the conclusion that, for both the agriculture and water sectors, early warning system is an enabler. It is important that an Early Warning System be created nationally with application points in all districts to enable climate change management and promote adaptation practices.

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