ACEWATER Phase II: National Strategy on Water Sector Human Capacity Development for Ethiopia

Sector-wide Assessment Desk Study Report

Ethiopian Institute of Water Resources

Addis Ababa University

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List of Abbreviations

ACEWATERII	African Centres of Excellence Water Project Phase II
CSA	Central Statistical Agency
EU	European Union
GDP	Gross Domestic Product
GTP	Growth and Transformation Plan
HCD	Human Capacity Development
JICA	Japan International Cooperation Agency
MoALR	Ministry of Agriculture and Livestock Resources
MoFE	Ministry of Forestry and Environment
MoH	Ministry of Health
MoWIE	Ministry of Water, Irrigation and Electricity
MoWR	Ministry of Water Resources
NGO's	Non- Governmental Organizations
OWNP	One WASH National Program
SDGs	Sustainable Development Goal
TVET	Technical and Vocational Education and Training
UNECA	United Nations Economic Commission for Africa
UNHCR	United Nations High Commissioner for Refugees
UNICEF	United Nations International Children's Emergency Fund
WASH	Water, Sanitation and Hygiene
WHO	World Health Organization

Executive Summary

Ethiopia is known for its abundant water resources that can be exploited for different water use to enhance socio-economic development. On the other side, the economic scarcity of water makes it one of the water stressed countries in Africa due to its inability in accessing and changing the resource into economic values that impact the livelihood of its citizens. In recent decades, the government of Ethiopia has drawn an ambitious Growth and Transformation Plan (GTP) currently on its second five years implementation phase which aims to achieve economic transformation through developing the country's natural resources including water resources as well as its human capital. This has been manifested through large scale water resources development mainly in building massive storage and other hydraulic structures for the purpose of hydropower and irrigation developments as well as expansion of university and vocational level trainings in different disciplines of water resources engineering, respectively. These have brought remarkable achievements in water sector development and contribute to the country's economic advancement.

However, the commendable progress that has been made in water resources development has brought additional multifaceted challenges to the sector. One major problem associated to this has been the country's human capital which is subjected to the development and management of water resource systems is not up to the level of skill and experience required and didn't go along with the pace of development in the sector. There have been different attempts to fix the problem and give temporary solutions in order continue the development momentum in the past. However, the effort in addressing the problem was more to rely on involving foreign expats and companies during in all phases of sector development, such as planning, design, construction and management.

Though the solution that has been given to the sector development addressed critical problems and shortages temporary, still the sustainability of all the systems which is already developed as well as is going to be implemented is not realized. Hence, developing the country's human capital with the required skill and state of contemporary knowledge that is capable of executing tasks in all phases of water resourced development is inevitable to realize the Ethiopia's ambition to become a middle income country by 2030

as indicated in its Growth and Transformation Plan. Reports have shown multiple efforts in expanding and improving human capital through tertiary level formal training at higher institutions via developing new curriculums and opening new programs in engineering and management disciplines related to water. Moreover, in-service short term trainings that aims in developing staffs capacity at water sector organizations were given to enhance their ability in developing and managing water resources of the country. Here, it is worth noting that there are discrepancies in the level of human and institutional capacity at federal-to-regional and sector-to-sector.

1 Overview

1.1 Background

Ethiopia is located in the Great Horn of Africa, bordering Sudan in the west, South Sudan in southwest, Djibouti in the north-east, Eritrea in the north, the republic of Somalia in the south-east and Kenya in the south. It lies between latitudes 3° and 15°N, and longitudes 33° and 48°E (Figure 1.). Ethiopia is the second-most populous nation on the continent, with over 100 million inhabitants (CSA 2016). It occupies a total area of 1.13 million km^2 (420 million square miles). Ethiopia encompasses a vast highland complex of mountains and dissected plateaus, which generally extend from southwest to northeast and surrounded by lowlands, steppes, or semi-deserts. The great diversity of terrains determines the wide variations in climate, soils, natural vegetation, and settlement patterns. Agriculture is predominantly the source of the country's economy and accounts for almost 41% of the gross domestic product (GDP), 80% of exports, and 80% of the labor force (CSA 2016). More than 90 percent of the country's energy is generated from hydropower source.

Ethiopia has considerable water resources which could meet the country's demand for irrigation and hydropower besides basic water needs. It has twelve river basins with an overall annual runoff volume of 122 billion cubic meters of water (MoWR, 2002; Awulachew et al, 2007). With regard to groundwater resources, the true potential of the country is not yet clearly known. However, different literatures reported a different amount that Ethiopia possesses a groundwater potential of approximately 2.6 billion m^3 (e.g. Awulachew et al, 2007). Recently, the groundwater potential is reported also to be 36 billion cubic meters (Gebremeskel, 2015).

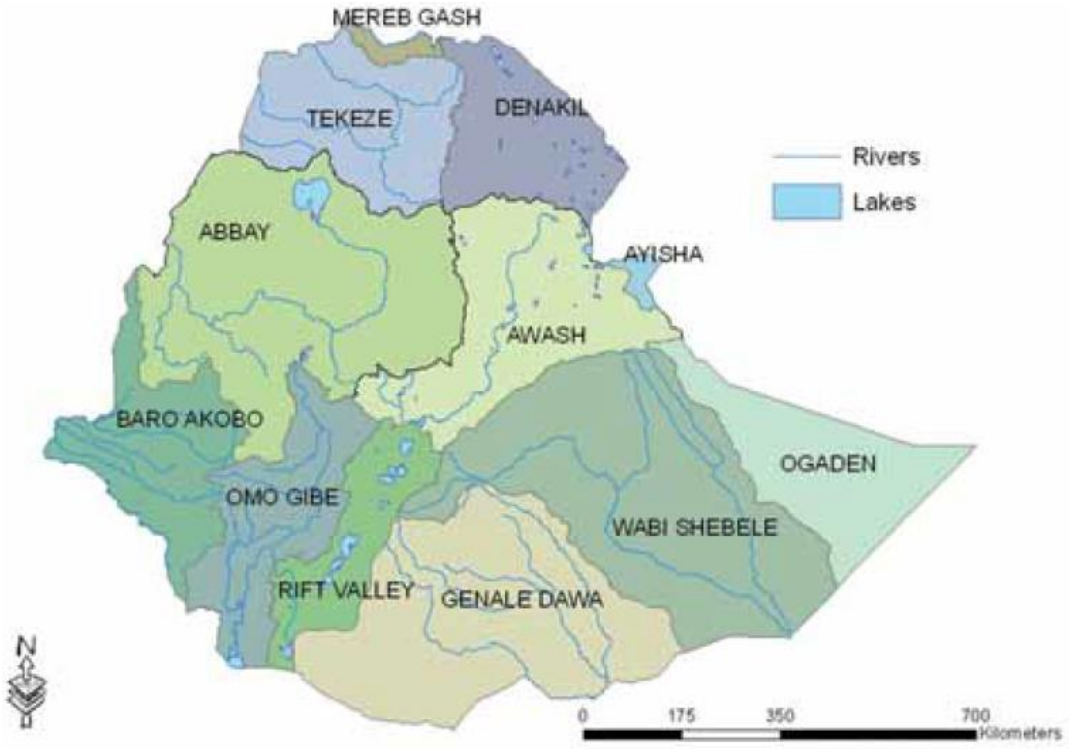


Figure 1. River basins of Ethiopia

The country's hydropower potential and irrigable land is estimated to be 45, 000 Mega Watt (MoWR, 2002) and about 3,798,782 hectares respectively (MoWR, 2002; Awulachew et al, 2007). The three river basins of Ethiopia which have the highest development potential i.e. Abbay, Baro-Akobo, and Omo-Gibe contribute about 76 per cent of the total runoff from a catchment area comprising only about 31.2 per cent of the total area of the country. About 69.9 per cent of surface water resource is located in Nile River basin (Blue Nile, Baro-Akobo, Tekeze and Mereb river basins) where 35 per cent of the Ethiopian population resides (Hassan and Rasheedy, 2007). These large runoff stems from the fact that the river basins occupy the western and southwestern parts of Ethiopia where the amount of rainfall is highest. The Danakil, Aysha, and Ogaden river basins are dry with no or insignificant flow out of the drainage system. These are the river basins' where water is extremely scarce in Ethiopia.

Table 1. Ethiopian surface water resources by major river basins

No.	River basin	Catchments area (km^2)	Annual run off ($\times 10^9 m^3$)	Specific discharge (litres/km^2)	Share out of total
1	Abbay (Blue Nile)	199,812	52.6	7.8	43.05/17.56
2	Awash	112,700	4.6	1.4	3.76/9.9
3	Baro-Akobo	74,100	23.6	9.7	19.31/6.51
4	Genale-Dawa	171,050	5.9	1.2	4.81/15.03
5	Mereb	5,900	0.3	3.2	0.21/0.52
6	Omo-Ghibe	78,200	18.0	6.7	14.7/6.87
7	Rift Valley	52,740	5.6	3.4	4.62/4.63
8	Tekeze	90,000	7.6	3.2	6.24/7.9
9	Wabi-Shebele	200,214	3.2	0.5	2.59/17.59
10	Danakil	74,000	0.9	0.0	0.7/6.5
11	Ogaden	77,100	0.0	0.0	0/6.77
12	Aysha	2,200	0.0	0.0	0/0.19
Total		1,138,016	122.19		

All river basins except the Nile basin face water shortages (EU, 2011). Most of the rivers in Ethiopia are seasonal and there are almost no perennial rivers below 1500 m altitude. About 70 percent of the total runoff takes place during the period June-September. Dry season flow originates from springs which provide base flows for small-scale irrigation.

1.2 HCD-National context

1.2.1 National strategy (Five year Growth and Transformation Plan)

The Second Growth and Transformation plan of Ethiopian Government (GTP II) stressed the need of sustainable water resources management in water supply, waste management, irrigation, and hydropower. Human resources are the other basic input to materialize water resources development and management. All implementation agencies need to have

the necessary experts well trained and having adequate experience in the area of their specialty. According to the GTP water sector action plan, the main responsibility of the government is to develop policies, legislations, strategic plans and the like and search for financial sources while the private sector would be involved in study, design, construction, operation and maintenance. Donors provide financial and technical assistance. Rural communities and urban utilities are beneficiaries of projects; they will have significant involvement in all project implementation cycle. Total human resources required for the water sector is depicted in Table 2. Accordingly, during the planning period overall 527,874 work force individuals are required of which 4,374 are higher and 13,000 medium professionals and the remaining 510,500 are artisans and care takers.

It is planned that the higher and medium professionals would be trained by government and private sectors' universities and colleges while artisans and care takers would be trained by regions, zones, woredas and woreda WaSH consultants. Moreover, Ethiopian Water Technology Institute training center which is supported by JICA is considered to provide training in borehole drilling and other relevant skills.

Table 2. GTP II water supply and sanitation subsector action plan for training and job opportunity creation, 2016-2020 (MoWIE, 2015)

	Profession and Level	20	2017	2018	2019	2020	Total
A	High Level Professionals						
1	Water Engineer	28	200	200	200	200	1080
2	Geologist	80	80	80	80	80	400
3	Hydrogeologist	12	140	140	140	140	684
4	Hydrologist	20	25	25	25	25	120
5	Electromechanical Engineer	17	170	170	170	170	850
6	Sociologist	14	140	140	140	140	700
7	Economist	20	30	30	30	30	140
8	Chemist	0	50	50	50	50	200
9	Biologist	0	50	50	50	50	200
	Subtotal	83	885	885	885	885	4374

B	Medium Level Professionals						
1	Water Supply Technicians	13	1350	1350	1350	1350	6750
2	Electromechanical Technicians	11	1130	1130	1130	1130	5650
3	Drillers	12	120	120	120	120	600
	Sub-total	20	2600	2600	2600	2600	13000
C	Others						
1	Artisans	21	2100	2100	2100	2100	10,500
2	Care-takers	90,	90,000	110,0	105,000	105,000	500,000
	Sub-total	92,	92,100	112,1	107,100	107,100	510,500
	Total	**95,**	**95,585**	**115,5**	**110,585**	**110,585**	**527,874**

1.2.2 Institutional Aspect

Ethiopia is a federal state comprising of 9 regional states and two city administrations. At federal level, the Ministry of Water, Irrigation and Electricity (MoWIE) is regulatory organ that oversees the development and management of water resources for all sectors (Water supply and sanitation, Irrigation, Hydropower). In addition, it is mandated to develop policies, strategies and action plans for water resource development and management across the nation. However, regional water bureaus are responsible for the delivery of all water demands to citizens and have a mandate to develop their human capital that are capable of developing and delivering services related to water at regional level. Federal Ministry of Agriculture and Livestock as well as regional Agriculture bureaus are responsible for the development and management of small scale agriculture and watershed development.

Although water sector institutions at federal and regional level have a standard organizational structure, they are not fulfilling their responsibilities or delivering services to the general public. One of the major reasons is related to shortage of properly trained human resources that has a capacity in the development and management of water resources for socio-economic transformation. On the other side this creates water and food insecurity though the country is known by its abundant water and land resources. Due to rapid changes in climate and demography, the problem even became more complicated and

left the country as one of large amount of international assistance recipient in the world. Recent reports have shown some efforts have been implementing to solve the critical human capital by sector organizations through recruiting young water professionals and providing on-job training for their staffs aiming to build institutional capacity.

1.2.3 ICT system

Information Communication Technology (ICT) is a key infrastructure for achieving a good human capacity development in any sector. ICT development is at its infancy in Ethiopia and major services lack in this regard. Internet access and web learning services are limited and almost non-existence in all the rural parts of the country. Web-based training facilities are missing and as a result its contribution to human capacity development is insignificant.

1.2.4 Water supply and sanitation sub sector

An adequate supply of safe drinking water and access to sanitation are universally recognized as a basic human need and human right. In 2015, 663 millions of people worldwide do not have ready access to an adequate and safe water supply (WHO and UNICEF, 2015). Nearly half of all people using unimproved drinking water sources live in sub-Saharan Africa, while one fifth live in Southern Asia. These people use unimproved drinking water sources, including unprotected wells and springs and surface water that are potentially contaminated with microorganisms to causes diarrheal diseases. Worldwide diarrheal disease is one of the leading causes of morbidity and mortality in developing countries, accounting for 21% of all deaths in children younger than 5 years old and a total of 2.5 million deaths per year.

Ethiopia has a universal access plan for water supply, hygiene and sanitation by 2020. During MDG era, Ethiopia has made considerable progress for the attainment of millennium goal for improving access to drinking water. According to WHO and UNICEF (2015) updates on water and sanitation, Ethiopian access to improved water supply coverage was 57% in 2015. The improved water supply access coverage varies from among regions and rural versus urban. The national improved sanitation coverage at the same year was about 27% that exacerbate water contamination risks. The SDG baseline estimate of JMP report indicates 11% of the Ethiopian population had safely managed drinking

water while 13% of households, 7% in rural area, use drinking water free from contamination at home by 2015. According to CSA (2016), 65% population is using improved sources, 20% get water on premises and 43% of the rural population uses unimproved water sources. Appropriate household water treatment is practiced only by 7% of households.

Diarrhea is a major public health burden throughout the world, particularly in developing countries (UNICEF and WHO, 2009; Walker et al., 2013; Azage et al 2015; Azage et al, 2016; Woldu et al, 2016), and children are severely and disproportionately affected. Diarrhea was responsible for more than 50% of childhood morbidity and 50–80% of childhood mortality in the Sub-Saharan Africa countries (Lozano et al., 2012; Walker et al., 2013). In Ethiopia, diarrhea was the first causes of morbidity for children under five years of age in 2015 (FMoH, 2016). According to 2016 Ethiopian Demographic and Health Survey, 12 percent children under age 5 had diarrhea in the 2 weeks preceding the survey (CSA, 2016). This report also indicates under-five mortality rate of 67 per 1,000 live births and diarrhea is one of the contributing factors. Outbreaks of acute watery diarrhoea were repeatedly reported in every corner of Ethiopia as a result of lack of improved water supply and sanitation facilities. Nationally there were high acute watery diarrhea (AWD) cases in 2016 which highly associated with 2015/2016 El Nino drought. The outbreaks were occurred in almost all the regions except Gambella. The highest number of AWD cases was reported from Addis Ababa (7245 cases). Similarly, there was also AWD case in 2017 in nine regions. However, the number of Woredas affected is reduced in comparing with 2016.

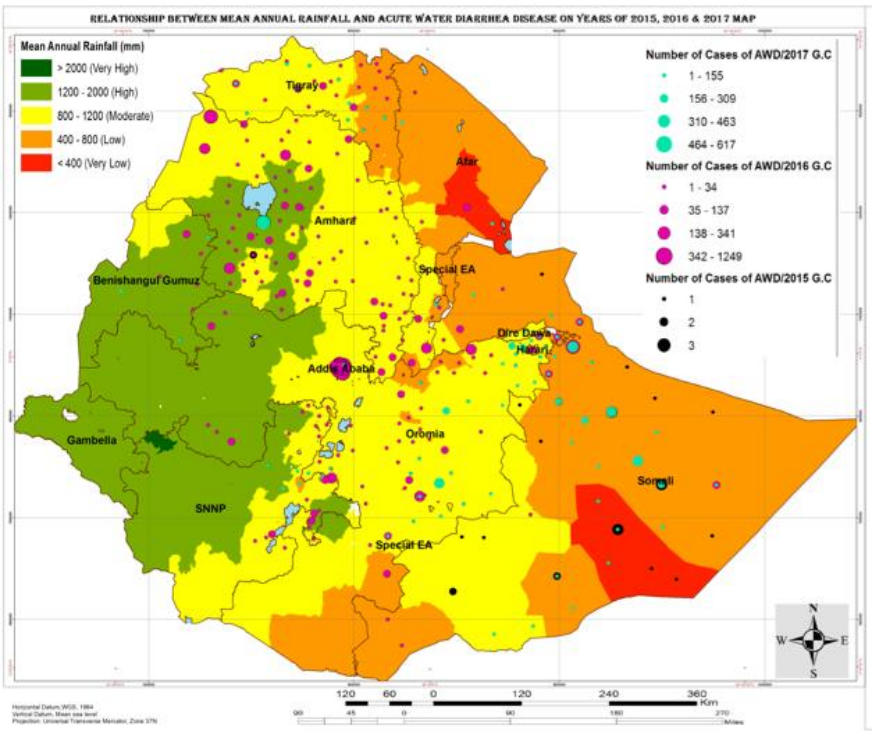


Figure 2. Acute water diarrheal cases from 2015 - 2017

Geogenic contaminants such excessive fluoride in groundwater is a serious water quality problem in the Ethiopian Rift Valley regions and adjacent highlands particularly in Oromiya, Southern Nations Nationalities and Peoples Regional State, Afar, Somali and part of Amhara (MoWIE, 2013). It was estimated that about 14 million people are potentially at risk of fluorosis in Ethiopian Rift Valley regions (Fluoride Action Network, 2012). As fluoride affected areas are confined in arid and semi-arid regions where groundwater is the only source of water supply, it is still used to provide drinking water for large part of this population and is the sole source of drinking water for many rural communities and urban centers in the Rift Valley. According to MoWIE (2013) report, Oromiya is the most fluorosis affected region and worst in East Shoa and East Arsi Zones. The fluoride problem also extends beyond the Rift Valley into some highland regions of Ethiopia (e.g. Kloos and Tekle-Haimanot, 1999; Tekle-Haimanot et al, 2006; Ayenew et al, 2008; MoWIE, 2013). High arsenic content were also reported in fluorosis prone areas of Ethiopian rift (Reimann et al, 2003; Rango et al, 2010; 2013; Merola et al, 2014). The aquifers of the Ziway-Shala basin in the northern part of MER were identified as high arsenic risk zones.

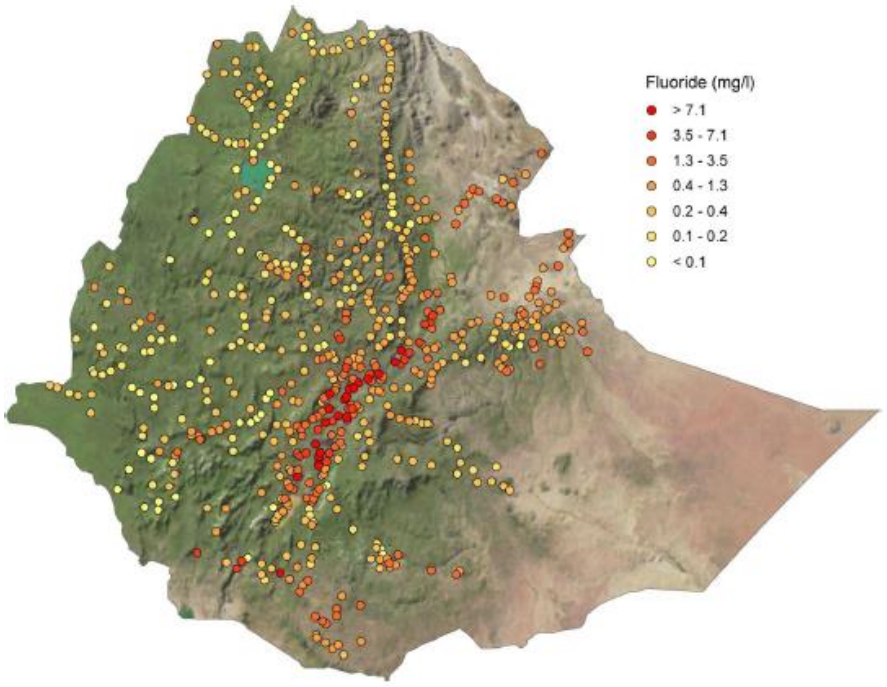


Figure 3. Fluoride concentration profile in drinking water sources of Ethiopia (RiPPLE, 2008)

Ethiopia declared a universal access plan for water supply, hygiene and sanitation by the year 2020. Memorandum of Understanding among Ministries of Water and Energy, Health, Education and Finance and Economic Development was signed in November 2012 for one WASH national program (OWNP). Strong effort should be made forthcoming to address water safety as part of this plan. Also Ministry of Health developed national hygiene and environmental health strategy (2016-2020) which included water safety as one of the strategic objective (FMoH, 2016). Furthermore, water safety plan guideline is developed in 2017 for effective implementation of this strategy on water quality monitoring and surveillance with focus to household water safety. The Ministry declared to equip capacities at all tires and existing well-structured health service delivery system to the grass roots level for the implementation of the water safety plan guideline to ensure safe water for public health protection.

In order to fulfill the national strategy and delivering the required services in addressing the challenges that Ethiopia faces in this specific sector, a large deployment of skilled human resource (specifically TVETCs and Health Science College graduates) to the sector is

inevitable. Some efforts are undergoing to improve both quantity and quality of staffs at federal and regional offices. However, there is a huge gap between the pace of implementation in capacity development and existing problems where the society is being affected and economy is dragged. Capacities of TVETCs (to train water technology professionals) and Health Science Colleges (to train Health Extension Workers and Environmental Health) will be enhanced at an estimated cost of USD 11,977,590 through support to training of trainers, curriculum development and training equipment for workshops and laboratories (GoE, 2013). Similarly, services from the Ethiopian Water Technology Institute (EWTI) will be used to train WASH professionals at an estimated cost of USD 3,655,308.

In the recent WASH capacity assessment, it is observed that the Capacity Building Project has conducted capacity assessments of 16 TVETCs and HSCs through SNV and Water Aid. These assessments identified the following capacity gaps:

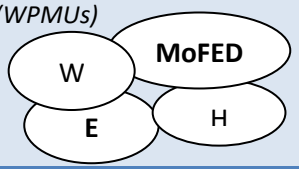
- Limited and/or non-existence of essential physical and training resources, including equipment and tools, reference books, logistics and support facilities
- Not adequately consulting relevant WASH stakeholders when planning training
- Deficiencies in assessing and responding to their environments and developing appropriate training strategies and programs
- Skill gaps among instructors in conducting practical training, with only a few teachers having completed teaching methodology courses
- Limited knowledge of WASH policies and strategies

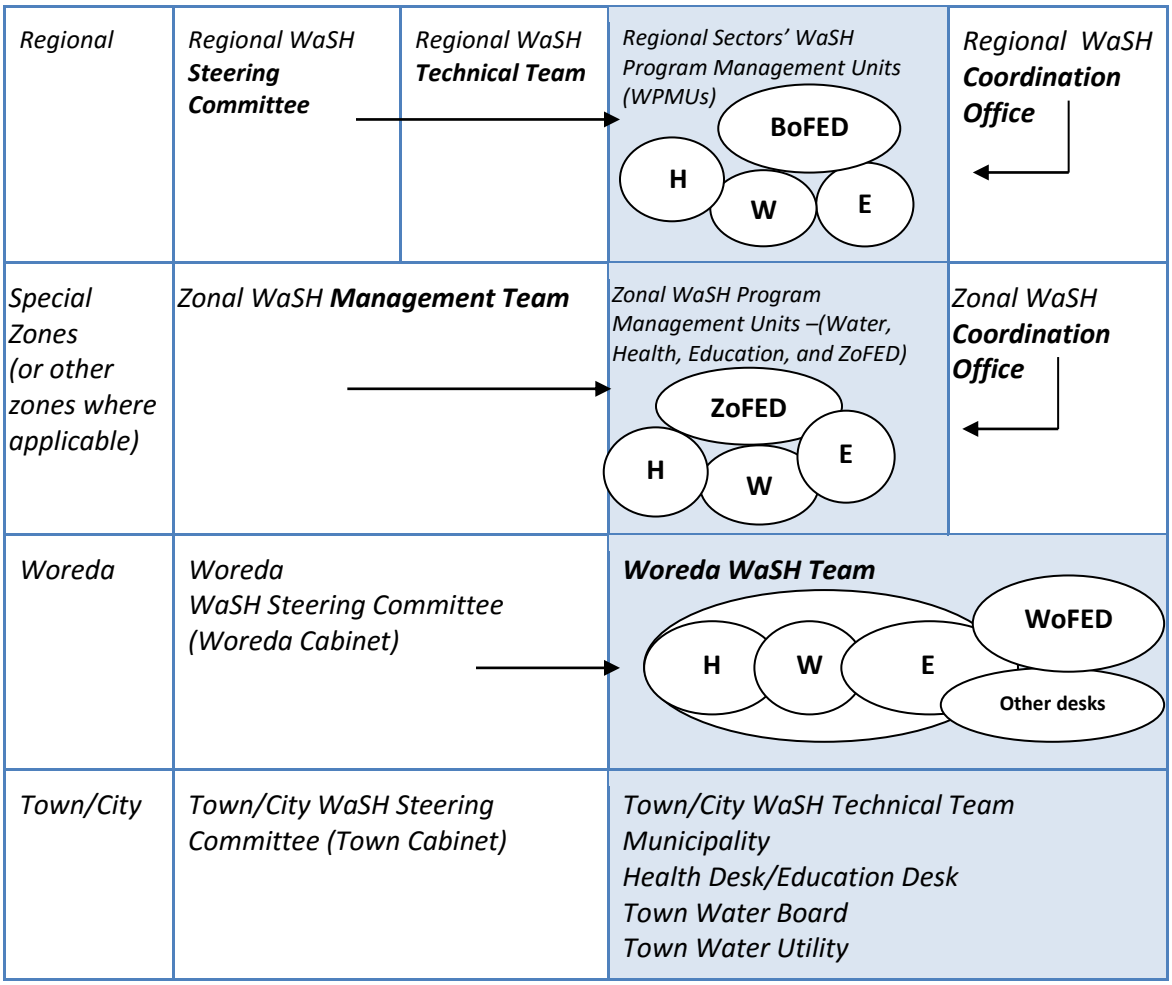
To further institutionalize and professionalize the training of much-needed skilled technicians for the WASH sector. The Program will seek to replicate and scale up the support to TVETCs and HSCs provided through UNICEF, SNV, Water Aid and other organizations to additional TVETCs and HSCs. This assistance will include support to curriculum development and lesson planning, teacher training and basic training equipment and tools for workshops and laboratories.

The Program will also support short-term professional and technical training by EWTI and other institutions to produce a cadre of trained WASH technicians with relevant knowledge and skills. Training modules can be prepared or adapted through technical assistance or collaborative arrangements among training institutions, including universities, in and outside Ethiopia.

Water supply, sanitation and hygiene are no longer addressed separately, but as an integrated package aimed at achieving agreed targets. Government is now committed to implementing a Sector Wide Approach through the One WASH National Program, which is also supported by a number of Development Partners and NGOs. To facilitate achievement of the GTP and Universal Access Plan targets, Government of Ethiopia (GoE) has prepared a WaSH Implementation Framework (WIF) to provide guidance for implementing the Program that defines the roles and responsibilities of major stakeholders in the WASH sector. Responsibility for achieving WASH targets is shared between Ministry of Water, Irrigation and Electricity (water supply and water testing), Ministry of Health (hygiene and sanitation, water quality monitoring and water supply and sanitation in health institutions) and Ministry of Education (school water supply and sanitation, school health clubs and support to TVETCs and Health Science Colleges). Ministry of Finance and Economic Development plays an important role in implementing Public Financial Management policies, channelling GoE and donor funds and financial management and reporting.

Table 3. Institutional arrangement and functions for One WaSH National Program Implementation (GoE, 2013)

Level	***Governance & Guidance***	***Oversight & Management***	***Program Implementation***	***Program Coordination***
Federal	*National WaSH* ***Steering Committee***	*National WaSH* ***Technical Team***	*Federal Sectors' WaSH Program Management Units (WPMUs)* 	***National WaSH Coordination Office***



H: Health, W: Water, E: Education

MoFED: Ministry of Finance and Economic Development

BoFED: Bureau of Finance and Economic Development

ZoFED: Zonal Office of Finance and Economic Development

WoFED: Woreda Office of Finance and Economic Development

1.2.5 Irrigation sector

The Ethiopian irrigation potential is estimated to be about over 5.7 million ha (MoANR, 2017).To ensure food security for the growing population of Ethiopia in the GTP II planning horizon, irrigation development projects will be will be carried out to ensure sustainable agricultural development enhancing its productivity through improved water utilization and agro-ecological based irrigation schemes. Over 4 million hectare of land will be

developed that can be undertaken by smallholder farmers during the GTP II period. Besides, medium and large scale irrigation development and dam constructions will be undertaken and strengthened by federal and regional government institutions. Major irrigation development targets during the GTP II are: (i) increase the area of land covered by irrigation from 2.34 million hectare in 2014/15 to 4,143,000 hectares by the end of 2019/20, (ii) develop 1,743,000 hectare additional irrigated land during the plan period and providing access to at least one alternative water point for 80% of smallholder farmers (semi-pastoralists) of which 50% are users of the full irrigation farming package. If these targets are achieved as planned, this will contribute to the realization of the irrigation potential of the country.

In the national smallholder irrigation and drainage strategy, insufficient skilled human resources and high turnover in public institutions is mentioned as the major water sector bottleneck issue in the country. As can be seen from the table below many regional government bodies in the irrigation sub-sector, such as government bureaus / teams and water works design or construction enterprises, suffer from human resources capacity gaps with mainly (>=75%) inexperienced staff, high (>=25%) turnover rates, high (>=25%) unfilled roles, or high (>=25%) headcount shortfall.

Table 4. Human resource status in seven regional government bodies in the irrigation sub-sector. Source: National stakeholder irrigation and drainage strategy (MoALR, MoWIE, 2018)

Responding regional agency	Unfilled roles	Headcount shortfall	Staff with <3 years' experience	Turnover rate per year
Tigray	3%	20%	95%	22%
Oromia	>25%	>25%	>75%	>25%
Gambella	n/a	n/a	>75%	>25%
Diredawa	>25%	>25%	>75%	>25%
SNNP	64%	25%	n/a	27%
Amhara (#1)	20%	50%	85%-90%	10-30%
Amhara (#2)	0%	15%	80%	35%
Beninshangul	<25%	>25%	>75%	>25%

% High	***43%***	***63%***	***100%***	***75%***

Stakeholders highlighted the following factors as driving low human resources recruiting and retention capability:

- Low compensation rates in public agencies make retention of experienced staff difficult
- Limited job opportunities in the sub-sector due to the large funding gap and concentration of opportunities within the public sector
- Undergraduate and graduate programs in irrigation are few and quality of programs needs substantial improvement in basic technical skills and applied areas such as scheme management.

The sub-sector cannot be strengthened through the other interventions listed in this document without addressing this critical issue of sufficiently strong human resources in government agencies. The Government of Ethiopia is undertaking various efforts across all sectors to improve human resource funding, and recruitment and retention capacity of government agencies. The interventions proposed here therefore focus on improving training in universities, and establishing knowledge and experience sharing programs with international partners to build local capacity.

1.2.6 Hydropower development

Energy from hydropower accounts more than 90% the national energy demand. The country's hydropower potential is estimated to be 45, 000 Mega Watt (MoWR, 2002; MoWE, 2011) and continue to develop all its potential from the existing, under construction and planned hydropower plants. Currently most hydropower dams are highly affected by siltation, eutrophication, and poor watershed management practices. Moreover, proper reservoir operational management is not yet fully implemented due to lack of human and institutional capacity. This is also the sector where large number of foreign expats involved during all phases of development. In The GTP II period activities to sustain hydropower projects are:

- Update hydrological geographical / survey and mapping/, social, economic and environmental information that serve for sustainable feasibility study of each selected electric generation areas;
- Integrated and successive assurance of study of hydro power generation projects whose feasibility is assured to implement them as soon as fund is secured;
- Consider hydropower development projects inseparable and part to other multi sector development projects so as to minimize the unit cost of production;
- Identify and fully record the specific features of the country's hydropower potential and put in to use these potentials; take measures that brings benefit;
- Encourage local consultants and contractors to participate in the design, construction and management of hydropower generation;
- Provide appropriate training to the local staffs and strengthen the internal capacity to gradually reduce dependence on external experts and build capacity at federal level in the following streams:
  - Study and design of medium and large scale hydropower development;
  - License those who like to involve in hydropower development projects;
  - Control water related constructions.

1.2.7 Political context

All policies, strategies, and action planes are designed based on the developmental state ideology where there is massive public investment in major sectors of socio-economic development such as, human resources and infrastructure (mainly water and road infrastructures). Most of the Ethiopian government policy documents reiterated the importance of county's water resources for the socio-economic transformation and outline its economic development corridors across the major river basins such as Blue Nile, Omo Gibe, Awash, and Baro Akobo.

In the last two decades, mainly in water sector development, these have been transformed into practice by constructing massive dams for hydropower and irrigation development in the aforementioned river basins which contributed for decade long double digit economic growth. Currently, the attention given to the water sector from the government is getting

even bigger and continues to commit large share of the country's GDP to water resources development and other pro-poor economic sectors.

1.3 Dimensions in Capacity Development

1.3.1 Regional Perspective

Capacity development can be defined as "the process of change whereby individuals, organizations, institutions and systems develop their abilities to perform functions, solve problems and set and achieve their goals. Furthermore, the World bank defines it as " a locally driven process of learning by leaders, coalitions and other agents of change that brings about changes in socio-political, policy-related, and organizational factors to enhance local ownership for effectiveness and efficiency of efforts to achieve a development goal", as it is stated in the capacity development framework document of commonwealth foundation (2014). According to the capacity development strategy report of United Nations Economic Commission for Africa (UNECA), Africa is making great strides with regard to development, conflict resolution and strong economic growth. Nevertheless, capacity development in many sectors remains high on the list of the continent's foremost challenges. The capacity development plan framework reported by the African Capacity Building Foundation (2016) indicated that key capacity dimensions needed for the first 10 years of Agenda 2063. Some of the capacity dimensions to fulfill agenda 2063 include: (1) critical, technical and sector-specific skills and trainings, (2) the importance of developing mechanisms to enhance the role of youth and women as central capacity pillars, and (3) Mind-set transformation.

1.3.2 National Perspective

In many Policy and Strategic documents of Ethiopia, all forms of Capacity development (human, institutional, and sector-based) has been considered the main driving mechanism for the socio-economic transformation of the country and determining factor to develop the natural resources in order to improve the livelihood of citizens. The concept of capacity development can be translated into categories having strategic and operational objectives. The strategic objectives mainly focused on: (1) strengthen sector based technical and scientific competencies of all stakeholders involved in the planning, implementation and

monitoring and evaluation, (2) improving multi-sectoral and multi-stakeholder coordination at the local, national and regional levels, (3) strengthen the implementation of policy, legislative and resource mobilization framework at all administrative levels. Whereas, the operational objectives pined at: (1) facilitating the formulation, implementation and evaluation of country development plans, (2) improving technical and organizational skills for effective implementation of local development plans, good practices and technologies for proper management of resources, (3) catalyzing regional and global development agendas into national development plans and strategies.

Sustainable water resources management is a global challenge in the 21st cebtury due to factors like climate change, global warming, population growth, urbanization, pollution, etc. It is also a critical challenge in Ethiopia where impacts of climate change, population growth and pollution have been adversely affecting the water resources. To address these, the government of Ethiopia has well acknowledged the need to increase senior water professionals to ensure sustainability of water resources development and management. As such, water sector capacity development is given a large priority in the national development plans such as GTP-I (2011-2015) and GTP-II (2016-2020).

Water related activities are involved in several ministries, including the Ministry of Water, Irrigation and Electricity (MoWIE); Ministry of Agriculture and Livestock Resources (MoALR); Ministry of Forestry and Environment (MoFE); Ministry of Health (MoH), etc. All these ministries have their own human resources development plan in the concerned water sub-sectors that would be accomplished in collaboration with the Ministry of Education.

The Ethiopian government has gone a long way in terms of expansion of universities and other training facilities to make sure that higher education and other training needs are accessible for all citizens. The expansions of the training institutions have made un-replaceable contributions to human capacity development in the water sector in Ethiopia. However, mass qualification cannot be accomplished with the same pace as quality education delivery. As a result, quality of education has been a major concern during the last decade. Competence of the graduates particularly of first degree levels have

significantly deteriorated over these years due to a number of factors, including huge student population, inadequate university professors, inadequate facilities including laboratories, etc. Having, well noted the issue, the government has now reverted to ensuring quality. To assist this, a new National Education Roadmap is under development to be finalized soon.

2 Current status of capacity development in the water sector

2.1 The training/the knowledge base

2.1.1 University level training

Public Universities

There are 42 public universities in Ethiopia with different sizes, age of establishment and areas of specializations. These universities based on their ages, sizes, areas of studies and student admission capacities, are divided into there: First generation, Second generation and Third generation.

- ***First Generation universities:*** There are 8 universities in this category and are generally older and good universities. They all offer water related trainings at BSc, MSc and PhD levels in one or more water related programs.
- ***Second generation universities:*** There are 10 universities in this category and are no more than 10-15 years old. Some of these universities existed before; but as colleges not as universities. All of these universities have water related BSc level trainings and several of them have MSc levels water related trainings.
- ***Third generation universities:*** These universities are very young; most of them with 10 years or less of age. Of the 22 universities, only a few of them have BSc level trainings in water related fields, but no MSc level trainings.

Table 5. Water related training status in public universities in Ethiopia (Consultation with each university, 2018)

Description	1st generation universities	2nd generation universities	3rd generation universities

Total Number	8	10	122
Water related BSc trainings	All	All	Few
Water related MSc trainings	All	8	No
Water related PhD trainings	7	No	No

Table 6. Water related training programs in major public universities in Ethiopia (Consultation with Respective Universities and their websites, 2018)

University	Level of training programs		
	BSc	**MSc**	**PhD**
Addis Ababa University		Water Resources Engineering and Management: Surface Water Management (WREM-SWM)	Water Resources Engineering and Management: Surface Water Management (WREM-SWM)
		Water Resources Engineering and Management: Surface Water Management (WREM-GWM)	Water Resources Engineering and Management: Surface Water Management (WREM-GWM)
		Water Resources Engineering and Management: Surface Water Management (WREM-IWM)	Water Resources Engineering and Management: Surface Water Management (WREM-IWM)
		Water and Health: Water and Public Health (WaHe-WPH)	Water and Health: Water and Public Health (WaHe-WPH)
		Water and Health: Water and wastewater Treatment (WaHe-WWWT)	Water and Health: Water and wastewater Treatment (WaHe-WWWT)
		Environmental Engineering	Hydraulic Engineering
		Water Supply and Environmental Engineering	Dam Engineering
		Hydraulics Engineering	PhD in Irrigation Engineering
		Hydropower Engineering	Water Supply and Environmental Engineering
		Environmental Science	Environmental Engineering
		Hydrogeology	Environmental Science
		Water Resources Management	Hydrogeology
Arba Minch University	Hydraulic and Water Resources Engineering	Hydraulic Engineering	PhD in Irrigation and Drainage Engineering

University	Level of training programs		
	Water Resources and Irrigation Engineering	Hydropower Engineering	Water and Environment
	Water Supply and Environmental Engineering	Dam Engineering	Geo-Information Science and Earth Observation
	Meteorology and Hydrology	Sustainable Water Resources Engineering	
		Irrigation and Drainage Engineering	
		Irrigation Engineering and Management	
		Hydrology	
		Climate Change	
		Water Supply and Environmental Engineering	
Jimma University	Hydraulic and Water Resources Engineering	Environmental Health	Water Resources Engineering
	Water Supply and Environmental Engineering	Environmental Science and Technology	Environmental Engineering
	Environmental Health	Environmental Engineering	Environmental Health
		Hydraulic Engineering	
Haramaya University	Water Resources and Irrigation Engineering	Water Supply and Sanitation Management	Irrigation and Drainage Engineering
	Water Supply and Environmental Engineering	Engineering Hydrology	Soil and Water Conservation Engineering
	Hydraulic and Water Resources Engineering	Irrigation Engineering	
	Environmental Health	Soil and Water Conservation Engineering	
Bahir Dar University			

University	Level of training programs		
	Hydraulic and Water Resources Engineering	Engineering Hydrology	Integrated Watershed Management
	Water Resources and Irrigation Engineering	Hydraulic Engineering	
		Irrigation Management and Engineering	
		Water Supply and Sanitary Engineering	
		Environmental Engineering	
Hawassa University	Environmental Health	Environmental Health	Natural Resource Engineering and Management
	Water Resources and Irrigation Engineering	Water Resources Engineering and Management	Hydraulic Engineering
	Hydraulic and Water Resources Engineering	Irrigation and Drainage Engineering	Environmental Management
		Dam Engineering	
		Soil and Water Conservation Engineering	
Mekelle University	Environmental Health	Irrigation and Drainage Engineering	
	Hydraulic and Water Resources Engineering	Hydraulic Engineering	
		Environmental and Sustainable Infrastructure Engineering	
		Irrigation Engineering and Management	
University of Gondar	Sanitary Science/Environmental	Environmental Health	
	Environmental Health	Hydraulic Engineering	
	Hydraulic and Water Resources Engineering		

University	Level of training programs		
	BSc	**MSc**	**PhD**
Addis Ababa University		Water Resources Engineering and Management: Surface Water Management (WREM-SWM)	Water Resources Engineering and Management: Surface Water Management (WREM-SWM)
		Water Resources Engineering and Management: Surface Water Management (WREM-GWM)	Water Resources Engineering and Management: Surface Water Management (WREM-GWM)
		Water Resources Engineering and Management: Surface Water Management (WREM-IWM)	Water Resources Engineering and Management: Surface Water Management (WREM-IWM)
		Water and Health: Water and Public Health (WaHe-WPH)	Water and Health: Water and Public Health (WaHe-WPH)
		Water and Health: Water and wastewater Treatment (WaHe-WWWT)	Water and Health: Water and wastewater Treatment (WaHe-WWWT)
		Environmental Engineering	Hydraulic Engineering
		Water Supply and Environmental Engineering	Dam Engineering
		Hydraulics Engineering	PhD in Irrigation Engineering
		Hydropower Engineering	Water Supply and Environmental Engineering
		Environmental Science	Environmental Engineering
		Hydrogeology	Environmental Science
		Water Resources Management	Hydrogeology

University	Level of training programs		
Arba Minch University	Hydraulic and Water Resources Engineering	Hydraulic Engineering	PhD in Irrigation and Drainage Engineering
	Water Resources and Irrigation Engineering	Hydropower Engineering	Water and Environment
	Water Supply and Environmental Engineering	Dam Engineering	Geo-Information Science and Earth Observation
	Meteorology and Hydrology	Sustainable Water Resources Engineering	
		Irrigation and Drainage Engineering	
		Irrigation Engineering and Management	
		Hydrology	
		Climate Change	
		Water Supply and Environmental Engineering	
Jimma University	Hydraulic and Water Resources Engineering	Environmental Health	Water Resources Engineering
	Water Supply and Environmental Engineering	Environmental Science and Technology	Environmental Engineering
	Environmental Health	Environmental Engineering	Environmental Health
		Hydraulic Engineering	
Haramaya University	Water Resources and Irrigation Engineering	Water Supply and Sanitation Management	Irrigation and Drainage Engineering
	Water Supply and Environmental Engineering	Engineering Hydrology	Soil and Water Conservation Engineering
	Hydraulic and Water Resources Engineering	Irrigation Engineering	

University	Level of training programs		
	Environmental Health	Soil and Water Conservation Engineering	
Bahir Dar University			
	Hydraulic and Water Resources Engineering	Engineering Hydrology	Integrated Watershed Management
	Water Resources and Irrigation Engineering	Hydraulic Engineering	
		Irrigation Management and Engineering	
		Water Supply and Sanitary Engineering	
		Environmental Engineering	
Hawassa University			
	Environmental Health	Environmental Health	Natural Resource Engineering and Management
	Water Resources and Irrigation Engineering	Water Resources Engineering and Management	Hydraulic Engineering
	Hydraulic and Water Resources Engineering	Irrigation and Drainage Engineering	Environmental Management
		Dam Engineering	
		Soil and Water Conservation Engineering	
Mekelle University			
	Environmental Health	Irrigation and Drainage Engineering	
	Hydraulic and Water Resources Engineering	Hydraulic Engineering	

University	Level of training programs		
		Environmental and Sustainable Infrastructure Engineering	
		Irrigation Engineering and Management	
University of Gondar			
	Sanitary Science/Environmental Health	Environmental Health	
	Environmental Health	Hydraulic Engineering	
	Hydraulic and Water Resources Engineering		

Table 7. Total number of academicians in 1st to 3rd generation Universities (MoE, 2018)

Band	Lecturer			Assistant Professor			Associate Professor			Professor			Others			Total		
	M	F	Total	M	F	Total	M	F	Total	M	F	Total	M	F	Total	M	F	Total
1	1925	401	2326	259	67	326	42	11	52	12	11	23	309	73	382	2547	563	3109
2	1603	255	1858	437	61	501	108	14	122	35	9	44	68	20	88	2251	359	2613
3	2027	517	2544	658	217	875	127	20	147	31	2	33	163	62	225	3006	818	3824
4	929	226	1145	349	71	419	84	30	114	18	5	23	44	7	51	1424	339	1752
5	1059	160	1210	214	63	277	26	7	33	4	0	4	32	4	36	1335	234	1560
6	1991	425	2417	635	106	741	125	15	140	24	0	24	98	20	118	2873	566	3440
Total	9534	1984	11,500	2552	585	3,139	512	97	608	124	27	151	714	186	900	13436	2879	**16,298**

Private universities

There are over 50 private universities and university colleges and colleges in Ethiopia; however, most of these offer trainings mainly in the areas of business and health sciences. There are only 2 or 3 of them offering trainings in Science and engineering fields. There are no private colleges/universities offering trainings in the water related discipline.

2.1.2 Technical and Vocational level training (public and private)

The Ministry of Education of Ethiopia (MoE) has set a vision to the Technical and Vocational Education and Training (TVET). The vision stated by the MoE is to create competent and self-reliant citizens to contribute to the economic and social development of the country, thus improving the livelihoods of all Ethiopians and sustainably reducing poverty.

There are about 400 public and private technical and vocational training colleges/centers in Ethiopia. At the moment, information on the exact number of these colleges offering water related trainings is not obtained; however about 10% of these colleges are estimated to have water related trainings.

2.1.3 On-job/tailor made training

The purpose of the on-job training is to enhance specific knowledge /skills of people on jobs as per the demand for skills in those specific areas. On job trainings are offered to employees of government and private companies operating in the areas of water. The trainings are given by both universities and Technical and Vocational Training colleges/centers. Main on job trainings in water related areas focus on key knowledge and skills generally for a duration ranging from 2 weeks to 3 months.

As to the on job trainings, particularly in the water supply sub-sector technical trainings, the Ethiopian Water Technology Institute (EWTI), which is a public institute under the Ministry of Water, Irrigation and Energy (MoWIE) plays a major role. This institute offers short-term hands-on on-job-trainings particularly to water supply and sanitation technicians. The specific areas of on-job training offered by the institute include, but not limited to:

- Water well drilling technologies
- Water supply systems installation
- Water supply infrastructure maintenance
- Pump installation and maintenance
- Water harvesting technologies

2.1.4 National water sector professionals profile

There is no as such accurate information on the water sector human capacity profile in Ethiopia. The data available is scanty and not well structured. However, desk study of available information and consultation with Universities, Ministry of Education, and other ministries and stakeholders involved in the water sector, the human capacity profile in Ethiopia in 10 major water related disciplines is shown in Table 8.

Table 8. National human capacity profile estimate in major water related disciplines (Consultation with universities, MoE, MoWIE, MoALR, 2018)

No	Discipline	PhD	MSc	BSc
1	Hydrology and Water Resources	50	500	-
2	Irrigation Engineering	20	500	4000

3	Hydraulic Structures/Engineering	100	500	4000
4	Groundwater Hydrology/Investigation	20	100	-
5	Environmental Engineering/Science	10	200	100
6	Water Treatment	10	20	-
7	Water Well Drilling Technology	-	-	-
8	Wastewater Treatment	-	20	-
9	Water Quality Management	5	50	-
10	Water Supply Engineering	10	200	3000
	Total	**215**	**1,890**	**8,100**

Of all these disciplines, the irrigation sector consumes the largest number of professionals due to the fact that agriculture is a major economic sector it Ethiopia that employs about 83% of the total population and accounts for about 41.6% of GDP (GTP II, 2015). Agriculture also accounts for about 86% of export earnings. Still, the sub-sector is characterized by low human capacity in all regions in general.

2.1.5 Ethiopian Public Universities Academic staff profile in the water sector

The water sector academic staff profile of the eight 1st gegneration universities which have well established water related training programmes were studies. These are the universities which contribute for over 95% of the water professionals in the country. Consultations were made with key personnel from each university to obtain their staff profile as indicated in Table 9. It can observed overall that the Ethiopian public university water sector lecturers is dominated by junior and less qualified personnel, with 13% PhD, 40% MSc and 47% BSc holders.

Table 9. Water sector academic staff profile of Ethiopian 1st generation Public Universities (Consultation with each university, 2018)

University	Academic staff qualification			
	PhD	MSc	BSc	Total
Addis Ababa University	62	43	59	164
Arba Minch University	21	90	151	262
Jimma University	11	73	126	210

Haramaya University	5	48	30	83
Bahir Dar University	18	56	68	142
Hawassa University	12	59	21	92
Mekelle University	5	13	45	63
University of Gondar	7	48	6	61
Total	**141**	**430**	**506**	**1,077**

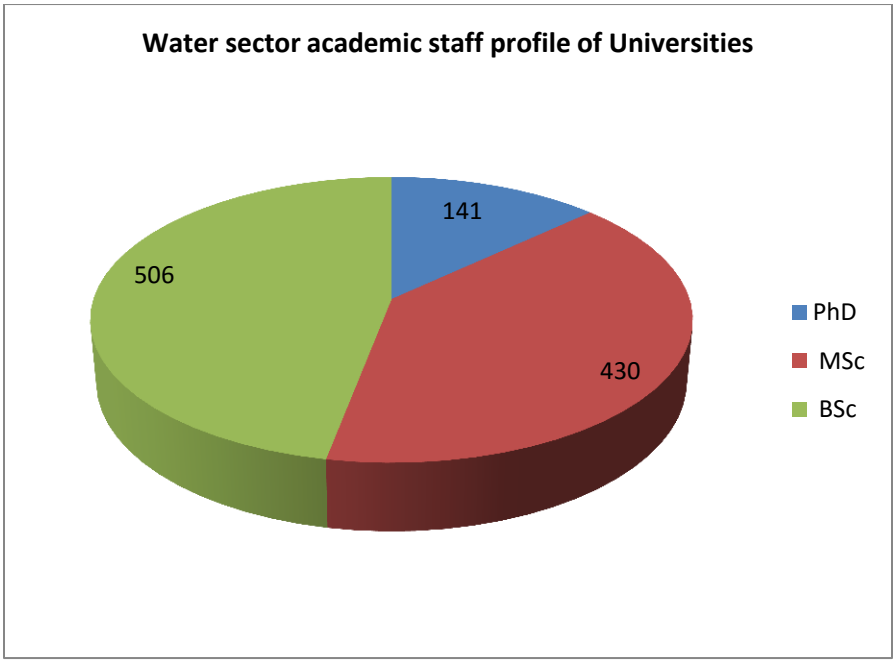


Figure 4 . Total number of water sector academic staff profile of eight 1st generation universities in Ethiopia (Consultation results with key personnel of each university and respective university websites, 2018)

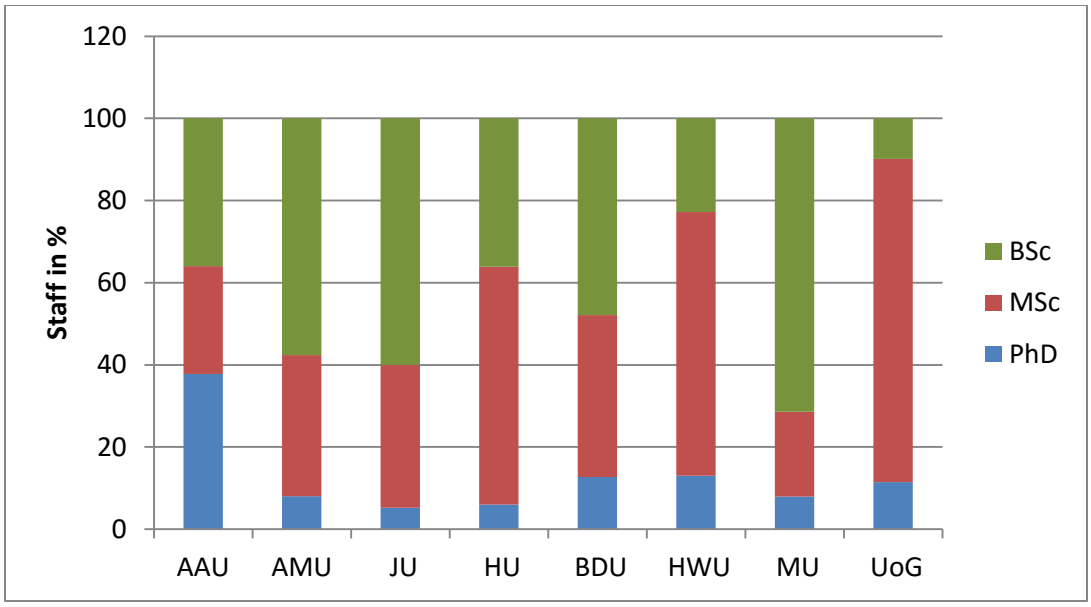


Figure 5 . Water sector academic staff profile of 1st generation universities in Ethiopia by university (Consultation with each university, 2018)

2.2 Human Resource Development Plan for water supply sub-sector

The GTP-II stressed the need of sustainable water resources development and management in water supply, waste management, irrigation, and hydropower. The plan stresses that human resources are the basic input to materialize the plan in water resources development and management. All implementation agencies need to have the necessary experts well trained and having adequate experience in the area of their specialty. According to the GTP-II water sector action plan, the main responsibility of the government is to develop/modify policies, legislations, strategic plans, etc. and search for financial resources; while the private sector would be actively involved in study, design, construction, operation and maintenance. Accordingly, during the planning period overall 527,874 work forces are required of which 4,374 are higher and 13,000 medium professionals and the remaining 510,500 are artisans and care takers.

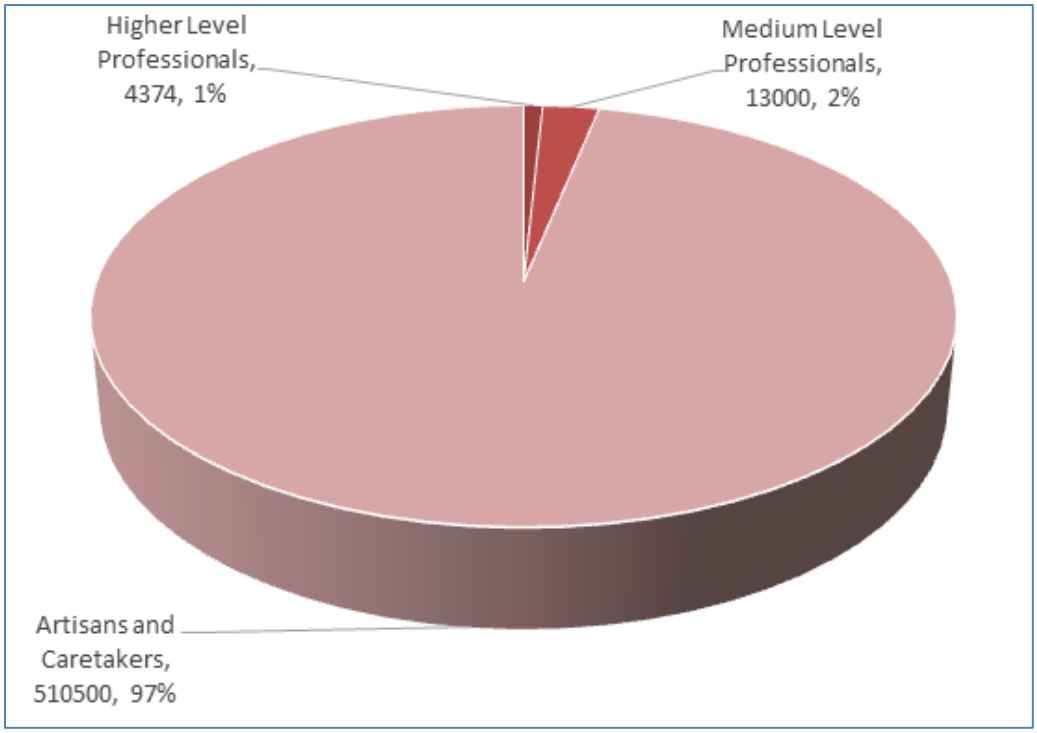


Figure 6. Training and job opportunity creation plan in water supply and sanitation subsector (2016-2020) (Source: GTP-II, Government of Ethiopia)

2.3 Laboratory facilities Infrastructure

Water Laboratory service is considered as a major need for successful human capacity development in any country. Water Laboratories are key for enhancing knowledge and human skills in water transport (dynamics), soil water physics, water quality and treatment, wastewater quality and treatment, environmental monitoring, etc. There is critical lack of water laboratories in Ethiopia, both in the universities and in the industries. The situation is bad in the universities given most of the universities in Ethiopia are very young, less than 15 years of age. Water related laboratories in the country are divided into:

- *Hydraulics laboratory*- for analysis of hydraulic characteristics of water which are mainly related to water pressure, transport (dynamics), water power, etc.
- *Water quality/Environmental laboratory*- for water quality testing and monitoring including physical, biological and chemical water quality parameters.
- *Soil and water laboratory*- for characterizing water in soils either for agricultural or civil engineering applications, such as soil moisture content for irrigation, field

capacity, saturation, soil water potential, optimum moisture content for compaction work, etc.

Table 10. Water laboratories in Ethiopia (Quick Assessment by EiWR, 2018)

No	Water related laboratory	Total number
1	Hydraulics laboratory	10
2	Water quality/Environmental laboratory	12
3	Soil and water laboratory	30

2.4 Financial resources

Ethiopia is noted to be one of the fast growing economies in Africa and in the world during the last decade; however, inadequate monetary policy and the country's poor export market competence did not bring significant socio-economic development in the country. As such, shortage of foreign currency has been the greatest challenge over the last few years for big water resources development infrastructure. Major water resources development works in the country are dependent on foreign aid either in the form of grant or loan, except the Great Ethiopian Renaissance Dam (GERD), which is under implementation with own financial resources of Ethiopia.

Human capacity development at MSc and PhD levels some 10 years ago used to depend on studies abroad generally in Europe, USA and Asia with scholarships from abroad due lack of government financing for studies overseas. However, during the last 10 years, large expansion of post graduate studies (both MSc and PhD) in Ethiopia has significantly reduced dependence on studies abroad. The Government of Ethiopia currently allocates the largest share of annual budget to education sector, mainly to the universities.

Achieving the GTP-II targets for only the water supply and sanitation sub-sector will require a total investment of USD 2.41 billion, the breakdown of which is shown in Figure 7. An estimate of potential funding sources indicates that Government will provide over 52.5% , communities 8%, NGOs 4.9% of the total required finance, with Development partners providing about 13.1% as grant and 21.4% as loan. However, a funding gap of

about 32% or over 0.778 billion USD still remains. The financial resources mobilization plan shows about 35% depending on loans and grants.

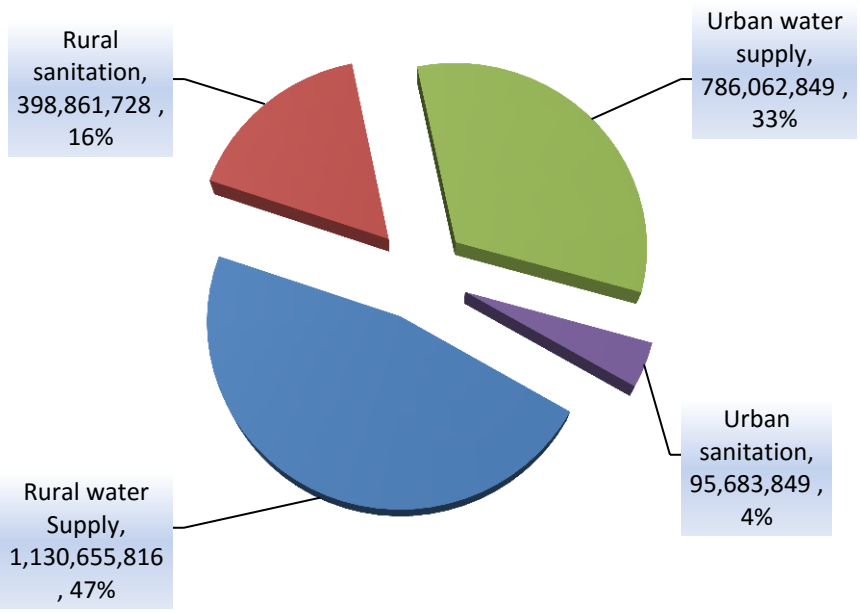


Figure 7. Financial requirement by major program component in water supply and sanitation in USD for 2016 -2020 (Government of Ethiopia, 2015).

2.5 Enabling conditions

Water sector human capacity development in Ethiopia is among top national human capacity development agenda. The enabling conditions for enhanced water sector HC developments are:

- Enabling water resources management policy of Ethiopia, which is currently undergoing revision to address recent issues;
- Expansion of universities and presence of water related training programs at PhD, MSc and BSc levels in several of them,
- Large number of TVET colleges for training technicians in the water sector;

2.6 Rationale

The rationale for enhancing human capacity development in the water sector in Ethiopia are:

- Ethiopia is water tower in the Eastern Africa region with 12 major river basins, contributing 86% of Nile water resources- need to manage the resources in sustainable way;
- Ethiopia is the 2nd most populous country in Africa with estimated population of 100,000,000, need for increased food demand;
- Climate change is critically affecting both surface and groundwater resources; need to address adaptation and mitigation strategies;
- Rapid urbanization in recent years, calling for strict water quality management interventions;
- Little utilization of the water resources of the country in all sub-sectors (Irrigation: 40% of potential, hydropower: 10% of potential) - need for accelerated water sector development activities to be done in the next decades. Water storage per capita in Ethiopia is the lowest-more infrastructure development and management needed. Although the data is old, Ethiopia's per capita water storage is only nearly 2% of that of USA.

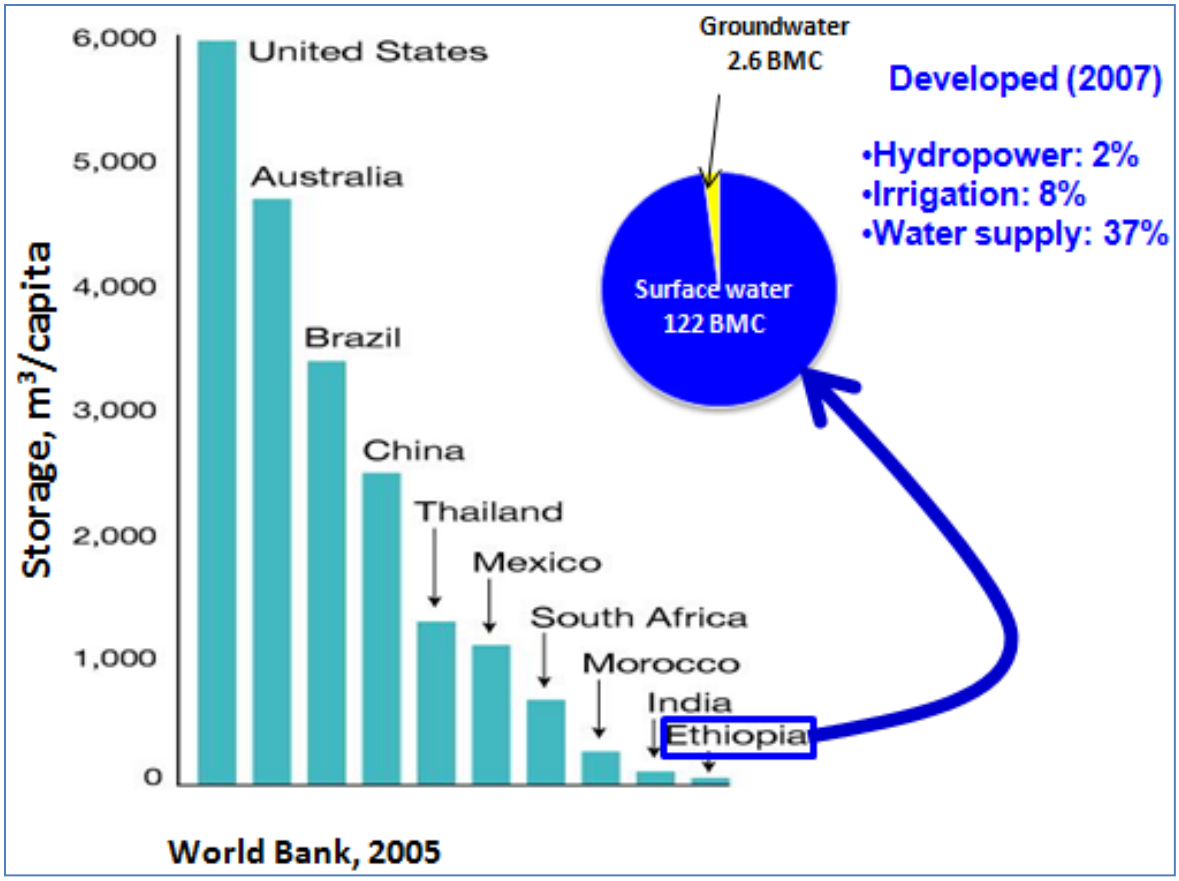


Figure 8. Per capita water storage of countries; Ethiopia's is only about 2% of that of USA (World Bank, 2005)

2.7 Monitoring and evaluation mechanisms and challenges

Water sector human capacity development plans are generally included in various national development plans; however monitoring and evaluation tools are generally poor and plans are seldom accomplished fully. The reasons, among others are:

- There is weak link between the sector organizations leading the sector and training universities; so, there is low chance that the trainings are in line with plans;
- University training in Ethiopia is not fully by choice, and entrance to specific training programs is based on academic performance, and placement is made by the Ministry of Education. In doing so, there is weak chance to stick to plans of sector organizations for their human capacity trainings; because water sector training plans are not generally guaranteed;

- While sector organizations could plan capacity building further trainings for their staff, they have little control on the national training programs.

For the Human Capacity development plans at national levels as stipulated in the Growth and Reformation Plans (GTP), is monitored by the National Planning Commission of Ethiopia through regular visits and information gathering on performance. The Human capacity development plan accomplishment by individual water sector organizations, although weak, is monitored by annual assessment of human capacities development accomplishments.

3 Sector-wide HCD limitations and success

3.1 Success of the water sector HCD

Water sector human capacity development in Ethiopia in Ethiopia has significantly improved over the last decade. The successes are apparently due to expansion of universities and colleges offering water related trainings. Ethiopia, being a water rich country (through the spatial and temporal variability is high) and due to the fact that most of the resource is not utilized so far, has a lot to be done in the sector in development and sustainability issues. The success factors include:

- Over 40 universities in Ethiopia, with several of these offering water related trainings at PhD, MSc and BSc levels;
- Over 400 TVET colleges of which 10% are estimated to have water related technical trainings;
- Large young generation with very high interest to pursue water related trainings;
- Large scholarship opportunity for MSc and PhD studies in Europe, Asia and USA for Ethiopian students;
- Ethiopian Governments' commitment to ensure sustainable water resources management in the country, etc.

3.2 Limitations in in water sector HCD

Following the success of water sector-wide and multi-sectoral approaches, water sector organizations identified the following priority or hot spot areas of Institutional and Human Capacity Challenges. The actors are MoWIE, Ministry of Environment, Forest and Climate Change (MoEFC) and the Ministry of Agriculture and Livestock Resource (MoAL) as well as development partners in developing a high impact National Integrated Water Resources Management Program. All these challenges/limitations are related to human capacity development in general.

Institutional

- Many young organizations to absorb and handle several intricate emerging issues which is often beyond their institutional capacity;
- Multiple sector and sub-sector actors on the same activity (duplication of efforts and non-efficient utilization of human resources)
- Limited enforcement of policy and regulatory framework;
- Unequipped (inadequate) training & technology/ (development, resources, incubation, upgrading) centers, technology parks.

Knowledge management

- Gaps in institutional capacity and knowledge management system;
- Lack of reliable information (no systematic data collection, poorly organized and analyzed, inaccessible, weak documentation, poor reporting, inconsistent & fragmented scheme inventory);
- Little human capacity and hence poor National level water sector database and information management activities.

Capacity (Human, Physical and Financial)

- Insufficient skilled human resources; Recruit…Train…Retain; Retraining, Reskilling;
- High turnover in public institutions; inability to attract best and keep brightest talent;
- Insufficient focus and budget;
- Lack of focus and limited practical research and capacity building.

- Lack of sound technology and transfer mechanisms, demonstration, adoption, innovation, generation, multiplicities

Sustainability of water resources developments

- Insufficient focus on sustainability and follow up in public sectors (projects after handover);
- Ineffectual institutional framework to implement cost sharing, bulk water tariff, water fees & cost recovery in Irrigation, problems in the formation and implementations of WUAs;
- Lack of proper inventory on available resource and not taking lessons from the previous failures, operation and maintenance, scheme rehabilitation & revitalization is weak;
- Consolidation and redistribution of land in command area & right of way issue.

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Annex II: GTP II Policy matrix in the water sector for Potable water and sanitation subsector (MoWIE & MoALR 2018)

Link with SDGs	Objective	Output	Indicator	Base Yea	Annual Target					Agency	MoV
				2014/15	2015/16	2016/17	2017/18	2018/19	2019/20		
Goal 3.9, 6.1, 6.4 & 9.1	Increase the quality and access to safe drinking water and improving sanitary services	Increased access to safe drinking water	Rural potable water supply coverage in standard of GTP II (25 liters/ capita/day	59	64	69	75	80	85	MoWIE, MoH	MoWIE, MoH and NPC Report
			Rural potable water supply coverage in standard of GTP II (by pipe) (%)	-	4	4	4	4	4		
			Urban potable water supply coverage in standard of GTP II (%)	51	55	60	65	70	75		
			National potable water supply coverage in standard of GTP II (%)	58	63	67	73	77	83		
			Total (urban and rural) potable water supply coverage by GTP II standard (pipe) (%)		6	6	6	6	6		
	Improving the quality, sustainability and supply of drink water	Reduced number of disfunctional rural water	Rural malfunction water stations (%)	11.2	11	10	9	8	7		

Link with SDGs	Objective	Output	Indicator	Base Year	Annual Target					Agency	MoV
				2014/15	2015/16	2016/17	2017/18	2018/19	2019/20		
Goal 3.9, 6.1 & 11.1	Improve urban and rural water supply	Increased number of rural water supplying institutions	Number of newly constructed stations	238,370	42,308	43,485	54,811	48,020	49,745	MoWIE, MoH	MoWIE, MoH and NPC Report
		Increased number of urban water supplying	Number of newly constructed stations	400	90	90	90	70	60		
	Improve urban waste management and sewerage system	Strengthened urban waste management and sewage system	conducted on urban drainage management and sanitation (number)	36	18	18					
			Number of urban sanitation system constructed				3	3			
Goal 6.2 & 11.6	Developing surface and underground water hydrological information	Developed surface and underground hydrological information	Coverage of ground and surface water hydrology information (%)	89.8					95		
Goal 6.3 & 6.6	Rehabilitation and conservation of water bodies	Conserved and rehabilated	Area of land rehabilitated and conserved (ha)	922,521	276,456	276,456	276,456	276,456	276,459		

Annex III: GTP II Policy matrix in the water sector for the Large and Medium Irrigation Development subsector (MoWIE & MoALR 2018)

Link with SDGs	Objective	Output	Indicator	Base Year	Annual Target					Agency	MoV
				2014/15	2015/16	2016/17	2017/18	2018/19	2019/20		
Goal 12.2, 6.4, 6.5 & 2.4	Feasibility study, design and construction works for irrigation development	Developed medium and large scale irrigation projects	Feasibility study and design of medium and large scale irrigation development (ha)	1,320,074	431,286	142,781	110,375	132,100	99,339	MoWIE	MoWIE and NPC Report
			Construction of medium and large scale irrigation development (ha)	410,651	210,430	162,212	190,223	211,948	179,187		
		Design works undertaken by MoWIE for large and medium scale irrigation development	Construction of medium and large scale irrigation development (ha)		56,077	56,077	56,077	56,077	56,077		
		Design and construction works by sugar corporation for irrigation development and sugarcane production	Feasibility study and design of medium and large scale irrigation development (ha)		99,856	51,638	60,375	82,100	49,339	Sugar Corporation	
			Construction of medium and large scale irrigation development (ha)		99,856	51,638	60,375	82,100	49,339		
		Design and construction works by regional government for development of medium and large scale irrigation projects	Feasibility study and design of medium and large scale irrigation development (ha)		291,430	31,143				Regional States	
			Construction of medium and large scale irrigation development (ha)		54,497	54,497	73,771	73,771	73,771		
Goal 7.1, 7.2, 8.1, 9.1, 13, 17.1	Increase national capacity for the generation & production of electric power	Growth of renewable green electric power	Production of hydroelectric power (MW)	3734	4,828	4,828	10,078	10,078	13,817	MoWIE	MoWIE and NPC Report

Annex IV: GTP II Policy matrix in the water sector for the Agricultural Development and Rural Transformation subsector (MoWIE & MoALR 2018)

Link with SDGs	Objective	Output	Indicator	Base Year	Annual Target					Agency	MoV
				2014/15	2015/16	2016/17	2017/18	2018/19	2019/20		
Goal 2.4, 15.2, 15.3, 15.5 & 15.9	Sustained agricultural development by expanding watershed management practices	Strengthened and expanded natural resource management practices	Number of planned community watersheds	60460	5803	6233	6706	7226	7285	MoANR	NPC and MoANR Reports
			Areas covered by soil and water conservation structures (in thousand ha)	20170	1062	1168	1284	1412	2134		
Goal 2.4, 6.5, 12.2, 15.1	Improve water resources management and utilization	Strengthened water resources management and utilization	Size of irrigated land using small scale irrigation schemes (in 1000 Ha)								
			Number of farmers and agro pastoralists who have access to at least one water source (in thousands)								
			Number of community watershades covered by biodiversity (in 1000 Ha)								
			Amount of greenhouse gas emitted from community watersheds covered with biodiversity (in million metric tons)								