ACCELERATING SANITATION AND WATER FOR ALL IN GHANA

GOVERNMENT OF NETHERLANDS - UNICEF PARTNERSHIP FOR WASH IN WEST AFRICA

SENSITISATION ON WATER SOURCE AND CATCHMENT PROTECTION FOR SUSTAINABLE WATER SUPPLY IN GHANA

Modules for MMDAs

Prepared by the Water Resources Commission of Ghana

January, 2015

Foreword

In 2014, the Water Resources Commission with the support of UNICEF carried out a rapid assessment of water resources and catchment protection in selected Metropolitan, Municipal and District Assemblies (MMDAs) in Ghana. Following the recommendations in the rapid assessment report, some training modules have been developed to equip the selected MMDAs to manage their water resources in a more sustainable manner. Workshops would be organised to introduce trainers on the subject matter and to negotiate with the institutions concerned (i.e. Kwame Nkrumah University of Science and Technology (KNUST), Institute of Local Government Studies (ILGS), Water Research Institute (WRI), Water Resources Commission (WRC), Ghana Country Water Partnership of the Global Water partnership (GCWP of GWP), Community Water and Sanitation Agency (CWSA), International Water Management Institute (IWMI), University of Ghana (Legon), the Environmental Protection Agency (EPA), Local Government Service Secretariat (LGSS), the Trans African Hydro Meteorological Observatory (TAHMO)) to run certified short courses for the identified stakeholders (potential trainers). Other institutions could also help with the trainings such as TREND and IRC-Ghana. This will ensure that the training is continuous, effective and sustainable.

The target group for the modules are Planning officers, Engineers, WASH officers, Communication officers, Finance and Budget (including Revenue Mobilisation) officers at the MMDAs, Ministries, Departments and Agencies (MDAs), NGOs operating in the Districts and Regions of interest; Research Institutions; administrators and workers in Local Government in general.

The training module prepared suggests a more practical approach should be used to translate it to the lowest possible (community) level. This could be done by using the Catchment Simulation Game (CSG), Business Plan Development, Revenue mobilisation techniques and activities that enhance fun-critical thinking hands-on as suggested in the modules.

Executive Summary

Meeting the MDGs/SDGs targets requires conscious effort at enhancing the provision of water supply services to the populace without compromising environmental integrity. It is in this light that the Water Resources Commission with the support of UNICEF carried out a rapid assessment of water resources and catchment protection in selected Metropolitan, Municipal and District Assemblies (MMDAs); and School Health Clubs (SHCs) in Ghana. This was done to determine their knowledge and application of policies on Water and Environment and how they are mainstreaming Water Resources Management into their core functions, particularly within the context of Climate Change Adaptation and Mitigation for sustainable water supply. Based on the findings from the rapid assessment, the following nine (9) training modules have been developed to equip the MMDAs to manage their water resources in a sustainable manner:

i. Water Resources Management (practical and implementable);
ii. Water Conservation measures (including ecosystem services);
iii. Rainwater harvesting technologies and management of water storage facilities;
iv. Conflict Management; Effective Networking; and Benefit Sharing Mechanisms;
v. Water quality and health related impacts of Climate Change;
vi. Innovative financing of WASH projects through various PPP arrangements;
vii. Preparation of bankable project proposals and identifying various sources of funding to implement projects;
viii. Monitoring and Evaluation of WASH projects; and
ix. Water Governance and Institutions in Ghana.

The proposed didactics for teaching and transfer of information include lectures, workshops, hands-on (design) exercises, field trips, and e-learning. Methods such as catchment simulation games, role play, brain-storming, De Bono's 6 thinking hats, the marshmallow challenge, group works and presentations, SWOT analysis, Business Model You, Business Model Canvas, back casting, mind mapping and concept maps would be used to stimulate the participants to do things differently and invoke their creativity.

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List of Acronyms

CLTS	Community Led Total Sanitation
CWSA	Community Water and Sanitation Agency
DMTDP	District Medium Term Development Plan
DWSP	District Water and Sanitation Plan
EHO	Environmental Health Officers
EHSU	Environmental Health and Sanitation Unit
EPA	Environmental Protection Agency
FC	Forestry Commission
GHS	Ghana Health Service
GIDA	Ghana Irrigation Development Authority
GoG	Government of Ghana
GSA	Ghana Standards Authority
GSGDA	Ghana Shared Growth Development Agenda
GWCL	Ghana Water Company Limited
GWP	Global Water Partnership
ILGS	Institute of Local Government Studies
LCIC	Low Carbon Development and Information Centre
M&E	Monitoring and Evaluation
MC	Minerals Commission
MDA	Ministry Department and Agencies
MDG	Millennium Development Goals
MMDAs	Metropolitan, Municipal and District Assemblies
MOFA	Ministry of Food and Agriculture
NADMO	National Disaster management Organisation
NEPAD	New Partnership for Africa's Development
NDPC	National Development Planning Commission
NGOs	Non-Governmental Organisations
PNDC	People's National Defence Council
RCC	Regional Coordinating Council
SHC	School Health Club
SHEP	School Health Education Programme
SWM	Soil Water Management
TAHMO	Trans African Hydro-Meteorological Organization
TCPD	Town and Country Planning Department
ToT	Training of Trainers
UNICEF	United Nations International Children's Emergency Fund
WASH	Water, Sanitation and Hygiene
WATSAN	Water Sanitation Teams
WinS	WASH in Schools
WB	World Bank

WRC	Water Resources Commission

1. INTRODUCTION

In order to accelerate the achievement of the the Million Development Goals and currently the Sustainable Development Goals, the Netherlands Government and UNICEF aims at giving access to safe water to over 500,000 people in Ghana. The strategy to attain this goal is grouped into four (4) areas under the project on "Accelerating Sanitation and Water for all in Ghana" as follows:

i. Accelerating safe water and sanitation coverage to meet the MDG targets
ii. Strengthening National Sector Development
iii. Strengthening Institutions and Capacity Development
iv. Ensuring the Sustainability of Systems and Behaviour

Meeting the MDGs/SDGs targets requires conscious effort at enhancing the provision of water supply services to the populace without compromising environmental integrity. It is in this light that the Water Resources Commission with the support of UNICEF carried out a rapid assessment of the water resources and catchment protection in selected Metropolitan, Municipal and District Assemblies (MMDAs); and School Health Clubs (SHCs) in Ghana. This was done to determine their knowledge and application of policies on Water and Environment and how to mainstream Water Resources Management into their core functions, particularly within the context of climate Change Adaptation and Mitigation for sustainable water supply. Based on the findings from the rapid assessment, training modules have been developed for the selected MMDAs in the project areas to equip them to better manage their water resources. These training modules would be anchored in some tertiary institutions for continuous training and education. It is intended that the KNUST Civil Engineering Department's Centre of Excellence in Water and Sanitation in Kumasi and the Institute of Local Government School in Accra together with some partner institutions would run the modules for the Northern and the Southern Sectors of the Country respectively in the long run. This would be done after the stakeholders have been introduced to the modules through consultative and validation workshops. Some of the modules are based on materials from these institutes.

Based on the findings from the rapid assessment, the following eight (9) training modules have been developed to equip the MMDAs to better manage their water resources:

I. Water Resources Management (practical and implementable);
II. Water Conservation measures (including ecosystem services);
III. Rainwater harvesting technologies and management of water storage facilities;
IV. Conflict Management; Effective Networking; and Benefit Sharing Mechanisms;
V. Water quality and health related impacts of Climate Change;
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Each module has been structured to be taught fully within 3 days with some field trips where appropriate.

2. PRACTICAL AND IMPLEMENTABLE WATER RESOURCES MANAGEMENT MODULE

The main objective of this module is to introduce participants to the concept of IWRM and how to implement this in a practical way. Examples from the Densu basin and the White Volta basin would be used as examples on how to make IWRM effective and applicable in districts and regions. Participants would go through lectures, presentations, group exercises, role plays and a field trip on IWRM, Water Security and Climate Resilient Development in Ghana: Water Access, Management, linkages to development, Economics, Welfare etc. and how it could be implemented and not just remain a fairy tale.

2.1 Lesson 1: Basic Water Resource Concepts and Principles

2.1.1 The hydrological cycle

The main components of the hydrological cycle in semi-arid environments include precipitation, evapotranspiration, groundwater and runoff as shown in Figure 1. This shows the cycle through which rainfall goes through before returning to the atmosphere. The principle is that, the total water on earth remains fairly constant at all times and only changes from one state (liquid, vapour and solid) to another depending on environmental conditions. This mass balance is key in any hydrological study.

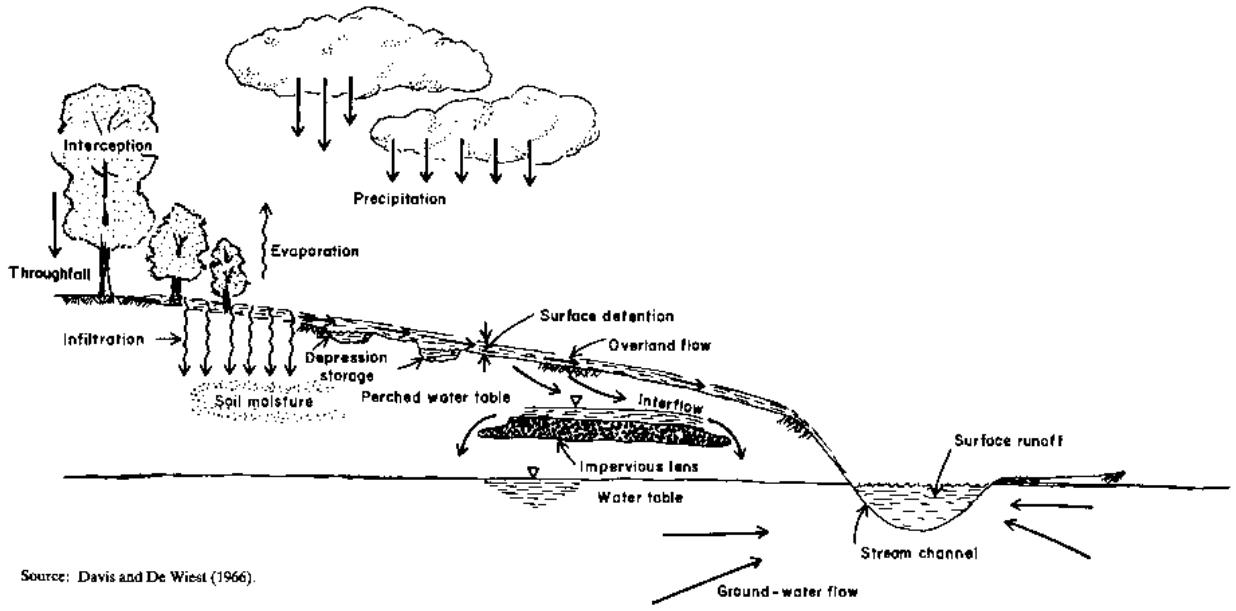

Figure 1: Main components of the hydrological cycle

(Source: Edwards et al. (1983)[1] cited in FAO, 2013)

The general expression describing the water balance of a watertight catchment over a given period is:
$P = Q + E_A + \Delta S + \Delta G$
Where P is precipitation, Q - runoff, E_A - Actual Evaporation, ΔS - Change in Storage, and ΔG – changes in groundwater storage or soil moisture. Runoff could be broken down further into surface runoff (Q_s) and infiltration (Q_i).

[1] K.A. Edwards, G.A. Classen and E.H.J. Schroten (1983). The water resource in tropical Africa and its exploitation.

The uses and value of water

Competition among water users and uses is one of the major concerns in Ghana. In terms of priority domestic water comes first, followed by hydropower, irrigation and environmental flows. Minimum flow requirements have not be well defined for most rivers in Ghana although it is required for several ecosystem services. The competition between these various uses are partly influenced by where the water is located: Blue (water in streams and rivers and ground water aquifers), Green water (water in the root zone immediately available to plants) and Grey water (Waste water). The (re) use of water at different temporal and spatial scales have different impacts and/or implications. For example a study conducted showed that in a "drought" year the use of water in the wet season significantly affects water availability or increases water stress in the dry season. It was therefore shown that spatial-temporal variability of water availability is influenced by water use and vice versa (van Oel *et al*., 2010).

Water resources as catalyst for development cannot be overemphasized due to their uses and importance. They are not just necessity for life but life themselves as is often stated "water is life". Despite this, most communities do not value water as an important natural resource such as timber, gold or bauxite. This is partly due to perceived low economic value of water. Water has economic, social and cultural importance such as the following[2]:

1. **Economic growth**: water is the main engine for poverty reduction and sustainable development. The Ghana Shared Growth and Development Agenda (GSGDA, 2014) which drives the Medium Term Development Plan of the MMDAs from 2014-2017, finds a key role for water resources to promote economic growth through agriculture and other water-related services which provides communities with sources of income. These include:

    i. ***Irrigation***: This is the application of water to the soil to make up the deficiency of manure under natural conditions. The success stories of irrigation schemes in Ghana are just a few with many suffering from shoddy works and lack of maintenance of facilities, long term planning and innovative business models which makes running the schemes unsustainable. Irrigation can ensure food security by increasing food production, increasing cash crops and plantation development, and improving the full agriculture value chain from land preparation to processing and marketing. It is only when value is added to the produce that there will be enhanced productivity and livelihoods which leads to economic development. Selling raw farm produce only will not get farming communities out of poverty. The surest way out is to introduce or enhance local food processing with industries;

    ii. ***Navigation***: Water transport (goods and people) is another area of economic development. River navigation occurs mostly in the big lakes and rivers in Ghana. Ghana is bounded in the South by the Gulf of Guinea which enhances marine navigation at the coasts and serves other land-lock neighbouring countries such as Burkina Faso and Mali. For instance, imports for Burkina Faso are sent from Tema by road to Akosombo Port, and transported over Volta River with navigable length of 415km to Buipe Port from where it is continued by road to Burkina Faso. Currently most of the goods are cart by

[2] S. O. Kwarteng and F.O. Annor (2014). Proposed Modules for the NEPAD Centre at KNUST on Water use and Allocation in Semi-arid regions.

road directly from Tema and Takoradi which possess a lot of danger to road users due to poor road networks and poor conditions of haulage vehicles that are used;

iii. ***Hydro-Electric Power Generation***: Rivers are dammed and used for the generation of power which is a very vital agent of economic development. Without power, no production of any form can take place and its implication will be lack of developments such as recent power crises that plunged the country in 2007 and 2014. Hydropower development does not only benefit Ghana for an example but also Burkina Faso, Togo and Benin. The "dumsor" conditions in 2014-2015 affected economic activities which earns the country foreign exchange. The energy gaps therefore need to be given utmost attention from government. This is another use which needs more innovation;

iv. ***Industrial use:*** Industries need water for their operational activities, which enhances development. Water enhances economic activities such as bottled drinking water, sachet water, canneries, and factories, industries that produce pharmaceutical goods, breweries and farm inputs such as fertilizers, pesticides and weedicides. Processing of agricultural produce locally increases the market value. That is why the entire leg of the value chain needs improvement;

v. ***Transboundary water co-operation***: Water resources that are shared by countries enhance economic co-operation, which is an agent of economic growth. Water could be an agent for cooperation or for conflict. For instance, Ghana has since July 1975 supplied hydropower to Togo and Benin in a joint venture. The Communante Electrifique Benin (CEB French acronym) ensures the sharing between the two countries, thus, promoting West African Cooperation. Again Interconnection of power system between Cote d'Ivoire and Ghana by constructing two-way transmission networks across the Ghana and Cote d'Ivoire border has set up a system for the exchange of power to cater for short falls in operation for mutual benefit, thus promoting development in both countries;

vi. ***Domestic water supply***: Water resources for domestic purposes in homes, institutions and commercial areas are to promote the general welfare of people. Adequate water promotes good health through body cleanliness and environmental sanitation. Water enhances sanitation, which means good health for people and thus reduces cost of health services. Sanitation is severely impacted on by the availability of water. Without water it is often difficult to achieve sanitation targets even for dry sanitation systems. However water use in schools for drinking and sanitary purposes needs improvement;

vii. ***Tourism***: Water resources attract tourists. Water resources projects such as waterfalls and tourist parks (e.g. Boti and Kintampo falls and the Kakum national Park) and reservoirs (Bui, Akosombo and Kpong dams) bring foreign exchange to the nation. The Paga crocodile pond also attracts tourists to Upper East Region.

2. **Socio-cultural Importance**

   i. **Rights and Rituals:** Water resources are needed for certain rights and rituals. For example in Ghana when there is dispute between traditional believers, they often resort rivers as gods for their assistance and resolution. Water resources are used in religious circles. Water is believed to be a cleansing substance. Christians baptize new converts in water to signify that they are dead to sin, have been buried with Christ and are resurrected with Him hence they are new beings. The Traditionalists believe that water is a sign of blessing so if it does not rain then it means that the gods have not blessed the land with harvest and are angry so must be appeased. Moslems always perform "wuzu" cleansing with water before praying to Allah (God) as a sign of coming to him with a holy heart and body;

   ii. **Recreation:** Water resource projects such as beaches, swimming pools for recreational purposes help people to exercise themselves and relax their minds. It is known that such exercises help people to get rid of stress and depression and promote healthy living conditions.

2.2 Lesson 2: Integrated Water Resources Management

2.2.1 Guiding Principles for Integrated water resources Management

The guiding principles of Integrated Water Resources Management is the Dublin principles. These are basically 4 principles presented at the Dublin summit in Rio in 1992. The principles state that:

i. Fresh water is a finite and vulnerable resource, essential to sustain life, development and the environment;
ii. Water development and management should be based on a participatory approach, involving users, planners and policy-makers at all levels;
iii. Women play a central part in the provision, management and safeguarding of water; and
iv. Water has an economic value in all its competing uses and should be recognized as an economic good.

It is important to bear these principles in mind when managing scarce water resources especially for competing uses such as domestic, hydropower and agriculture (irrigation). The first principle depicts that; the water in a catchment should be considered to be finite. It is not an infinite good, so should be used and allocated judiciously. Water is both finite in space and time however this information is not well disseminated nor understood by people who use water inefficiently and pollute water bodies. The second principle suggests that, for an efficient and effective management of water resources, all key stakeholders especially women and vulnerable groups should be approached and must contribute significantly in decision making to make implementation sustainable. This is vital for sustainable water management since every decision has an associated cost and benefit. Although environmental costs and benefits are often not easily quantifiable in monetary terms they are needed for sound decision making on the use of natural resources. This is the more reason why "grass-root"[3] stakeholder participation is essential for the success of sustainable water resources management. Involving both "high" and "low" level stakeholders from the planning to the implementation and monitoring stages of all water related projects is vital for the sustenance of WASH projects.

The third principle focuses on gender. Although women seem to be involved in all stages of water use and management, they mostly do not participate in key decision making on natural resources

[3] Grass-root stakeholders are those the measures and actions impact on directly (either positively or negatively).

management at the communities and the MMDAs. Only a few Assembly members and MPS are females in Ghana. Women in most part of the sub-region especially Ghana are marginalised with regards to allocation and use of land and water resources. Men take up arable lands which are closer to good[4] sources of water and leave women with poor lands which are also further away from reliable sources of water. This makes women involvement in the full agriculture chain non-competitive and unattractive from land preparation to marketing. What this means is that it is important to involve women in water management since they are the main users of the resource and custodians of natural resources at the community level. Enactment and enforcement of policies and bye-laws (backed by the required legislative Instruments) with the right institutional settings are needed to address some of these gender issues. This should start from the MMDAs. The last principle looks at safe-guarding scarce water resources in terms of its value. This applies to both treated and raw water. This principle tries to put measures in place to cut down wasteful uses and other uses that could harm the environment. It is however unclear where to draw the line for the lifeline block for access to irrigation water in poor communities. Metering of water used to check wasteful uses in Western countries has not caught up with us in Ghana yet, hence irrigation schemes seem to be the most inefficient with the use of water in the country. Clean water for drinking purposes and basic sanitation is mostly estimated to be under 25 litres per capita for rural areas and under 50 litres per capita for urban areas in most places in the country. Meeting these very low water demand throughout the country is even a big challenge at the moment and that is why access to water is not considered a right in Ghana yet. Considering water as an economic good has its own advantages and challenges. There is the need to create more awareness on sustainable use of water and land resources (especially giving water a value for all uses).

2.2.2 Sustainable Watershed and Water Resources Management Actions

Managing watersheds sustainably means preventing (reducing) land degradation, pollution and floods. Land degradation through erosion, loss of soil structure, deforestation and overuse of land is a critical environmental concern. This was pointed out in all 5 regions visited during the rapid assessment workshops. Land degradation reduces the water holding capacity of the soil, decreases infiltration thereby increasing runoff and worsening erosion. To conserve our water resources, trees and plants need to be cultivated along the banks of all rivers and streams. Afforestation could increase the abundance and frequency of precipitation. Felling of trees for charcoal does not only affect rainfall patterns but also exposes people to the impacts of climate change and makes one more vulnerable. Planting (e.g. economic) trees will check erosion thereby reducing siltation of water bodies while providing alternative livelihood options for the people who live close to rivers and streams. Water pollution from domestic, industrial and agricultural sources within the watershed could be prevented or controlled if existing bye-laws are enforced. The buffer-zone policy of the WRC and other policies need to be backed by LIs for strict enforcement or compliance. Education and awareness raising have to be continued for such policies since most MMDAs knew very little about them. This is partly due to how these policies were drafted (MMDAs involvement seemed to be weak). Kwarteng and Annor (2014) proposed the following measures to help curb issues of water bodies being turned into waste disposal (damping) sites for domestic, agricultural and industrial effluents, and for alluvial mining.

i. Artificial aeration of streams in towns and cities. This can be done by designing and constructing drains in such a way that their design velocities are high enough to make the transport of water turbulent to cause aeration thereby leading to self-cleansing properties of streams and rivers. Waste minimisation by industries by way of altering the manufacturing processes so that less

[4] Good in terms of accessibility and quantity

offensive wastes are produced. Industries can treat their effluents to a level as directed by EPA before discharging them into rivers and streams;

ii. Wastewater treatment: Treatment of domestic and other wastes before discharging them into water bodies need to monitored and enforced by the WRC and EPA. Design of various treatment plants and processes to purify wastewater flows by primary, secondary, and tertiary treatment should be encouraged;

iii. Upstream storage of wastewater and releasing it when necessary after treatment to argument flows will reduce pollution loads in streams and rivers; storing all forms of water upstream and releasing them when necessary will also reduce the incidence (and/or frequency) of floods; and

iv. Implementation of the water policy and enforcement of bye-laws (gazetted) on water could curb the menace of pollution, drainage (flood) problems and wasteful water uses.

2.2.3 Roles and Responsibility of Actors and Agencies in Water Resource Management

Education is a very important tool for sustainable water resources management. It is realised that the sustenance of water resource development entails the involvement of all stakeholders. Sensitising the populace especially at the community level about the value of water in an economic water-scarce country like Ghana should be a national priority. Water resources management should be a multi-sectorial activity that requires all stakeholders to coordinate and work efficiently. The various agencies such as WRC, CWSA, GWCL, VRA, Knowledge and Research Institutes involved in water resources management could combine efforts in research work, coordination, management, regulation and maximum utilization of scarce water resources to make Ghana a better country in the area of WASH.

2.2.4 Water resources planning and development – practical and implementable

Although integrated water resources management is being promoted by the WRC in Ghana, there is still a lot to do to change peoples' attitude towards integrated planning and implementation of projects. Due to the fact that sometimes budgets are prepared before plans (which should not be encouraged), integrating the activities of various stakeholders and institutions becomes extremely difficult. As was observed in Zimbabwe in a study[5], Ghana experiences similar conditions: institutions mandated by law to handle certain aspects of land and water management end up with multiple, overlapping and conflicting roles with unclear lines of implementation, monitoring and evaluation, and accountability. This leads to duplication of efforts and un-optimised use of scarce resources. There is therefore the need to foster integration in land and water resources management across all sectors in Ghana. Creating the enabling environment for integration calls for the development and implementation of an integrated plan by all stakeholders. The NDPCs strategic plan for the country which is being developed and has to be followed by successive governments should an LI be passed to support it, is a good start towards sustainable water resources management and economic development for all sectors in Ghana including water.

[5] Chereni A. (2007). *The problem of institutional fit in integrated water resources management: A case of Zimbabwe's Mazowe catchment*. Physics and Chemistry of the Earth 32 (2007) 1246–1256.

3. WATER CONSERVATION AND ECOSYSTEM SERVICES MODULE

This module aims at stimulating MMDAs and MDAs in Ghana to sensitise their communities about the need to conserve water in their Districts through demand management, catchment conservation (i.e. catchment and landuse plans and zoning), and implement them. Participants would go through these topics through lectures, presentations, group exercises, role plays (catchment detox game) and a field trip. The module should be run for one (1) week including the field trip.

3.1 Lesson 1: Water Conservation Measures

Water conservation is important or even necessary for water-scarce countries. This scarcity is mostly due to prolonged droughts and unreliable rainfall patterns due to climate change and inadequate water storage infrastructure. It could also be used where there is a shortfall in the urban water supply due to limited funds to expand water treatment facilities, as in the case of Ghana. Water conservation and efficient utilisation has the potential to reduce the huge investments required to expand water supply systems to meet the ever growing population with corresponding demand and will contribute immensely to sustainable development. The conservation of water resources is a key water policy objective which has to be achieved through the promotion of efficient utilisation and conservation of water by operators and consumers of WASH facilities and resources. Water conservation measures[6] could be grouped into three (3) categories with the implementation level depending on the type and capabilities of the systems designed or being used.

Level 1 Measures
Level 1 measures include metering, water accounting and control, pricing, and promoting good behavioral changes through education and access to information.

Level 2 Measures
Level 2 measures could consist of water-use audits as is currently being done by the Water Resources Commission, retrofitting, pressure management, and soil water conservation (SWC) or soil water management (SWM).

Level 3 Measures
These include, replacements, Reductions in water demand, Recycling and Re-use (3Rs), water use regulations and practical IWRM as discussed in Chapter 2.

This section will mainly look at level 3 measures and partly level 1 measures with the focus on water demand management, retrofitting and integrated planning and management of land and water resources.

In Ghana, the consumptive uses of water are for domestic, industrial and irrigation purposes. Consumptive water use means the water abstracted will not return to the hydrological system after use. Many uses of water generate return flows, which, in principle, make the water available for other uses. However, return flows normally have a lower quality than the water originally abstracted which sometimes limit their re-use. Traditionally, management of water has been supply driven. This caused a lot of problems such as unsustainable use of water resources, lack of maintenance of water facilities and lack of ownership. Traditional water management provided new facilities and structures based on perceived "increasing" water needs. Integrated Water Resources Management (IWRM) looks at both the demand side and the supply side and ensures the sustainability of the use of resources with effective

[6] EPA (USA) Manual Appendix 4

planning, implementation and monitoring of the plans. This indeed is the ideal IWRM plan. However in reality, Ghana is far from achieving this due to the fact that some important aspects of IWRM has not been fully addressed yet. These include the three stated by van der Zaag (2005) as institutional capacity for integration, transparent approach used in problem solving, and inclusive decision-making processes.

Institutional Capacity

Ghana has developed a lot of capacity through trainings offered in and outside Ghana. Although there is the need for continuous training, the existing capacities developed should have been able to put us on the right path towards achieving water and food sufficiency, economic development and prosperity. However this has not been fulfilled due to the fact that square-pegs have been put in round holes in some institutions which hinders the desired growth required through integration of activities. Others lack the motivation to put their knowledge to good use at their respective work places. For such people, leaders and are required to whip their interest in doing work. Apathy will not help the nation to develop.

Transparent Problem Solving Approach

Decisions made and criteria used for the selection, allocation of resources and implementation of projects is often not transparent. Transparent communication where everyone's concerns and points of view are freely expressed[7] is needed but often not offered. These setbacks prevent transformation of challenges into opportunities not only in Ghana but Africa at large. In order to enhance transparency in decision making, an all-inclusive government is needed where politics will be maligned in critical decision making for the MDAs.

Inclusive Decision-making Processes

Although almost every project carried out currently in Ghana includes some aspect of stakeholder consultation, inclusive decision making where people at the grass-roots have their views heard and given the opportunity to take critical decisions concerning their livelihoods is more of a buzz word. Integrated problem solving with all voices heard and taken on board for initiatives and projects would help enhance ownership and sustainability. This will not happen automatically hence has to be planned for, from the conception to the monitoring of the impacts of projects and initiatives. In doing so asymmetrical relationships built with water between people, communities and nations should be considered in practical integrated water resources management. The use of De Bono's 6 thinking hats will hopefully improve the involvement of all key stakeholders in decision making.

3.2 Lesson 2: Water Demand Management (WDM)

Water demand management (WDM) and water conservation are used interchangeably in most literature. WDM could be defined as a management approach involving selective conservation measures and economic incentives to promote efficient and equitable use of water while decreasing the (level of) demand for water[8]. WDM is normally done to improve efficiency and sustainable use of water resources taking into account economic, social and environmental (ecosystem services) considerations. WDM may also refer to any socially beneficial action that reduces or modifies average or peak water withdrawals or consumption consistent with the protection or enhancement of water quality. WDM could involve the use of price, quantitative restrictions and other devices to limit the demand or use of water. While water resources become scarce due to lack of storage infrastructure and the impact of climate change, the competition for the limited water resources available among different users/uses due to rapid urbanization keeps rising. There is therefore the need to promote in-house retrofitting with water saving devices to

[7] G. Llopis (2013). A blog on solving the leadership identity crisis to enable unseen opportunities: *The 4 Most Effective Ways Leaders Solve Problems.*

[8] White S. (1999). Integrated resource planning in the Australia water industry. Proc. of Conserv99, American Water Works Association, Monterey, California, 1999; Kwarteng and Annor (2014).

conserve water. Water conservation is a cheap and large source of water which could be provided within cities. For almost all range of water needs, it is possible to increase the efficiency of water use without reducing the service level. Reducing the amount of water used in toilets and eliminating leaks in the distribution system are the two most efficient approaches to water conservation in urban areas. Urban and rural water conservation enables the reallocation of water saved to the unserved. There are many different WDM measures which could be regrouped[9] aside their levels of service:

i. By type of tools used: (a) structural and operational measures include the use of devices, retrofitting, leakage control (b) non-structural measures include water pricing, education, legal, socio-political means;
ii. By type of incentives: (a) legal obligations (b) economic incentives (c) motivation through public education ;
iii. By time horizon: (a) emergency measure (b) medium term measure (c) long term measure
iv. By sector where the measure is applied (a) urban, (b) industrial (c) agricultural
v. By location of the water supply system (a) water treatment (b) distribution network (c) end-users' properties
vi. By the entity bound to carry out the measures (a) local authority (b) service provider (c) end-users

Water conservation could as well be grouped into four (4) based on the kind of tools and the responsible entity to carry out the measures as shown in Figure 2. The major problem in Ghana is the lack of integration of projects and overlapping responsibilities of various institutions.

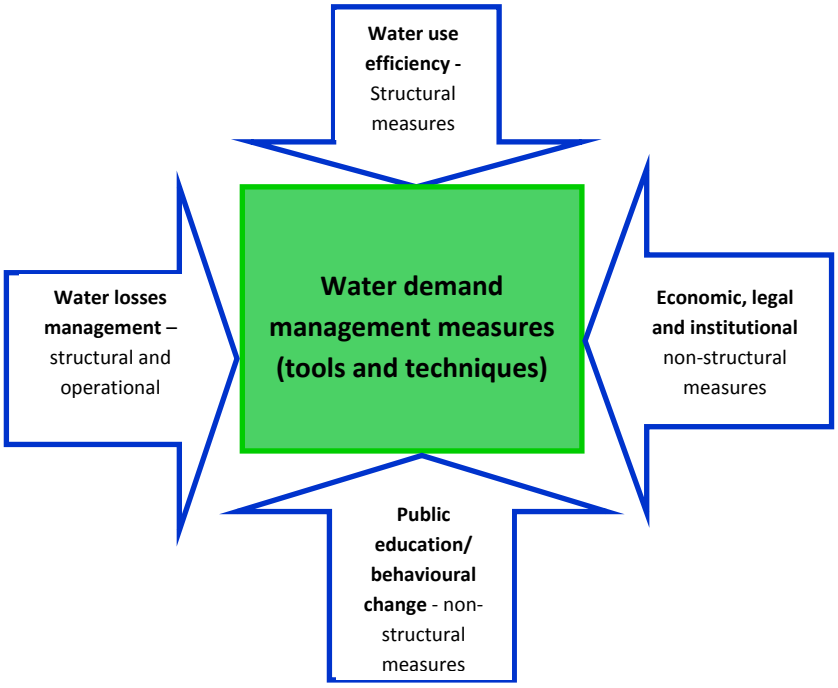

Figure 2: WDM measures based on tools and techniques[10]

3.2.1 Water Use Efficiency

Structural and operational measures for increasing water use could include the following

i. Using water efficient devices and retrofitting;
ii. Rationing and recycling water;

[9] Grouping found in Kwarteng and Annor (2014).
[10] Kwarteng and Annor (2014)

iii. Metering, reduction of unaccounted for water (UFW), leakage detection and repair; and
iv. Water use restrictions during periods of high water shortages[11].

Some of these measures could be carried out at the source of the supply or at the delivery point of the water which includes homes, offices, farms, and environment (wetlands). At homes and offices one can use:

a. Low flush and double flush toilets (toilets with two nobs for flashing especially one for urine and the other for toilet);
b. Water closet Cistern Dams to reduces amount of water required to fill a cistern after each flush;
c. Water saving taps and shower heads;
d. Water efficient washing machines and dishwashers (which has enjoyed increasing use in urban areas in Ghana even during the "dumsor" erra;
e. Urinal controls;
f. Waterless toilets and urinals (dry sanitation); and
g. Efficient water supply and irrigation systems for gardens and farms.

Table1 shows the water savings as a result of water conservation in household water use.

Table 1: Household water savings as result of water conservation measures[12]

Type of use	Without conservation (gpcd)	With conservation (gpcd)	Savings (%)
Toilet	**18.3**	**10.4**	**44**
Cloth washing	**14.9**	**10.5**	**30**
Shower	**12.2**	**10.0**	**18**
Faucets	**10.3**	**10.0**	**2**
Leaks	**6.6**	**1.5**	**77**
Bath	**1.2**	**1.2**	**0**
Dish washer	**1.1**	**1.1**	**0**
Total	**64.6**	**44.7**	**31**

3.3 Lesson 3: Public Awareness, Education and Behavioural Change

There is the need to educate stakeholders on the value of water. Knowing the value of water will help conserve water through efficient use and reduce economic water scarcity. This should be one of the key activities to be undertaken by the Water Resources Commission every year especially during the world water week celebrations. The commission can hold radio and television programs, school education (through environmental clubs), forums on water conservation and use, and publish articles in the mass and print media. The commission together with other partners could also organise symposiums and exhibitions for water saving innovations and fund promising innovations. Awareness raising and education should be considered as a key component of water conservation measures. The education should not be done only for end users but suppliers of water services as well. While vouching for

[11] These are used in the catchment simulation game – catchment detox. Reflect on it when you play the game.
[12] AWWA WaterWiser (1997). *Household end use of water with and without Conservation*.

behavioural change, it must be noted that sometimes, strong institutions should be used to boost these changes especially when the changes would not occur by self-motivation.

A key component of the awareness raising could be done using the water-wise garden principles[13] especially for gardening and farming which are given below:

i. Follow the natural rainfall patterns
ii. Provide shelter from the wind and sun
iii. Group plants according to their water needs
iv. Improve the soil (soil water management)
v. Provide much more mulch
vi. Reduce your lawn or farm when necessary (using wise designs)
vii. Water correctly
viii. Grow water-wise plants

A water-wise garden is one with all the main principles (stated above) applied. It is most appropriate to use plants that are adaptable to a site than changing the environment to suit the plants. For example, drought resistant seedlings could be used for very dry areas such as the Northing part of the country so as to reduce the cost of building expensive irrigation systems to enable crops survive. What is often needed is smart planning instead of huge and very often inefficient and ineffective investments. Water services providers should ensure they practise what they "preach" to serve as good examples for others.

3.3.1 Education in Schools

Educating students on WASH is one of the most important aspects of public awareness on water conservation. This is due to the fact that students are considered as ambassadors or change agents at homes. Once students get educated at schools, they will in-turn educate their parents and communities. Enormous amount of material is available for WASH in schools in Ghana especially from UNICEF and the Ghana Education Service[14]. Hence the focus on WASH in schools should be on designing posters, booklets, pamphlets, stickers, essay competitions, field trips or excursions to water and sewage treatment works and water conservation facilities, development of water audit kits and apps for use in schools, and water painting competitions. Aside these, schools could be encouraged in redesigning and implementing retrofitting projects on their own campuses to promote water conservation education. Some of these activities could be carried out as part of the celebration of the World Water Day in Ghana by the Water Resources Commission every year.

3.4 Lesson 4: Catchment Planning and Zoning

The failure to match supply with demand in terms of water is highly due to mismanagement of the resources and the destruction of forest reserves which provides clean, healthy water, including

[13] L. van der Walt (2001). Principles of Water-wise Gardening. South Africa National Biodiversity Institute. Available online http://plantzafrica.com/using/waterwis2.htm

[14] The WASH minimum Standards contain the following: National Implementation Model of WASH in Schools, Technical Guide for WASH in Schools, WASH in Schools (WinS) Facility Management Plan, WASH in Schools Facilities Planning & Management Guide, WASH in Schools Checklists, Samples of Technical Drawings, Education Guide for WASH in Schools, School Health Clubs Guide, Children's Role in Community Led Total Sanitation (CLTS), Children and Youth Ambassadors for WASH (WASHSPLASH), Best schools check list for grading schools on WASH delivery.

filtering effects[15]. This shows that planning of catchments is needed to protect water bodies and conserve water in terms of quality. Even though the direct effect of the protection of trees on water quality is not quantifiable in terms of numbers due to the fact that it depends on the location, age, type of the trees and the extent of pollution, the effect is almost always positive when well managed. To protect catchments, land use zoning is required to restrict human activities in these zones so as to keep or restore the natural cleansing conservation of water through forests in watersheds. In this module, participants would be introduced to the ABC catchment detox simulation game[16] with the aim to carry out activities and check their impacts on the catchment. In this game, participants can find various ways of conserving water including investing in research work to turn a watershed which is in terrible state to an almost excellent state. The challenge is strong but exciting and will help participants plan/zone their catchments well using examples from the game. The user-friendly interface is shown in Figure 3. The game was developed by ABC in Australia. Australia and Ghana share a lot in common in terms of climate. However it is intended that this be developed on collaboration with ABC for Ghana and other West Africa Sub-region with different species of trees, activities and culture.

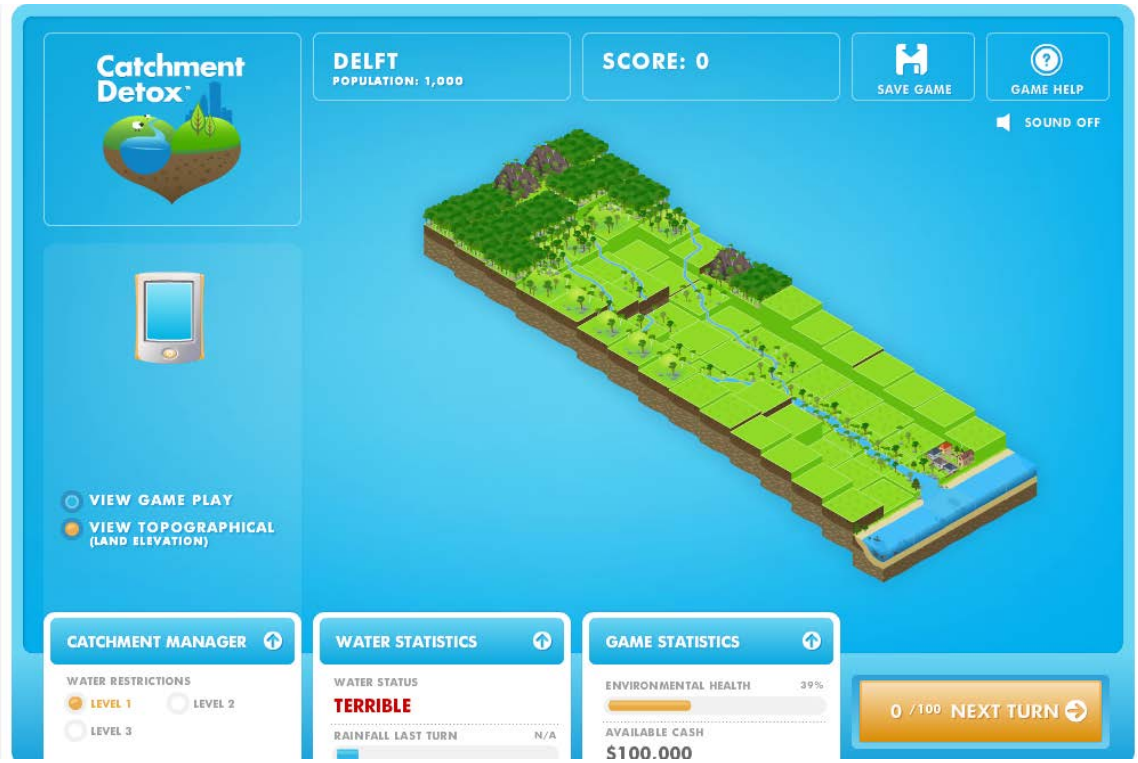

Figure 3: The catchment detox game interface

[15] FAO (2007). Managing forests for cleaner water for urban populations. Unasylva, Volume 58, 229, 2007/4.
[16] www.catchmentdetox.net.au

4. RAINWATER HARVESTING TECHNOLOGIES AND MANAGEMENT OF WATER STORAGE FACILITIES MODULE

The main objective of this module is guide participants on how rainwater harvesting could be done and stored without water quality problems using examples from the White Volta basin of Ghana. Practical ways of managing rainwater (in-situ and ex-situ rainwater harvesting and soil water management) would be discussed. Participants would go through lectures, presentations, group exercises, role plays and a field trip on rainwater harvesting, storage and use. This module should be taught within 3 Days. Site visits to existing facilities is essential for participants to appreciate the concepts very well.

1.1 Lesson 1: Rainwater harvesting technologies

Rainwater Harvesting Technologies (RWHTs) although helps capture and store water during the wet season and makes it available for use in the dry season (for domestic purposes and gardening), is not widely practiced in Ghana. This is due to poor knowledge and lack of data on the critical drivers and procedures for the use of low-cost but efficient rainwater harvesting systems at various levels (household, community and district levels). Accelerating the spread and utilisation of different RWHTs will enhance resilience building and climate adaptation especially for areas suffering from economic water scarcity in Ghana. The focus of this section will be RWHTs for farming, urban gardening and domestic uses. Some of the most widely used RWHTs in Sub-Saharan Africa is given in Table 2.

Table 2: Rainwater harvesting systems widely used in Ghana and Southern Burkina Faso[17]

Rainwater harvesting system	Description	Technologies	Management
Macro-catchment	Reservoirs (1–100 ha) for capturing and storing run-off at macro-catchment level. Water is used for supplemental irrigation during dry spells, livestock and for domestic consumption	Sand dams, cisterns, micro-dams; open ponds small reservoirs, earth dams, streams, spate irrigation	Farmer communities and/or individual farmer
Micro-catchment	Designed to collect run-off from small catchment areas (10–500 m^2); applied in areas characterised by low and erratic rainfall	Pitting (Zai pits, half-moon pits, trenches); contouring (stone/ soil/vegetation bunds); terracing	Farmer communities and/or individual farmer

Rainwater harvesting (in-situ and ex-situ) could transform societal, economic and environmental domains such as climate change adaptation, food security and water availability (societal), household income improvement and increase in yields (economic) and restoration of degraded landscapes, soil structure and fertility (environmental). There is a strong link between water conservation technologies (especially rainwater harvesting) and food security. This has to be well understood. More than 80% of farmers in Ghana practise rainfed agriculture. Hence improving soil and water (rainwater) conservations in farms is

[17] Timothy Karpouzoglou and Jennie Barron (2014). A global and regional perspective of rainwater harvesting in sub-Saharan Africa's rainfed farming systems. Physics and Chemistry of the Earth 72–75 (2014) 43–53.

of utmost importance to farmers. Some of the technologies used to conserve soil and water in farms include those shown in Plate 1.

(a) Small reservoir

(b) Ridges and furrows

(c)Treadle pumps and shallow wells

(d) Earth/Stone bund

(e) Demi-lune (half-moon)

Plate 1: In-situ rainwater harvesting systems applicable in Ghana

Rainwater harvesting systems (ex-situ) that could be used at homes is given in Plate 2 and Figure 4. These often include roof gutters, filtering systems and tanks. Buried tanks need pumps

Plate 2: Household rainwater harvesting system with an overhead tank

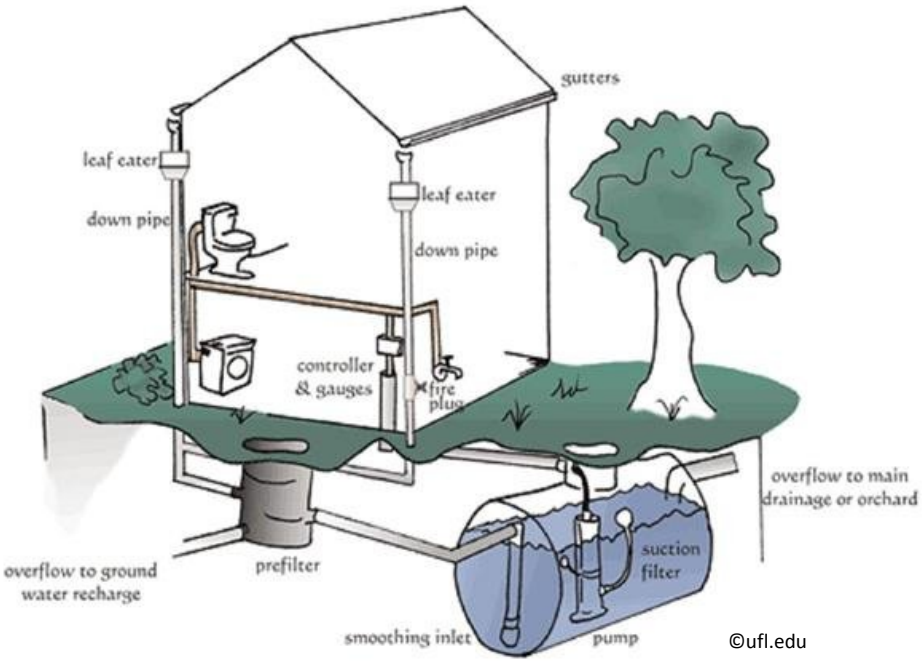

Figure 4: Household rainwater harvesting system with a buried tank

In urban and peri-urban areas rainwater harvesting could be promoted using the Ghana building code. This code needs to be updated and backed with a policy and LI to ensure strict compliance. One of the critical things that needs to be considered is the use of treated water for watering lawns and gardens in cities. All new constructions should incorporate rainwater harvestings systems in them especially state buildings. This means that MMDAs need to understand these codes and policies which they currently miss. This nodule will therefore enlighten them on the link between various environmental policies, rainwater harvesting technologies and agriculture productivity. Douxchamps *et al.* (2012) proposed an improvement in Agriculture Water Management (including rainwater harvesting) as the solution to sustainable benefits for regions with high water scarcity. Improving rainwater harvesting at homes and farms therefore have a direct bearing on water security and sustainable economic growth. The handbook[18] on rainwater harvesting policies is quite handy for this module.

[18] C. Kloss (2008). Managing Wet Weather with Green Infrastructure. Municipal Handbook on Rainwater Harvesting Policies. US EPA-833-F-08-010.

5. CONFLICT MANAGEMENT; EFFECTIVE NETWORKING; AND BENEFIT SHARING MECHANISMS

In the management of land and water resources the concept of benefit sharing needs to be understood. This has to be combined with effective networking and negotiation skills. This module will give some highlights on how to negotiate, use effective networks for development and enhance the optimal use of limited resources using benefit sharing mechanisms. Training materials would be presented in the form of lectures (presentations), group work, role plays and individual short paper assignments. The module is designed to be taught within 2 days.

1.2 Lesson 1: Conflict Management

Negotiating skills are needed for effective conflict resolutions and even to some extent to avoid (minimise) conflicts. Often partners come together at a table with different objectives, ideas, values and beliefs[19]. These differences are a primary strength for the collaboration while at the same time if not well managed could lead to war no matter how small they could be. There is therefore the need to help MMDAs to improve their abilities to function effectively on multi-stakeholder platforms by enhancing their understanding of conflicts and developing their capabilities to manage and resolve conflict through effective negotiations.

The Merriam-Webster dictionary defines conflict as a "*competitive or opposing action of incompatibles : antagonistic state or action (as of divergent ideas, interests, or persons) or a mental struggle resulting from incompatible or opposing needs, drives, wishes, or external or internal demands*". Conflict management can be difficult especially where involved parties take entrenched positions such as not to lose but only gain from a partnership agreement. One has to understand that to avoid conflicts there is the need to negotiate with the mentality to loose and gain from the partnership. There has been instances where joint waste treatment systems were proposed in Ghana by the Community Water and Sanitation Agency (CWSA) but kicked against by the District assemblies due to the low negotiation skills they have to unable them jointly carry out WASH projects.

There are three ways in which conflicts could be viewed (Ghadei, 2005);

1. The traditional view which believes that all conflicts are harmful and needs to be avoided;
2. Human relations view: belief that conflict is a natural and inevitable outcome in any group;
3. Integrationist view: conflict is not only a positive force in a group but that it is absolutely necessary for a group to perform effectively.

These definitions imply that conflicts could contribute to or work against achieving a set goal. Functional conflicts work toward achieving a group goal while dysfunctional conflict impinges a group from reaching its' goals. Conflicts could also be grouped into task (i.e. based on content and goals of the work), relationship (focuses on inter-personal relationships) and process (related to how work gets done) conflicts.

There is therefore the need to get ideas and innovations to change potential conflict(s) by investing time and resources in conflict management (prevention) especially on land and water resources. Again conflict

[19] K. Ghadei (2005). Conflict Management. Department of Extension Education Institute of Agricultural Sciences. Banaras Hindu University, Varanasi.

can be an opportunity to improve services and strengthen relationships. What is needed is to determine the level of the conflict and what mechanisms could be used to turn them into opportunities.

Figure 5 shows the various groups and levels of conflict.

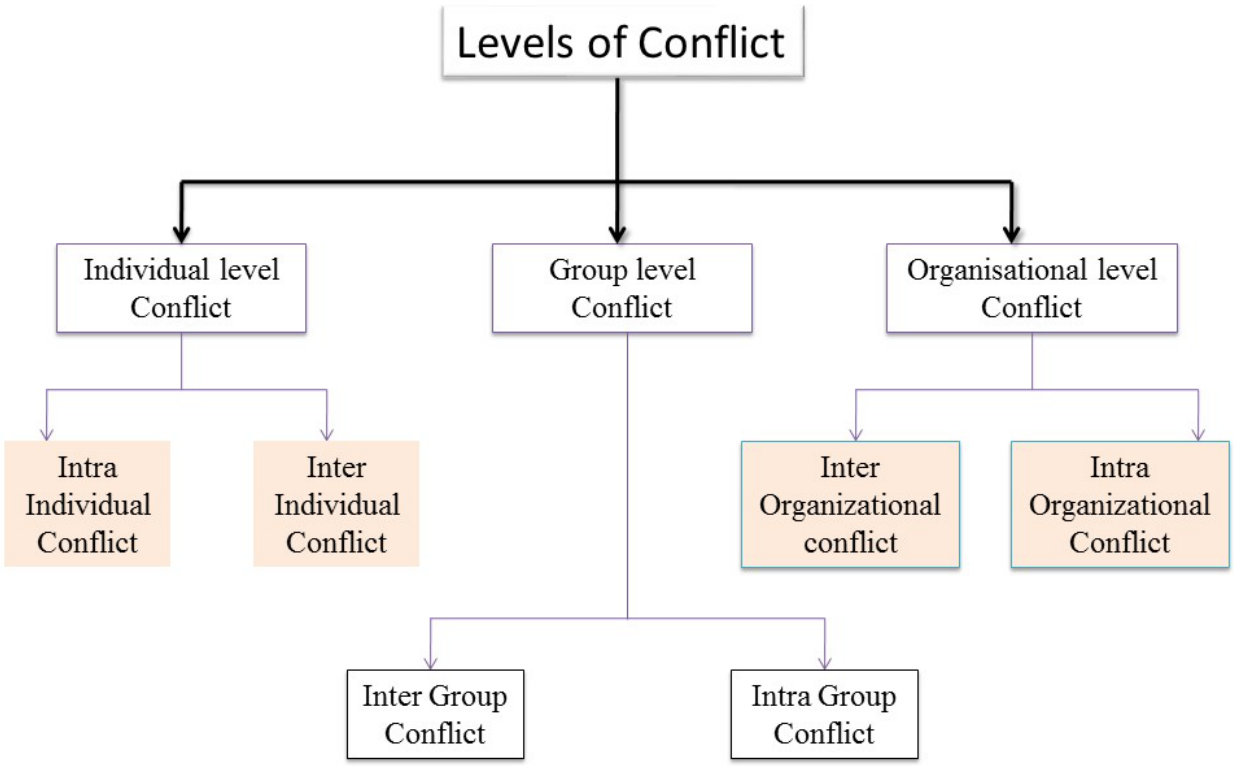

Figure 5: Levels of Conflict[20]

Table 3: Functional and Dysfunctional conflicts[21]

Functional Conflicts	**Dysfunctional Conflicts**
• Constructive • It helps increase information ideas • Encourages innovative thinking • Unshackles different points of view • Reduce stagnation	• Tension, anxiety, stress • Drives out low conflict tolerant people • Reduce trust • Poor decision because of withheld or distorted information • Reduce information

Conflicts could be managed in serval ways based on the qualities and (or) experience of the parties involved and sometimes the mediator. Some of the ways to manage conflicts includes the following:

- Avoidance (no one wins or losses)
- Competition/Forcing (I win, the other loses)

[20] Kanth *et al*. (n.d). Presentation on Conflict Resolution

[21] K. Ghadei (2005). Conflict Management. Department of Extension Education Institute of Agricultural Sciences. Banaras Hindu University, Varanasi.

- Accommodation (One loses or gives in)
- Compromise (Both parties get something)
- Collaboration (both win: win-win situation)

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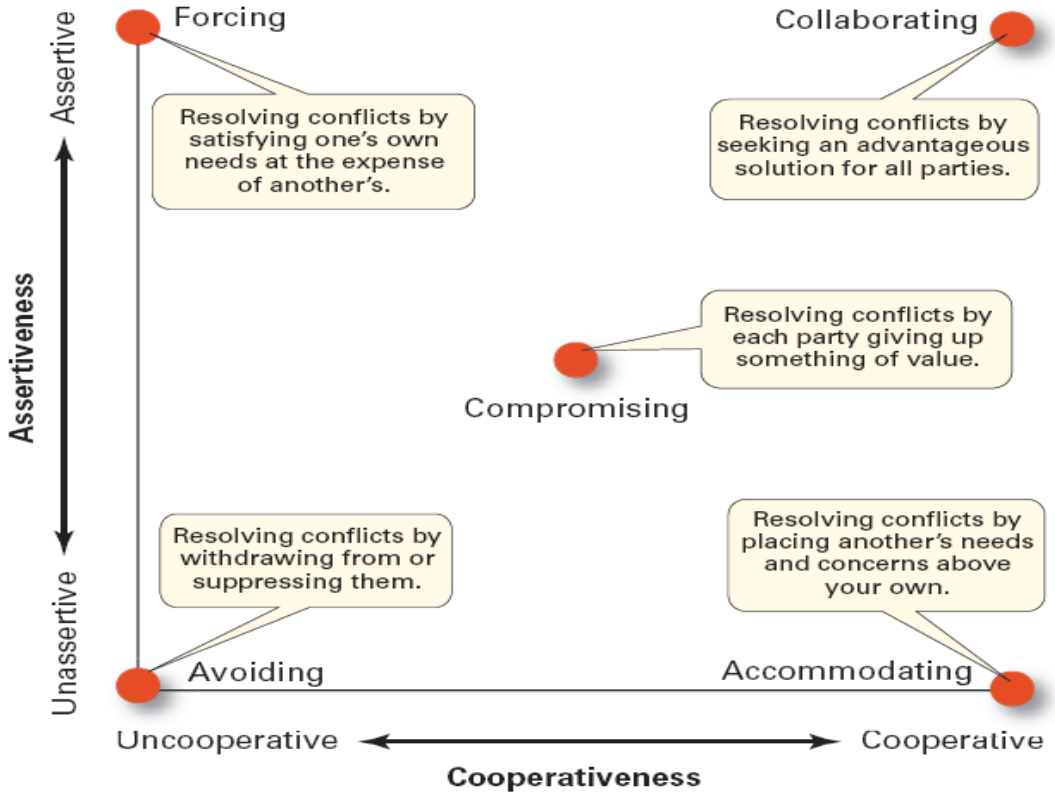

Figure 6: Conflict Management blocks
Source: Saptak das Somen Chatterjee (n.d)

1.3 Lesson 2: Effective Networking

Networking is essential for delivering solutions in the WASH sector. The challenges and opportunities in the sector in Ghana requires effective networking/collaboration to deliver the right outputs from projects and initiatives. One institution or person cannot do it alone. For one to effectively network, an analyses has to be done so as to partner a network of networks. This will ensure optimum benefits and cost sharing. The first thing to do is to identify key entry points for investments. This could be through MDAs, MMDAs, NGOs and private companies at the community, district, regional, basin, national and international levels. Network analyses is important for two main reasons:

- For identification of the right mechanisms and processes to ensure investments are carried forward for implementation; and

- To understand the planning systems at all levels to identify appropriate entry points

A network analyses could be considered as a tool for mapping the interactions between individuals, groups and organisations. This could be done from the lowest level (community) to the international level. One of the tested tools in Ghana for network analyses is the Net-Map which was used in the White Volta basin of Ghana. An example of the output from a network analyses using the Net-Map is shown in Figure 7.

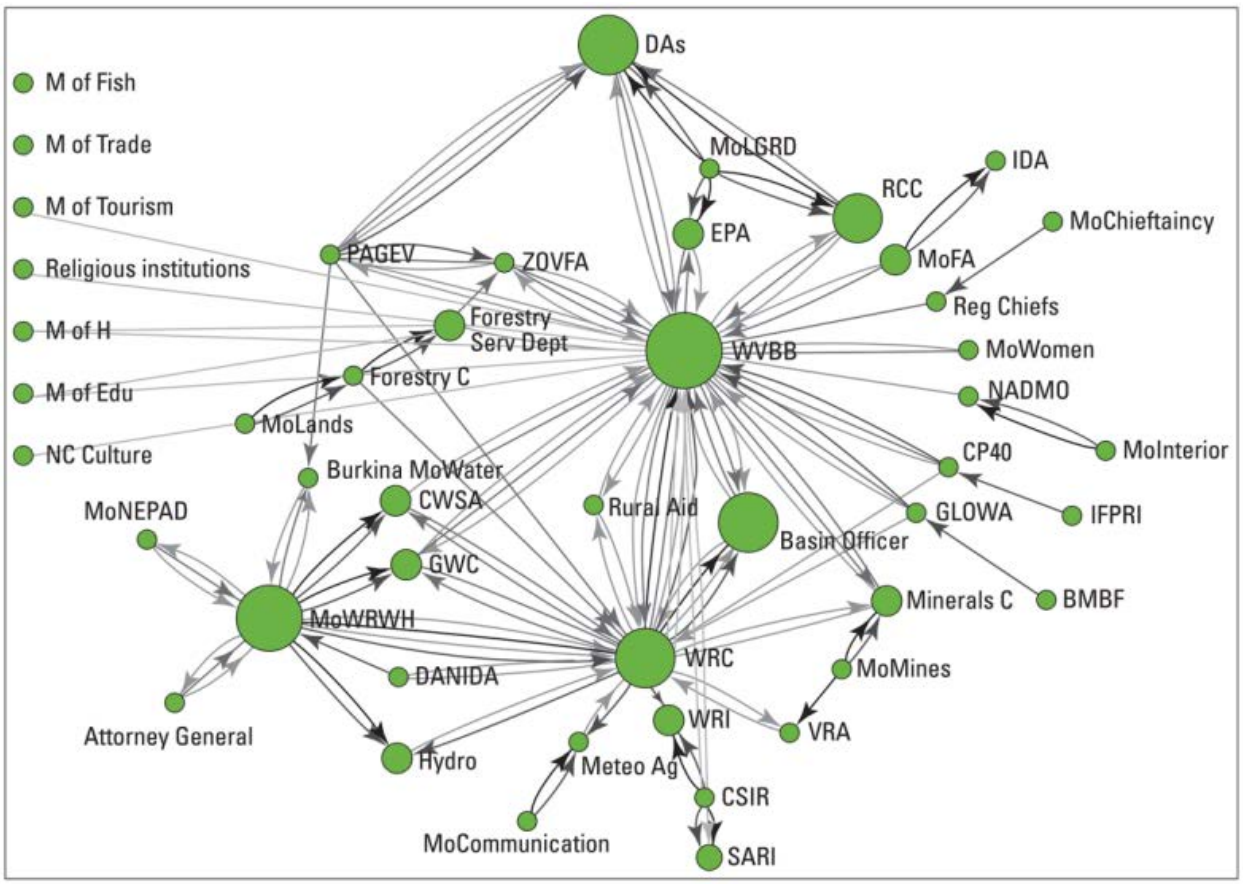

Figure 7: Results from a network analyses carried out in the White Volta Basin of Ghana[22]

Entry points that could be used for networking include budget statements, strategic documents and national policies. For MMDAs the Short and Medium Term Development Plans are key entry points for effective networking.

1.4 Lesson 3: Benefit Sharing Mechanisms

Benefit sharing means using common resources for the common good of all people who have access to the resource. This could be at various levels from community, national to transboundary levels. It must be noted that water could be a cause of conflict or an avenue for cooperation. The key element between these two (conflicts and cooperation) is how costs and benefits are shared especially with regards to water resources where there is a need for reciprocity between upstream and downstream users or uses. Upstream water users will only be prepared to forgo some immediate benefits should they get something in return. At the same time, downstream users would wish upstream users allow water to flow to them at an acceptable quantity and quality. In other to get this, there is a need for downstream users to motivate upstream users. This could only be done if there is some shared costs and benefits. Neighbouring countries like Burkina Faso (upstream) and Ghana (downstream) will only cooperate when they have developed ties and interdependencies for water-related joint ventures (e.g. infrastructure) and ventures beyond water such as trade, energy and transport. Benefit sharing requires some effort because it is technically complex, pre-supposes a consensus over basic water entitlements, should encompass all costs

[22] GWP (2014b). Delivering solutions. Presentation on integrating no/low regrets investments in the development of planning processes: The role of network analyses.

and benefits and also requires effective institutions to re-distribute the costs and benefits fairly[23]. The "referee" for costs and benefit sharing at the basin level such as the Volta Basin Authority (VBA) therefore has a herculean task and needs financial and human resources support. A good benefit sharing mechanism can help avoid or resolve conflicts.

[23] P. van der Zaag (2009). Capacity building for the peaceful and equitable sharing of transboundary water resources. Presentation in Accra, Ghana.

6. WATER QUALITY AND HEALTH RELATED IMPACTS OF CLIMATE CHANGE[24]

The aim of this module is to introduce participants to the link between climate change, water quality and health. The didactics include power point presentations (lectures), group assignments and short essays. The module is designed for 2 days of teaching and learning.

Water security as defined by GWP is the availability of an acceptable quantity and quality of water for health, livelihoods, ecosystems and production, coupled with an acceptable level of water-related risks to people, the environment and economies. Water security is greatly impacted on by changes in climate which is caused by volumetric changes in greenhouse gases which causes the earth's temperature to rise with its direct impact on rainfall regimes. This affects the distribution of water, the quantity available and the quality of the water available. For an example, high flows will have high dilution capacities as compared to low flows. In the midst of changes in climate there is the need to secure basic water needs for the populace of the country. This is quite a challenge since Ghana does not consider access to water as a basic human right yet since 2010 when the General Assembly of the United Nations acknowledged the "right to water" as part of the right to an adequate standard of living. Issues of water and health are critical especially in the most populated urban and peri-urban areas. There is therefore the need to focus on benefits derived from the use of water, rather than the allocation of water itself. This will provide far greater scope for identifying mutually beneficial cooperative actions for people and the environment (Sadoff and Grey 2005).

6.1 Lesson 1: Climate Change, Water Quality and Health implications

Climate change can affect water quality in two ways (both extremes: flood and drought). More rainfall will mean more runoff and higher levels of nutrients which contains more pathogens and pollutants. The contaminants which were originally stored in groundwater reserves would be flushed out in the discharge water (IPCC 2007).

With the other extreme condition (less rainfall and therefore drought) over a long period of time, will bring about a depletion of groundwater reserves. This means that base flow will reduce and hence the dilution factor of water in streams and rivers would be less. There would therefore be high levels of contaminants and even sea water intrusion since stream flows will be low an unable to push the sea water into the sea. Portable water in these areas will therefore be difficult to come by. The little that would be available could also suffer from high saline content. Changes in water quality has a direct bearing on the ecosystem services that the river or stream offers. Changes in quality would affect fisheries and domestic water supply and irrigation water supply.

The health sector is manned by the Ghana Health Service under the Ministry of Health (MoH) and other allied health service agencies. Together, they seek to improve the health status of all people living in Ghana by improving the human capital through the development and implementation of policies that will ensure improved health and vitality. Some of these policies include the following;

i. National Health Policy;
ii. Anti-Malaria Drug Policy;

[24] This section is based on a study by F.O. Annor for GWP (2014a) on the review of national adaptation responses in the context of water security and climate resilient development in Ghana under the WACDEP Project housed in GCWP of the GWP.

iii. Traditional Medicine Policy;
iv. Health Sector Gender Policy;
v. Health Sector ICT Policy and Strategy;
vi. Policy and Guidelines for Hospital Accident and Emergency Services in Ghana;
vii. National E-Health Strategy;
viii. Essential Medicine List; and
ix. Occupational Health & Safety Policy

Current challenges that confront the health sector in Ghana are low doctor-to-patient ratio, inefficient National Health Insurance Scheme (NHIS), inadequate equipment and facilities at the hospitals and medical schools and lack of funds to run the hospitals in general. This often leads to high infant and maternal mortality rates. In addition to these national challenges in the health sector, issues on climate change needs to be addressed. Climate change has a direct and indirect effect on the health of people. "*These include alterations in the geographic range and intensity of transmission of vector, tick, and rodent-borne diseases and food and waterborne diseases, and changes in the prevalence of diseases associated with air pollutants and aeroallergens"*[25]. Although there is some localised positive impact of climate change such as increases in food production, the overall health effect of climate change is more negative[26]. The negative impacts are mainly due to extreme temperatures (heat) and very high rainfall.

Extreme heat and health implications

There were reports of Cerebro-spinal Meningitis (CSM) in the Northern, Upper East and Upper West regions especially in 2006 and 2010. This is largely attributed to linkage between Neisseria meningitides bacteria and high (abnormal) temperatures[27] [28] [29] normally experienced between November and May within the CSM belt in Ghana. With these same abnormal temperatures (extreme heat) come along higher levels of pollen and aeroallergen which can trigger asthma.

Variable rainfall and health implications

With low rainfalls, food production will decrease which will affect diets especially that of children and exacerbate malnutrition. This calls for more innovative water storage systems and climate-smart irrigation facilities for improved food production. On the other hand, high rainfalls will also lead to floods which may contaminate freshwater sources leading to water-borne diseases, destruction of farms, houses and health infrastructure and possibly hamper the smooth delivery of essential medical and health services.

[25] Integrating climate change into the management of priority health risks in Ghana (2010). *UNDP Sustainable Development, Climate Change and Health Project in Ghana (2010-2013). Ministry of Health*
[26] WHO (2014). Climate Change and Health Fact sheet N°266. World Health Organisation. http://www.who.int/mediacentre/factsheets/fs266/en/
[27] B. Sultan, K. Labadi, J. Guégan and S. Janicot (2005). Climate Drives the Meningitis Epidemics Onset in West Africa. Journal of PLoS medicine. Doi: 10.1371/journal.pmed.0020006.
[28] S.N. Codjoe and V.A. Nabie (2014).Climate change and cerebrospinal meningitis in the Ghanaian meningitis belt. Int. Journal of Environ Res Public Health. 2014 Jul 7; 11(7):6923-39. Doi: 10.3390/ijerph110706923.
[29] G.K. Amofah (n.d.). Global Warming and Health: Policy Implications for the Health Sector. http://www.ghanahealthservice.org/

The impact of climate change on the sector is further elaborated on in Box 1[30]. It is in this direction that the UNDP in 2010 supported the Ghana Health Sector through the Ministry of Health to undertake the project on integrating climate change into the management of priority health risks in Ghana. The Project activities included identifying, implementing, monitoring and evaluating climate resilient measures to reduce the likely future burdens of malaria, diarrhoeal, cerebrospinal meningitis (CSM) and other priority climate change-related health issues identified by stakeholders[31].

Box 1. WHO Fact Sheet No. 266 on Climate Change and Health

Key facts

a. Climate change affects the social and environmental determinants of health – clean air, safe drinking water, sufficient food and secure shelter.

b. Between 2030 and 2050, climate change is expected to cause approximately 250,000 additional deaths per year, from malnutrition, malaria, diarrhoea and heat stress.

c. The direct damage costs to health (i.e. excluding costs in health-determining sectors such as agriculture and water and sanitation), is estimated to be between US$ 2-4 billion/year by 2030.

d. Areas with weak health infrastructure – mostly in developing countries – will be the least able to cope without assistance to prepare and respond.

e. Reducing emissions of greenhouse gases through better transport, food and energy-use choices can result in improved health, particularly through reduced air pollution.

Figure 8 below for example shows a map of the malaria prevalence model for Ghana. This shows the link between climate and the prevalence of diseases especially comparing the dry part of the country (Northern Ghana) and the wet (Southern) part on the map.

[30] WHO (2014). Climate Change and Health Fact sheet N°266. World Health Organisation. http://www.who.int/mediacentre/factsheets/fs266/en/

[31] Integrating climate change into the management of priority health risks in Ghana (2010). *UNDP Sustainable Development, Climate Change and Health Project in Ghana (2010-2013). Ministry of Health, Ghana.*

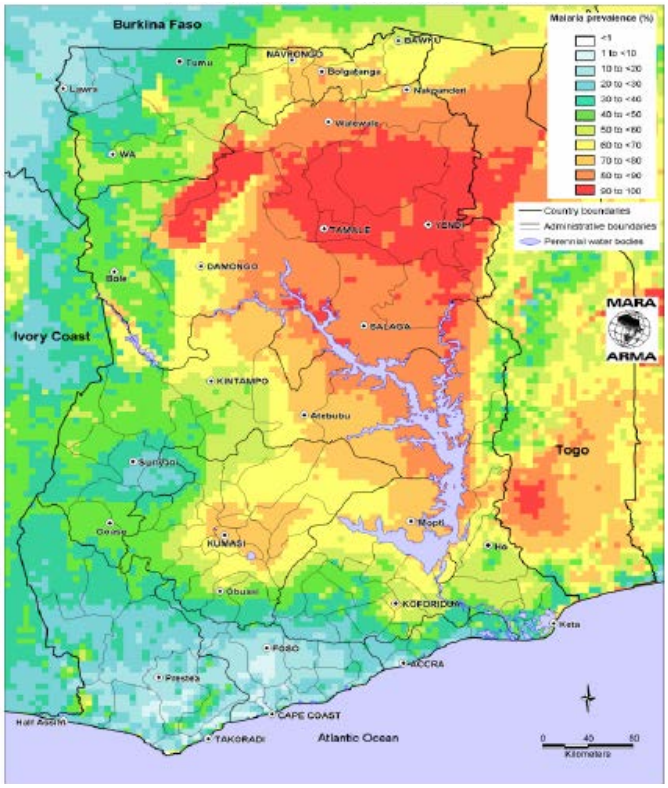

Figure 8: Malaria Prevalence Model for Ghana

Source: Strategic Plan for Malaria Control in Ghana (2008-2015)

There is an indication that the degree to which climate hazards are translated into human impacts is dependent on the resilience of the health and related sectors to deal with climate-related diseases. Even on the issue of water security the road map for implementation is still lacking. This increases the vulnerability of the populace especially those in coastal areas and very arid conditions are at risk.

7. INNOVATIVE FINANCING OF WASH PROJECTS THROUGH VARIOUS PPP ARRANGEMENTS

For this module, participants would be taught how to finance projects through PPP arrangements to support public investments. Participants would be taken through some power point presentations (lectures), group assignments, role plays and short essays. The module is designed for 3 days of teaching and learning.

The World Bank/IMF reforms has brought about many Public Private Partnerships (PPP) arrangements in Ghana since the 1980s[32]. These partnerships have brought about improvement in many of the organisations which used to be wholly public entities (i.e. state enterprises). Privatisation has also brought about some organisational (accounting control systems) and behavioural (attitudinal) changes at work places. Although there have been a few failures, most of these arrangements have been very successful. The idea for some of these arrangements was to get investment from the private sector and to reduce inefficiencies in the running of State-Owned Enterprises (SOEs) by bringing on board private management.

7.1 Lesson 1: PPP in the Water Sector in Ghana[33]

In the water sector several PPP arrangements were made in the late 1980s. Consistent with the objective of promoting private sector activities as enshrined in Article 37 of the Constitution of the Fourth Republic of Ghana, Government undertook major transformations in the SOEs. The entire economic reform program was to improve the economy by engaging the private sector in the development, utilization of capital and the management of SOEs using modern technology to access the global market. Some non-performing SOEs were disposed of and others divested. According to Sam (2001) "*at the outset of the divestiture program, most of the over three hundred SOEs operating in all sectors of the economy by then such as manufacturing, agriculture (including cocoa and coffee plantations, poultry and fishing), mining, hotel and timber had proven to be inefficient and wasteful, constituting the bulk of Ghana's massive budget deficits"*. The objectives of divestiture programme included the:

- Reduction of administrative burden on the state and diversifying ownership;
- Increment in the size and dynamism of the private sector through the creation of an enabling environment;
- Encouragement and facilitation of private sector investment from both domestic and foreign sources for modernization and rehabilitation;
- Enhancing macroeconomic stability as a result of increased revenue inflows from the sale of SOEs and accrued savings from withdrawal of support to SOEs.

The SOE reform program in Ghana had two components: performance improvement measures for enterprises retained for strategic reasons and divested or privatised state-owned enterprises with a transfer of ownership to private investors Ghanaians or non-Ghanaians alike. Details of SOEs divested by the various techniques as at the end of 1999 is given in Table 4.

[32] Ayotunde T. Etchie, Tunde O. Etchie, Gregory O. Adewuyi, Krishnamurthi Kannan, Satish R. Wate, Saravanadevi Sivanesan, Angela U. Chukwu (2014). Influence of seasonal variation on water quality in tropical water distribution system: is the disease burden significant? Water research 49 (2014) 186-196.

[33] Based on a report by Sadick Mahmud Sam (2001). Public-Private Partnerships in Ghana – the Case of the Water Sector. National Development Planning Commission, Ghana.

Table 4: Divested SOEs in Ghana as of 1999[34]

Technique	Number of SOEs divested
Sale of Assets	127
Sales by Shares	35
Joint Venture	21
Lease	7
Liquidation	43
Total	**233**

Due to the success stories of PPP arrangements in Ghana, development partners (donors) are moving from aid to trade to foster economic growth through support to private sector involvement in SOEs. This is the current trend hence MMDAs need to be strategically positioned to attract private investments at the local and national levels. Private sectors could be involved in financing the districts through the development of business plans based on the short and medium term development plans to sustain district activities. Some of these case studies should be used as exercises during the delivery of the trainings.

It must be noted that private investors want minimal risks. The higher the risks associated with a business venture the less likely they are willing to invest. This means MMDAs need a lot of innovations to attract private investments.

1.2 Lesson 2: Approaches to Risk-based decision-making (RDM) for investments[35]

There are two approaches that are commonly used for risk –based decision making: the science first approach or the policy first approach. These two broad approaches both aim to achieve climate resilient development, but take different routes to get there. Investing in climate resilient project will ensure that with or without climate change the project becomes sustainable.

The science-first approach (also called 'predict then act' approach) makes climate predictions and then select adaptation projects; while the policy first approach Starts with the investment or project and identify the conditions that would make it vulnerable. They both have their strengths and weaknesses.

Advantages of the policy first approach:

- It starts with the project;
- It uses existing institutions and processes;
- It embraces uncertainty;
- It comes from the point of view of the decision maker hence enabling environment is already created;
- It encourages a range of possibilities to be considered; and
- It doesn't seek the 'optimal state'

Policy first approach promotes robustness by embracing uncertainty, incorporating different future climate scenarios, estimating return of investment for a range of scenarios, identifying 'No/Low regret', climate change justified' and 'climate change risky' adaptation options, and avoids mal-adaptation.

Examples of low risk or climate resilient investments include the following:

[34] Sadick Mahmud Sam (2001). Public-Private Partnerships in Ghana – the Case of the Water Sector. National Development Planning Commission, Ghana

[35] GWP (2014b). Identify and appraise options: Risk-based decision-making for investments.

- Early warning systems with effective dissemination in locally relevant context;
- Risk communication between decision makers and local citizens;
- Sustainable land management, including land-use planning;
- Ecosystem management and restoration;
- Improvements to health surveillance;
- Water supply;
- Sanitation, irrigation and drainage systems;
- Climate-proofing of infrastructure;
- Development and enforcement of building codes; and
- Better education and awareness.

Projects such as the ones stated above could attract private investors for possible joint ventures with the MMDAs.

8. PREPARATION OF BANKABLE PROJECT PROPOSALS AND IDENTIFYING VARIOUS SOURCES OF FUNDING TO IMPLEMENT PROJECTS[36]

This module aims at helping MMDAs, Water and Sanitation Institutions to develop bankable (easily justifiable, feasible and less risky) projects that contribute to improving water security and climate resilience. Training would be done with lectures in the form of power point presentations, group work, role plays, mind mapping and assignments. 3 days has been earmarked for this module.

8.1 Financing Climate Responsive Development

Ghana is among the countries in Sub-Saharan Africa that are most vulnerable to the impacts of climate change (IPCC AR5, 2013). Development in Ghana have at times been slowed down by a number of factors such as weak institutions, lack of co-ordinations of activities and lack of financial and human resources. The impacts of climate change has put developments gains in the past few years at risk. There is therefore the need to develop climate smart interventions so as the gains of the few years are not put to waste. According to the African Development Bank (2014), in order to ensure this happens it is estimated that an amount of about US$30billion is needed annually by 2020 to combat negative climate change impacts. Currently there is a gap in climate funding sought and disbursed. This is mainly due to unavailability of long-term debt finance and less attractive projects. Packaging of projects is very important but mostly not given the needed attention. Project preparation facilities (PPFs) for infrastructure development is one of the key ways to address the issues with poor-packaged proposals. Currently the international credit environment is getting very competitive, especially for long-term debt to finance infrastructure. As stated already development partners are moving away from aid to trade so as to support sustainable development. All projects must therefore have PPP arrangements that promote sustainable business development so as to reduce the financing burden that is normally put on government with poor cost recovery mechanisms of government projects.

8.2 Preparation of Bankable Proposals

A bankable Project according to GWP (2014b) is one where following financial structuring, the perceived level of financial risk is at an acceptable level for a potential financier (investor or lender). District projects or ventures would be attractive to financiers only when the financial risk is less and the anticipated benefits high. This therefore requires that the project is well prepared and situated within a well-enabling environment. Project preparation has a number of benefits which includes:

i. Ensuring that projects are adequately conceptualised and planned;
ii. Ensuring that the project is strategically aligned with district and national plans;
iii. Providing a means for the project planner to efficiently allocate scarce resources and an opportunity to maximise scarce resources for commercially viable projects;
iv. Managing and controlling of project risks;
v. Managing cash flows by enhancing the predictability of project outputs and giving an indication of timeframes and required resources; and
vi. Increasing the chances of the project to be funded.

Some of the key questions that could be answered to determine whether a project would be commercially viable include the following:

[36] Based on GWP (2014b). Delivering Solutions with bankable project proposals.

i. Is there an enabling environment for the project? This includes institutions and legal frameworks to enable one carry out such an activity without any hindrance;
ii. Is the project feasible? Are there sufficient organizational, financial and social capacity to fund and manage the project?
iii. What is the structure (PPP, Private, SOE) of the project to be implemented and what is the legal framework backing this?
iv. How will the project implementation and monitoring be done. What indicators could be used to measure the impacts (implementation and results)?

More of these questions (checklist) could be found at http://www.icafrica.org/en/fund-finder/project-preparation-checklist/

The project preparation cycle involves three stages with a number of activities to be carried out. Figure 9 shows the various stages and the activities involved.

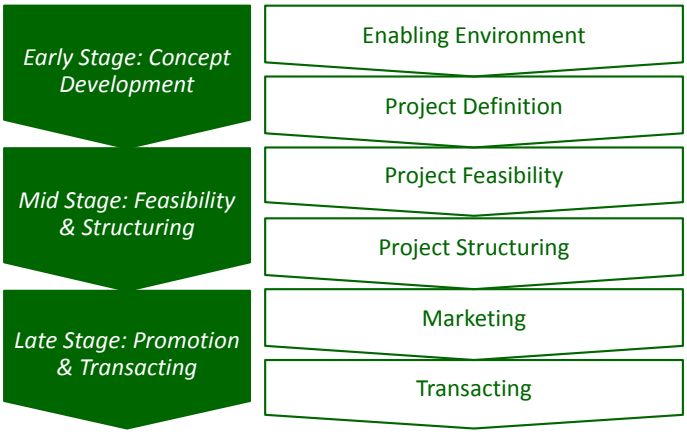

Figure 9: Project preparation cycle[37]

Enabling environment

This involves the identification of the legal, regulatory, institutional and other impediments which could affect the implementation of the project. It looks at the broader environment in which development planning and project development occurs.

Project definition

This helps determine the project ideas that are strategically aligned with district and national objectives, policies or plans to assess the relevance and feasibility of the project ideas. It also helps to articulate the project, its objectives and its desired outputs and outcomes.

Project Feasibility

This helps determine the (commercial) viability of the project after carrying out economic, financial, technical, social and environmental feasibility assessments.

Project Structuring

This consist of creating appropriate technical and commercial structures for the project so as to attract funding and to draw the right mix of public-private investments (financing).

[37] GWP (2014b). Delivering Solutions with bankable project proposals.

Marketing

This can be done even before the final product is out. A prototype could be used for the marketing to get buy-in from potential consumers and financiers. Marketing could be done through visits, symposia, exhibitions, demonstration fields or farms, advertisement through the print and mass media and through TV and Radio programmes.

Transacting

This is the final stage of the project preparation cycle. This is where planning is advanced into implementation with tangible outputs. During the transaction stage four (4) processes take place: project financing (including repayment schedules, cost of finance, and tenure), legal structuring, technical implementation of plans and procurement.

9. MONITORING AND EVALUATION OF WASH PROJECTS[38]

9.1 Lesson 1: Developing a Results-based Monitoring and Evaluation System

Effective monitoring and evaluation of WASH projects involves some (or all) of the following:

- Data collection
- Alternative monitoring models
- Monitoring and evaluation systems
- Reporting on and using findings
- Sustaining the monitoring and evaluation systems in the organization or project

9.1.1 Data Collection

A baseline survey is needed to assess the impact of a project before it is implemented (benchmarking or setting of a reference point). Baseline data related to the indicators are measurements carried out to set the reference scale. There are two sources of data (generally): Primary source which are gathered specifically for the project and secondary data which are normally collected for other projects or purposes but could be used for the project. The various sources of data that can be used are shown in Figure 10.

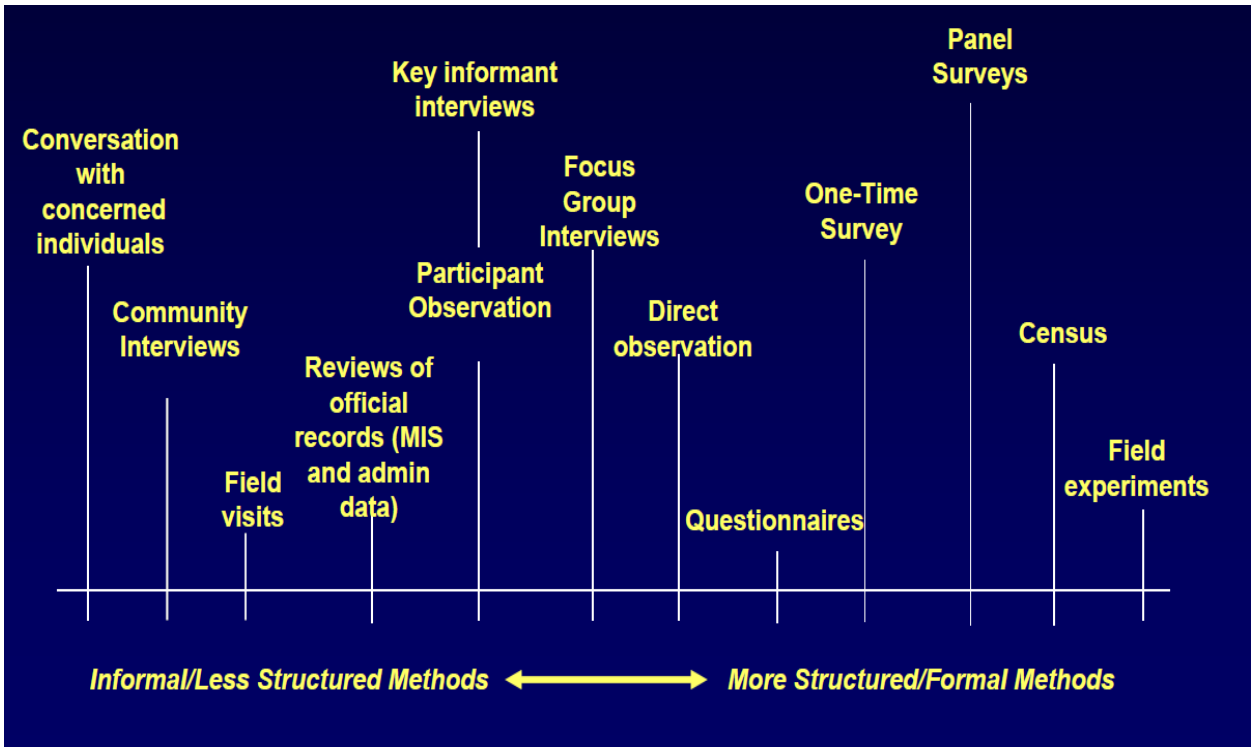

Figure 10: informal and structured data collection methods[39]

Most formal monitoring systems use Logical Framework Approach (LFA) and the Results-Based Monitoring (RBM) systems. However sometimes informal ways of collecting data is needed. Such

[38] Based on the GWP (2014c). Presentation on Monitoring and Evaluation I.
[39] GWP (2014c).

methods include the use of Most Significant Change (MSC) technique which does not require the use of indicators so as to capture "un-expected" outcomes/impacts in the form of a story.

In most Sub-Saharan countries such as Ghana, weather station networks are being reduced primarily due to budget constraints. When budget constrains prohibits reliable and continuous measurement of climate parameters such as rainfall, temperature, relative humidity, radiation and atmospheric pressure which provides us with a baseline to determine changes in weather on a short term (climate variability) or long term (climate Change) then we are heading for a problem. This equally holds for hydrologic data. At the moment the Ghana Meteorological Agency (GMet) is being supported by partners such as WRC, TAHMO, The Ghana Agriculture Insurance Pool (GAIP) and other development partners to ensure continuous and reliable measurement of climate parameters with telemetry (wireless transmission). It is only when this is well done, that one can assess the actual changes in weather due to climate change and promote climate resilient development. This will help come up with projects with highly likely impacts and reduce the waste of investments due to uncertain climate predictions.

Setting realistic time for implementation and impact (result) monitoring is important for the project cycle. In general monitoring and evaluation can be put into ten (10) based on the time schedule. It takes a lot of time and effort to put things together so it is helpful if one sets realistic targets and avoid promising too much.

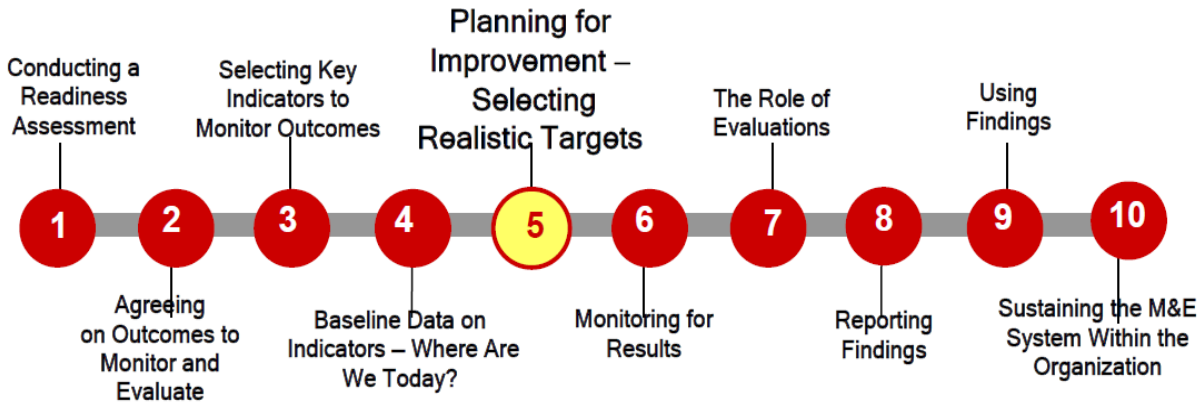

Figure 11: Steps in setting up a monitoring and evaluation system.

Monitoring could be grouped basically into two (2): Implementation monitoring and Impact monitoring. The difference is the level at which they engage stakeholders as shown in Figure11 and Figure 12.

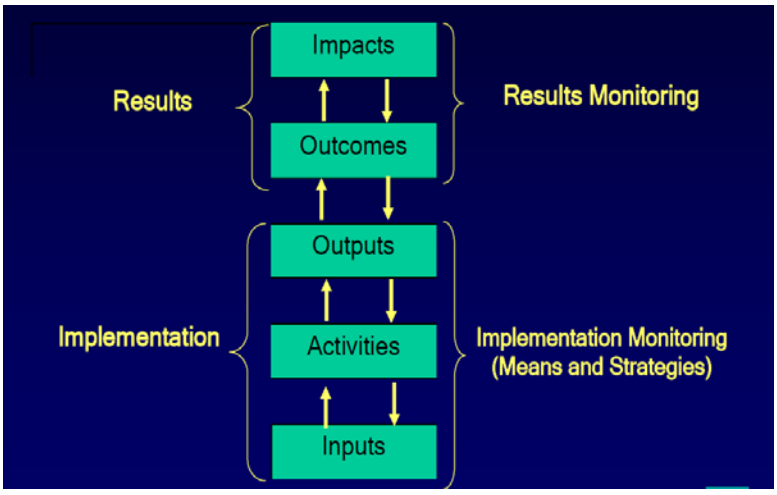

Figure 12: Different levels of monitoring

Implementation monitoring starts with the inputs and activities while immediate results

monitoring deals with the end user of the value chain specifically looking at outcome and impacts. Implementation monitoring is relatively easy (compared to results monitoring) since this is closer to monitoring project activities. Result monitoring is more difficult since it may require to see how a project intervention manage to improve the resilience of a community or improved the adaptive capacity of a group. The result may show up only when the hydro-climatic hazard actually takes place. However most projects (usually done within 4 years) do not monitor impacts or budget for it after the project period. This needs to change and the NDPC in particular have to be involved to help monitor impacts of various projects after its life span.

9.1.2 Measuring Results

There are five steps involved in measuring results for a project. These include setting a SMART (Specific, Measurable, Attainable, Realistic and Time bound) and CREAM (Clear, Relevant, economic (not too expensive), Adequate and Monitorable) objective (s), select the right indicators, specify the type of indicators, determine the baseline and selected the means of verification (using various tools and materials to collect data as shown in Figure 10).

9.1.3 Using the results analyzed after monitoring and evaluation

When monitoring and evaluating projects, there is the need to make some few considerations to make the M&E relevant and useful for other users (or projects).

Uses of Results findings from M&E[40]

i. Responds to elected officials' and the public's demands for accountability;
ii. Helps formulate and justify budget requests;
iii. Helps in making operational resource allocation decisions;
iv. Triggers in-depth examinations of what performance problems exist and what corrections are needed;
v. Helps motivate personnel to continue making program improvements
vi. Monitors the performace of contractors and grantees against set targets
vii. Provides data for special in-depth program evaluations
viii. Helps provide services more efficiently
ix. Supports strategic and other long-term planning efforts (by providing baseline information and traceability later to track progress
x. Communicates better with the public to build public trust

9.1.4 Models for monitoring

Table 5 presents the two models often used for monitoring projects and their differences. These as discussed in earlier sections are the Logical Framework Approach (LFA) and the Results Based Framework (RBF). The decision to use one or the other is often project dependent and issue at hand and time needed to resolve or solve the problem. However most projects in Ghana follow the Logical Framework Approach.

[40] GWP (2004d). Presentation on Monitoring and Evaluation II.

Table 5: Models for monitoring projects

Logical Framework Approach	**Results Based Framework**
- Defining goals and objectives - Identifying problems to reach goals through participatory methods - Identifying underlying assumptions - Monitoring progress towards reaching objectives *ASSUMPTIONS* *Focus on identification of problems (challenges to development) experienced by a target group.*	- Defining realistic expected results. - Monitoring progress towards results with the use of indicators. - Identifying and managing risks. - Increasing knowledge by learning lessons and integrating them into decisions - *Defining realistic expected results.* - *Monitoring progress towards results with the use of indicators.* - *Identifying and managing risks.* - *Increasing knowledge by learning lessons and integrating them into decisions* *RISKS* *Focus on achieving intended results and better performance*

9.1.5 Sustaining the M&E system within the organization

Traditionally it has not been the culture of most Ghanaian SOEs to engage in effective monitoring and evaluation with the results utilized. Maintenance has always been a challenge but now with climate education and awareness the systems can mix project implementation with results monitoring. To be successful with M&E one has to have ownership, management, maintenance and credibility.

For issues on sustainability, it would be good if answers to the following questions could be given as a proxy for determining the prioritization of Government

- What is driving the need for building an M&E system? Who are the champions? Who will benefit from an M&E system?
- What is the role of ministries and parliament in assessing performance? What is the role of the accountant general's department and several judgement debt and other committees set up by the state;
- Are there Technical skills, Managerial skills, existing data systems, Technical and fiscal resources, Institutional experience and Political will for the M&E system?
- Are there national documents to support the M&E?

Answering these questions will give one an idea about the sustainability of the M&E system.

9.1.6 Barriers to developing an effective M&E System in Ghana

Barriers that needs to be overcome in setting up an effective and sustainable M&E system includes the following:

- Lack of fiscal resources
- Lack of local champions (drivers for change)
- lack of political will
- Lack of knowledge and expertise
- Weak strategies and experiences

What is needed to address some of these challenges include targeted training, prioritization of our needs as a country, attitudinal change and strong and effective institutions.

10. WATER GOVERNANCE AND INSTITUTIONS AT DECENTRALISED LEVELS IN GHANA

This module looks at the various decentralized institutions in Ghana and their roles in managing watersheds/catchments, and water governance in general. How to integrate the various lessons taught in the previous 8 Modules for sustainable water management will be discussed in this module as well. Participants would be taken through lectures, role plays (games) and group exercises on decentralization and roles and functions of the three arms of government (Executive, Legislative and Judicial) in catchment protection, the collection and use of information for catchment management, decentralized Planning and financing mechanisms and tools and models for sustainable water governance . These are key for the sustainable use of water resources at the various districts. Participants would be made to review their value propositions and the services they render to those they serve using the "business model canvas" and "business model you" and the support that WRC and UNICEF can offer for decentralization of WASH activities. For this module materials from the Institute of Local Government Studies and the Local Government Secretariat would be used as additional reading materials. The module is based on some of these materials and other local examples.

10.1 Decentralisation - Some Definitions

Centralisation is the systematic and consistent reservation of authority at central points in the organization perceived to be a centralised command and control structure whereas Decentralisation is seen as the shifting of functions, responsibilities and power to lower levels of government. The whole idea about decentralisation is for top level of government to get closer to the people they serve, enhance participation in decision making, and ensure accountability, enhance efficiency and transparency which will lead to livelihood improvements through quality levels of services, low cost of government projects and initiatives and total-inclusion in governance.

10.1.1 Types of Decentralisation[41]

1. ***Political decentralization*** aims to give citizens or their elected representatives more power in public decision-making.

2. ***Administrative decentralization*** seeks to redistribute authority, responsibility and financial resources for providing public services among different levels of government. These are further grouped into:

    a. **Deconcentration**: decision making authority and financial & management responsibilities are redistributed among different levels of the central government;

    b. **Delegation**: "transfer responsibility for decision-making and administration of public functions by central government to semi-autonomous organizations not wholly controlled by the central government, but ultimately accountable to it";

    c. **Devolution**: transfer of authority by Government for decision-making, finance, and management to quasi-autonomous units of local government with corporate status.

[41] Source: Centre for International Earth Science Information Network (CIESIN), Columbia University, NY, USA via www.ciesin.org .

Municipalities elect their own DCEs and council members, generate their own revenues, and have independent authority to make investment decisions;

3. ***Fiscal Decentralization*** involves shifting some responsibilities from higher levels of government to lower levels on expenditures and/or revenues. The extent to which powers or responsibilities are shifted leads to various types of fiscal decentralization such as:

    a. Self-financing or cost recovery through user charges;
    b. Co-financing or co-production arrangements;
    c. Expansion of local revenues through property taxes, or indirect charges;
    d. Intergovernmental transfers that shift general revenues from taxes collected by the central government to local governments for general or specific uses; and
    e. Authorization of municipal borrowing and the mobilization of either national or local government resources through loan guarantees. In Ghana MMDAs possess the legal authority to impose taxes, but the tax base is so weak and the overdependence on central government subsidies has become a difficult habit to change. The maximum loan districts can take from a bank is GHc2000 (US$ 500). This amount has to be changed upwards.
4. ***Economic or Market Decentralization:*** This is done through privatization and deregulation which reduces the legal constraints on private participation in service provision or allows competition among private suppliers for services that in the past had been provided by the government or by regulated monopolies.

Functional decentralization needs some improvement. At the moment, a number of factors affect the implementation and functioning of decentralized administration for almost all sectors including WASH. These factors seem to be common in most developing countries especially Sub-Saharan African countries[42]:

1. Reluctance to transfer too much power to the lowest levels of government (MMDAs);
2. Inadequate capacities of staff at the lowest level of government;
3. Planning is somewhat focused on political agenda and more on infrastructure than on soft issues that could promote pro-poor and community development;
4. MMDAs inability to generate enough funds for their operations hence over relying on government budget and funds from Development Partners and NGOs for projects. This does not make them self-sustaining hence leaving administration functions to them to run fully could lead to some initial setbacks and allocating funds for WASH activities could be a challenge;
5. Some MMDAs are setup for political reasons when government is fully aware that they cannot stand on their own.

To enhance decentralisation especially for WASH projects the four pillars on which it lies should be strong. These include:

1. *Decentralized Communications;*
2. *Decentralized Law;*

[42] Brikke, F. (2011). "Big Bang" Decentralisation, the experience of decentralisation and impact on WASH sector in Indonesia. Presentation at the Water Conference in Brisbane, May 2011.

3. *Decentralized Production; and*
4. *Decentralized Finance.*

10.2 Decentralisation in Local Government for WASH Delivery in Ghana

Act 240 of the 1992 Constitution allows Ghana to have a decentralised governance structure. This is further backed by other national legislations. District assemblies are backed by Article 240 (2) (c) of the 1992 constitution to establish a sound financial base with adequate and reliable sources of revenue". Article 252 of the same constitutions creates the District Assemblies Common Fund (DACF) to support administration and development in the various districts. There are quite some challenges with the disbursement of the DACF including delays with payment.

Local government revenues refer to funds collected and received by Metropolitan, Municipal and District Assemblies (MMDAs"). The Accounting Manual for MMDAs (2009) defines revenues as the "earnings of the Assembly within an accounting period. These earnings should be geared towards effective administration and development of the districts including WASH delivery projects.

Water supply governance and delivery over the past decades had been guided by the GWSC Act 310 of 1965 which placed the responsibility for both rural and urban water supply in the then Ghana Water and Sewerage Corporation now Ghana Water Company Limited (named changed to GWCL since 1999)[43]. In 1986 a rural department was created within GWSC to be in charge of rural water since the rural water sector was being relegated to the background. The Government then launched the National Community Water and Sanitation Programme (NCWSP) in 1994 and in 1998, transformed the Community Water and Sanitation Department (CWSD) into the Community Water and Sanitation Agency (CWSA) by Act 564, and mandated it with coordinating and facilitating the implementation of the NCWSP in District Assemblies[44]. Currently most rural WASH project are done by the CWSA and driven by funds from Development Partners which is not sustainable due to changing economic ties and conditions. Development Partners are now moving from aids to trade to support many developing countries. This therefore calls on MMDAs to generate more Internally Generated Fund (IGF) in an innovative way to support their activities in the districts.

The traditional sources of MMDA revenue (IGF) items as listed under the Sixth Schedule of Act 462 are:

1. Basic rates
2. Special rates
3. Property rates
4. Fees and charges
5. Licenses
6. Trading activities
7. Rent
8. Investment income

The revenue mobilisation activities and procedures that should be followed to raise funds in the districts include[45]:

1. Planning (including database and staff motivation);
2. Budgeting (including budget hearing);
3. Procurement and Contract Management;

[43] TREND (2007). Contribution and lessons of decentralized management of rural water to decentralization in Ghana. Presentation at the Institute of Local Government Studies Conference on Decentralized Management in the Context of GPRS and MDBS in 2007"

[44] TREND (2007).

[45] ILGS (2013)

4. Accounting;
5. Auditing (including monitoring and evaluation)

This calls for innovation and strategies in mobilising the resources such as

- Door to door collection
- Computerized registers
- Privatization of collection (commissioned agents)
- Direct Deposit of payments
- Pre-printed licenses/Bills
- Effective Administration

MMDAs have to use the resources at their disposal in the districts to improve the livelihoods of the people they serve through good governance, innovations and technology uptake. These are the core mandate of the local administration hence if missing the whole idea of decentralization would be defeated.

Water Governance is a bit complex and involves several elements. The elements include Policy, Legislation, Planning, Stakeholder Consultations, Expertise, Information & Tools, Education/Awareness & Research, Institutions, Ownership and responsibilities[46] (See Figure 13 and Table 6). These chains of elements are equally important with the strength of water governance dependent on the weakest link in the chain. In explaining these elements, the White Volta basin IWRM Plan (2008) which has been updated in 2015 could be used as a case study to show how this is being done practically and the challenges associated with them.

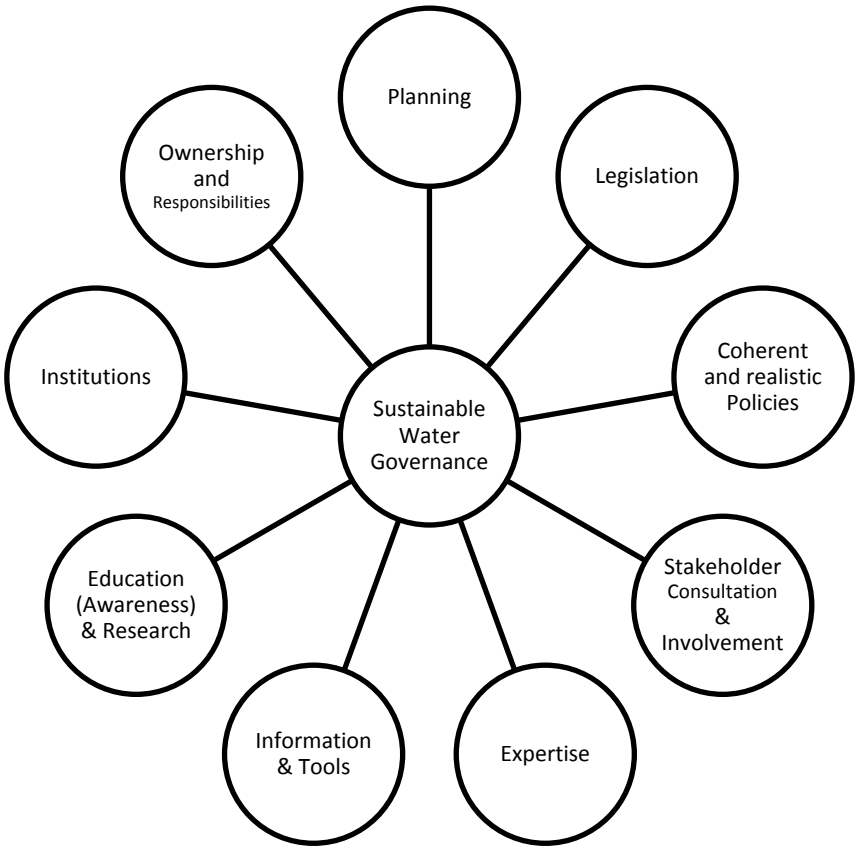

Figure 13: Elements of a Sustainable Water Governance Structure

[46] Adapted from the Programme for Water Governance in Fiji via http://www.pacificwater.org/

Table 6: Functions of the various elements of a Sustainable Water Governance Structure

Element	Function/Role	Remarks
Policy	This is needed for drafting and amending laws needed to guide water resources management. It also creates an avenue for stakeholder consultations. Policies are "living document" needed for environmental norms and values[47].	Several polices exists in Ghana. Unfortunately people who are to implement the policies at the lowest level are not well informed about the policy directives hence make it difficult to implement. Policies need to be updated frequently taking into account current political dispensation or status (e.g. "Least developed country" to "Middle Income Country"). There is a need to make several policies that exist in Ghana more coherent and realistic. Policies for water include the National Water Policy, National Climate Change Policy, National Buffer Zone Policy, National Forest and Wildlife Policy, National Environmental Policy, Environmental Sanitation Policy, Food and Agriculture Sector Development Policy, Irrigation Policy and the National Energy Policy.
Legislation	Meaningful legislature and effective legislative processes are essential for democratic water governance which ensures accountability and an avenue for the voices of all stakeholders to be heard[48].	Formation of the legislature is important for how governance is implemented in general. In Ghana, it is important to de-politicize issues and concentrate on core elements of discussions that will lead to enhanced economic development and improved livelihoods especially for the poor and marginalized who constitute the majority of the population.
Stakeholder Consultations	This is critical for the conceptualization and implementation of all water interventions. Stakeholders have to be involved and not just informed.	Most of often, the buzz word "stakeholder consultation' is used interchangeably for involving (getting all stakeholders on board at every stage of the

[47] Iza, A. and Stein, R. (Eds) (2009). RULE – Reforming water governance. Gland, Switzerland: IUCN.

[48] A. Awah (2013). The crucial role of legislation in the promotion of democratic governance vis a vis the diversified interests of the electorates and the need for a cordial working relationship between the legislature and other arms of the government. Pan-African Parliamentary Conference on Capacity Building. Rabat, Morocco, 2013.

		project/initiative) and just informing them. Stakeholders need to be involved to enhance ownership of projects, initiatives, facilities and water infrastructure. That is an effective way of enhancing sustainable use of resources.
Expertise	People with adequate know-hows (technical expertise) are needed to implement policies, projects and initiatives. All expertise is needed in water governance. Not just the physical planning experts but the socio-cultural experts.	The issue with expertise in Ghana has to do with putting the right people in the wrong places and the vice versa. Political interference in public administration (especially in employment and award of contracts) hinders good water governance. There is a need to completely decouple expert work from political works. Some District Coordinating Directors, their deputies and other public servants are unable to function as they should due to political interference. This is a "cancer" that must be defeated.
Information & Tools	Information flow is essential for good governance. Without easily accessible, current and reliable data/ information, planning would be ineffective. Data and information access are key elements in water governance. To share data it will be good to obtain user-friendly tools and platforms that help with planning, implementation and evaluation[49]. Data gathering could be done with modern technology or innovations such as Unmanned Arial Vehicles (UAVs) for precision agriculture which could help conserve water and other farm inputs like fertilizers saving farmers some money and creating less pollution.	With ICT it should be possible to have access to information easily and share this information on available platforms such as being done by the Community Water and Sanitation Agency. It is good to gather data but these should be transformed into useful information that can inform the daily activities of water users. Websites of several MMDAs do not have data or information readily available for download. Most of them even do not have their own websites.
Planning	Plans and procedures are needed to attain various water goals. They help with the allocation of (often) scarce resources which should inform national, regional and district budgets for the implementation of strategies and infrastructure in a more systematic manner. Planning is needed to enhance efficiency and effectiveness of projects,	Both Physical and Spatial planning are needed to promote water governance in Ghana. Unfortunately Planning which involves the distribution of goods, people activities and infrastructure in space have not been very effective. Ghana lacks proper and implementable landuse and environmental plans. There is an urgent need for creativity

[49] This has been discussed in Module 9.

	initiatives and programmes.	and innovation in this regard.
Education/Awareness & Research	Research and Education informs policy. Research should also lead to a more efficient way of utilizing water and other natural resources. Research should not end on the shelves. People should be informed about the outcome of, or advances in research and translate this into useful products or tested processes/procedures which could promote WASH development.	The gap between research and industry is so wide in Ghana. There is a need to have more applied research supported by the government to enhance the development of tools and processes for gathering information, and developing products and goods using the natural resources at the disposal of MMDAs (i.e. value addition) for sustainable economic growth and livelihood improvement.
Institutions	These are organizations, laws or practices which are established to promote water governance. Organisations have the mandate to prepare, implement and evaluate plans. They also have the mandate to mobilise the needed resources to carry out the plans (including enforcement of bye-laws).	Duplication of efforts in various institutions needs to be worked on. It is better to mobilise resources together and coordinate the activities of various organisations working in the water sector in Ghana. The debate on strong institutions to force behavioural change versus behavioural change to promote strong institutions seems unending. Whatever the case one or both are needed in Ghana. If everyone should start from his/her small "corner" and reduce apathy, this puzzle could be solved.
Ownership and responsibilities	Ownership enhances responsibilities of various stakeholders in all water projects. If grass-root stakeholders do not feel that they own a facility, infrastructure, policy, strategy or plan, it would be difficult to maintain or implement it.	Ghana is gradually moving away from supply driven approach to demand driven approach with regards to WASH infrastructure. There should be a strong need for an infrastructure before it is constructed but not just done for political gains. This is something that still needs a bit of work to get it right.

Water governance needs all hands on deck to make it effective. If one link is weak the whole chain will be loose and catchment conservation or water management will be ineffective.

Bibliography

Amofah, G.K. (n.d.). Global Warming and Health: Policy Implications for the Health Sector. http://www.ghanahealthservice.org/

Awah, A. (2013). The crucial role of legislation in the promotion of democratic governance vis a vis the diversified interests of the electorates and the need for a cordial working relationship between the legislature and other arms of the government. Pan-African Parliamentary Conference on Capacity Building. Rabat, Morocco, 2013.

AWWA WaterWiser (1997). *Household end use of water with and without Conservation*.

Ayotunde T. Etchie, Tunde O. Etchie, Gregory O. Adewuyi, Krishnamurthi Kannan, Satish R. Wate, Saravanadevi Sivanesan, Angela U. Chukwu (2014). Influence of seasonal variation on water quality in tropical water distribution system: is the disease burden significant? Water research 49 (2014) 186-196.

Brikke, F. (2011). "Big Bang" Decentralisation, the experience of decentralisation and impact on WASH sector in Indonesia. Presentation at the Water Conference in Brisbane, May 2011.

Centre for International Earth Science Information Network (CIESIN), Columbia University, NY, USA via www.ciesin.org

Chereni A. (2007). *The problem of institutional fit in integrated water resources management: A case of Zimbabwe's Mazowe catchment*. Physics and Chemistry of the Earth 32 (2007) 1246–1256.

Codjoe, S.N. and Nabie, V.A. (2014). Climate change and cerebrospinal meningitis in the Ghanaian meningitis belt. Int. Journal of Environ Res Public Health. 2014 Jul 7;11(7):6923-39. doi: 10.3390/ijerph110706923.

Douxchamps, S., Ayantunde, A. and Barron, J. (2012). Evolution of Agricultural Water Management in Rainfed Crop-Livestock Systems of the Volta Basin. Colombo, Sri Lanka: CGIAR Challenge Program forWater and Food (CPWF). 74p. (CPWF R4D Working Paper Series 04).

Edwards K.A.,Classen G.A. and Schroten E.H.J. (1983). The water resource in tropical Africa and its exploitation.

EPA (USA) Manual Appendix 4

FAO (2007). Managing forests for cleaner water for urban populations. Unasylva, Volume 58, 229, 2007/4.

Ghadei, K. (2005). Conflict Management. Department of Extension Education Institute of Agricultural Sciences. Banaras Hindu University, Varanasi.

Ghana Shared Growth and Development. Agenda (GSGDA, 2014)

GWP (2014a). Delivering solutions. Presentation on integrating no/low regrets investments in the development of planning processes: The role of network analyses.

GWP (2014). Review of National Adaptation Responses in the context of water security and climate resilient development in Ghana.WACDEP Project housed in GCWP of the GWP in Ghana.

GWP (2014b). Identify and appraise options: Risk-based decision-making for investments.

IPCC (2013). Fifth Assessment Report.

Iza, A. and Stein, R. (Eds) (2009). RULE – Reforming water governance. Gland, Switzerland: IUCN.

Kanth *et al*. (n.d). Presentation on Conflict Resolution

Kloss C. (2008). Managing Wet Weather with Green Infrastructure. Municipal Handbook on Rainwater Harvesting Policies. US EPA-833-F-08-010.

Kwarteng S. O. and Annor F.O. (2014). Proposed Modules for the NEPAD Centre at KNUST on Water use and Allocation in Semi-arid regions.

Llopis, G. (2013). A blog on solving the leadership identity crisis to enable unseen opportunities: *The 4 Most Effective Ways Leaders Solve Problems.*

Sadick M. S. (2001). Public-Private Partnerships in Ghana – the Case of the Water Sector. National Development Planning Commission, Ghana.

Saptak das Somen Chatterjee (n.d)

Sultan B. La badi, K., Guégan, J. and Janicot, S. (2005). Climate Drives the Meningitis Epidemics Onset in West Africa. Journal of PLoS medicine. DOI: 10.1371/journal.pmed.0020006.

The WASH minimum Standards. GES, 2014

Timothy Karpouzoglou and Jennie Barron (2014). A global and regional perspective of rainwater harvesting in sub-Saharan Africa's rainfed farming systems. Physics and Chemistry of the Earth 72–75 (2014) 43–53

UNDP (2010). Integrating climate change into the management of priority health risks in Ghana. *UNDP Sustainable Development, Climate Change and Health Project in Ghana (2010-2013). Ministry of Health*

van der Walt L. (2001). Principles of Water-wise Gardening. South Africa National Biodiversity Institute. Available online http://plantzafrica.com/using/waterwis2.htm

van der Zaag P. (2009). Capacity building for the peaceful and equitable sharing of transboundary water resources. Presentation in Accra, Ghana.

van Oel, P. R., Krol, M. S., Hoekstra, A. Y., and Taddei, R. R. (2010). "Feedback mechanisms between water availability and water use in a semi-arid river basin: A spatially explicit multi-agent simulation approach." Environmental Modelling & Software. 25(4), 433-443.

White S. (1999). Integrated resource planning in the Australia water industry. Proc. of Conserv99, American Water Works Association, Monterey, California, 1999.

WHO (2014). Climate Change and Health. Fact sheet N°266. World Health Organisation. http://www.who.int/mediacentre/factsheets/fs266/en/

www.catchmentdetox.net.au