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Establishing common water sector priorities in Africa

Human Capacity Development and Water sector in the context of Agri-Energy sectors

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Disclaimer

The views expressed in this report are those of the author and do not necessarily reflect the views of AMCOW, the AUC, EC-JRC or UNESCO-IHP.

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Abstract

The report addresses a twofold objective, in order to provide an overview of:

- the Human Capacity Development (HCD) priorities in the water sector in Africa;
- the Development Priorities of the Water Sector placed in the context of Agri-Energy sectors

The activity was implemented based on both the information gathered by the European Commission Joint Research Centre and available through strategic policy, planning and programme documents of the project partner institutions and key continental and regional organisations, addressing water, food, energy and ecosystems security in Africa.

HCD priorities in the water sector in Africa

The demand for human capacity development in the water sector is defined by the role water plays in Africa's ambitions for socio-economic development as espoused by the African Union Agenda 2063. A key priority area of Agenda 2063 is water security. The report, therefore, employs the UN definition of water security, which is developing the capacity "*... to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability*" (UN Water, 2013). By this approach, the continental aspirations for growth and transformation are juxtaposed with the influence of water access and use on overall economic output. In this perspective, capacity constraints in the water sector are understood to pose grave implications for the realisation of Africa's development agenda.

Due cognisance is also given to the strategic directions of the education and training sector to develop the requisite human capital to sustain the vision of an integrated, prosperous and peaceful Africa. And it being that improvement of water wisdom is one of the facets of that undertaking, the ongoing strategic reforms in the education and training sector provide the framework within which the water sector HCD priorities are identified.

The review, thus, focused on the following documents:

- i) the African Union agenda 2063: "the Africa we want";
- ii) the Africa water vision 2025 and framework for action;
- iii) the AfDB human capital strategy for Africa;
- iv) the continental education strategy for Africa;
- v) the Science, technology and innovation strategy for Africa;
- vi) the African space policy and strategy;
- vii) the agreement on the African resources management satellite constellation;
- viii) the continental strategy for Technical and Vocational Education and Training (TVET);
- ix) the AMCOW strategy 2018 – 2030;
- x) the AMCOW policies and strategies on mainstreaming the youth and gender in the water and sanitation sector in Africa;
- xi) various decisions and declarations of the policy organs of the African Union and the African Ministers' Council on Water (AMCOW); and,
- xii) relevant human capacity development instruments currently under implementation by the East African Community; the Economic Community of West African States; the Intergovernmental Authority on Development; the Southern African Development Community and the Union du Maghreb Arabe.

Four broad categories of priorities are deduced from the derivational linkages between the African Union clarion call for a revolution to a knowledge-based and productive society; and the vitality of a vibrant water sector to the advent of sustainable development in Africa. And as such, the water

sector HCD priorities are identified within the framework of the strategic reforms in the education and training sector as follows:

- i) Building critical skills – particularly as relates to sustainable development, utilisation and management of water and related resources – to enhance economic growth and social transformation. The strategy is to utilise approaches encouraging technological empowerment, e-education and adaptive learning. To this end, the centres of excellence in water sciences and technology (CoEs) have to be strengthened into a fully functional, Africa-wide knowledge and excellence network. In turn, the network will play a significant role in fostering opportunities for development and water knowledge sharing across all AU Member States.
- ii) Fostering transformation in the TVET sector to integrate flexibility, adaptability and continuous learning in education and training supply. For the water and sanitation sector, it is imperative to: a) develop and institute officially recognised vocations for the water and wastewater sectors; and, b) raise the level of prestige and attractiveness of sanitation related occupations.
- iii) Supporting space science and astronomy research, teaching and outreach. There are numerous underdeveloped opportunities for the application of space science and technology to effectively manage resources such as water, land, forests, and marine ecosystems. The use of space technology is also of vital importance in generating sorely needed information to support decision making for the sustainable utilisation of the resources.
- iv) Recognition of competences from non-formal and informal education and training. The overarching goal is twofold. First, enable tapping into existing technological preferences, cultural practices, local values and traditions of community learning to impart life skills. And, secondly, contribute to mainstreaming indigenous water and pollution management knowledge into lifelong learning systems.

Specific scientific, technical and institutional priorities are defined under each of the above mentioned broad themed categories. The specific priorities provide entry points for implementing the AMCOW human capacity development programme to address junior professional and technician level capacity challenges in Africa.

Outside the AU-NEPAD African network of centres of excellence in water sciences and technology (CoEs), the key identified institutional partners include: the pan-African University; the African Scientific, Research and Innovation Council (ASRIC); the African Observatory of Science, Technology and Innovation (AOSTI); the Africa Regional Centres for Space Science and Technology Education (ARCSSTE); the African Association of Remote Sensing and Environment (AARSE); African Centre of Meteorological Application for Development (ACMAD); the African Regional Institute for Geospatial Science and Technology (AfRIGST); the Association for the Development of Education in Africa (ADEA); the pan-African Institute of Education for Development (IPED); the Forum for African Women Educationalists (FAWE); the Global e-Schools and Communities Initiatives (GeSCI); the International Research and Training Centre for Rural Education (INRULED); the Africa Network Campaign on Education for All (ANCEFA); and the Pan African Association for Literacy and Adult Education (PAALAE).

An implementation, monitoring and evaluation framework is also defined. It delineates roles and responsibilities for the policy organs of the African Union and AMCOW; the AMCOW Secretariat; the Commissions of the African Union and the European Union; the EC Joint Research Centre (EC-JRC) and UNESCO-IHP; the regional networks of the centres of excellence; and the individual centres of excellence. These span leveraging of political and financial commitment; resources mobilisation; coordination of funding and implementing partners; periodic planning and reporting; and project management oversight and accountability for resources and results.

Development Priorities of the Water Sector placed in the context of Agri-Energy sectors

The report section provides an overview on the Development Priorities of the Water Sector in Africa, placed in the context of Agri-Energy sectors. Based on the analysis of information gathered through strategic documents and deliveries of the ACEWATER2 project partner institutions and organisations, the report synthesises the development priorities of the water sector in Africa within the context of the express plans for productive use of water in the sectors of energy and agriculture.

Further to the above mentioned policy, planning and programme documents, other resources specific to the assessment of water, food, energy and ecosystems security in Africa are referenced:

- i) reports from the African Water and Sanitation Sector Monitoring and Reporting (WASSMO) System;
- ii) the Africa water investment programme;
- iii) the comprehensive Africa agriculture development programme (CAADP);
- iv) the programme for infrastructure development in Africa (PIDA);
- v) the water, climate and development programme (WACDEP) and
- vi) the African water resources management priority action programme 2016 - 2025 (WRM-PAP).

The key emerging priorities from the analysis can be summarised as follows:

- i) Promoting a new narrative on water that recognises the full potential of water in the economy to further Africa's future development needs. The new narrative should foster an appreciation of the vitality of water in economic growth; job creation; and industrialisation.
- ii) Strengthening the business case for water investments, as well as raising the profile of water in national and regional development in Africa. The economies of many countries in Africa are extremely vulnerable to climate variability and climate change as they are largely based on natural resources (water, land, energy, forests/ecosystems). Lack of investments to enhance human and institutional capacities; build infrastructure; and improve information systems to support water management exacerbate the difficulties. To overcome these challenges – and achieve the SDGs – it is imperative for governments, societies and the private sector to fully embrace the concept of environmental security. A paradigm shift in the approach to developing, utilising and managing Africa's water and related resources is urgently required.
- iii) Water infrastructure development should be advocated for and promoted as a means to provide a service – which is water – to the economy in order to enable growth and development to happen. Water sector interventions, especially for such resource management functions as water storage and flood control, should not be designed and marketed from the perspective of 'water sector development'. Rather, the approach to packaging them for investment should be centred on their eventual utility – from an economic perspective – in terms of providing water for food and energy production. This should be extended to the opportunities for employment and wealth creation: not to mention peace, social security and political stability.
- iv) Strategies to improve the investment outlook for water and related resources development will also benefit from the application of the High Level Panel on Water (HLPW)¹ principles for valuing water. The principles provide a guideline for determining the real value of proposed investments; the associated costs; and the benefits that can be expected. In essence, they serve the purpose of improving the appreciation of the economics of water in a country, river basin or region. The application of the principles – together with targeted interventions to catalyse change – holds promise for delivering sustainable solutions for assuring water for energy, food and environmental security in Africa.
- v) Application of the Water-Energy-Food-and-Ecosystems nexus approach to promote and facilitate investment led transboundary management and governance of water and environmental resources. The aim is to consolidate and capitalise on the achievements

¹ The High Level Panel on Water (HLPW) was co-convened in 2016 by the UN Secretary General and the World Bank President to provide the leadership required to tackle one of the world's most pressing challenges – an ever growing water crisis. It identified ways in which the world could accelerate progress towards ensuring availability and sustainable management of water and sanitation for all (SDG 6).

to-date of implementing the principles of Integrated Water Resources Management. It is thus important to revitalise implementation of the following ongoing initiatives:

- a. establishing economic accounting for water as a discipline to, among others, improve the financing and investment outlook for water resources management in Africa;
- b. improving national-level capacities for collecting complete and reliable hydro-meteorological and piezometrical data in all of Africa's 64 shared river basins;
- c. applying nexus perspective solutions to assure water, food and energy security in Africa;
- d. improving agricultural water management;
- e. implementing the PIDA priority transboundary water and energy projects;
- f. enhancing use of wastewater and sludge, as appropriate and acceptable, for nutrient recovery in agriculture and bio-gas energy production;
- g. standardising regulatory frameworks for agricultural water management across Africa;
- h. developing and adopting legal, policy and institutional frameworks for the collection and treatment of wastewater to a minimum water quality standard before discharge into transboundary water courses and aquifers; and,
- i. supporting Member States, R/LBOs and RECs to conduct water resources assessments as well as supporting them to monitor and manage groundwater use.

1 Introduction

The European Commission's Joint Research Centre (EC-JRC) – in collaboration with UNESCO-IHP – supported and coordinated the implementation of the African Networks of Centres of Excellence on Water Sciences (ACE WATER) project, phase 2. As one of the project activities, a review of available information was conducted on:

- i) the Human Capacity Development (HCD) priorities in the Water Sector in Africa; and
- ii) the Development Priorities of the Water Sector in Africa placed in the context of Agri-Energy sectors.

This report synthesises the development priorities of the water sector in Africa within the context of the express plans for productive use of water in the sectors of energy and agriculture. They are drawn from a review of relevant continental policy, planning and programme documents for assuring water, food, energy and ecosystems security in Africa.

2 The demand for Human Capacity Development: implementation of African Union Political Commitments

Overcoming the challenge of inadequate human capacity for planning, developing, utilising and managing Africa's natural resources base² (AUC, UNECA, AfDB, 2000; AUC, AMCOW, AfDB, GWP, 2019) is a key pillar of the political agenda to actualise both the African Union's Vision of:

an integrated, prosperous and peaceful Africa, driven by its own citizens and representing a dynamic force in the global arena

and the Africa Water Vision 2025 of:

an Africa where there is an equitable and sustainable use and management of water resources for poverty alleviation, socio-economic development, regional cooperation and the environment.

AMCOW's Human Capacity Development Programme (HCD Programme) for the water sector, **thus responds to – and is motivated by – the need to plug the capacity development gaps identified in, among others, the policy initiatives and strategies listed below:**

1. the African Union Agenda 2063;
2. the Africa Water Vision 2025;
3. the African Development Bank human capital strategy for Africa;
4. the continental education strategy for Africa 2016 - 2025
5. the science, technology and innovation strategy for Africa 2024;
6. the African space policy;
7. the agreement on the African resources management satellite constellation;
8. the continental strategy for TVET;
9. the Sirte Declaration on integrated development of agriculture and water in Africa; and,
10. the Sharm el-Sheikh Declaration on accelerating the achievement of water and sanitation goals in Africa.

In the sub-sections that follow, an overview is provided on each of the above listed initiatives and strategies. Emphasis is placed on highlighting their individual specific objectives that:

- either have a bearing on making improvements (efficiency, efficacy) on the development, utilisation and or management of water and related resources vis-à-vis increasing economic output from all sectors;
- or impact on education and training processes to generate knowledge and facilitate its application to assure water security, which is a necessary condition for sustainable development.

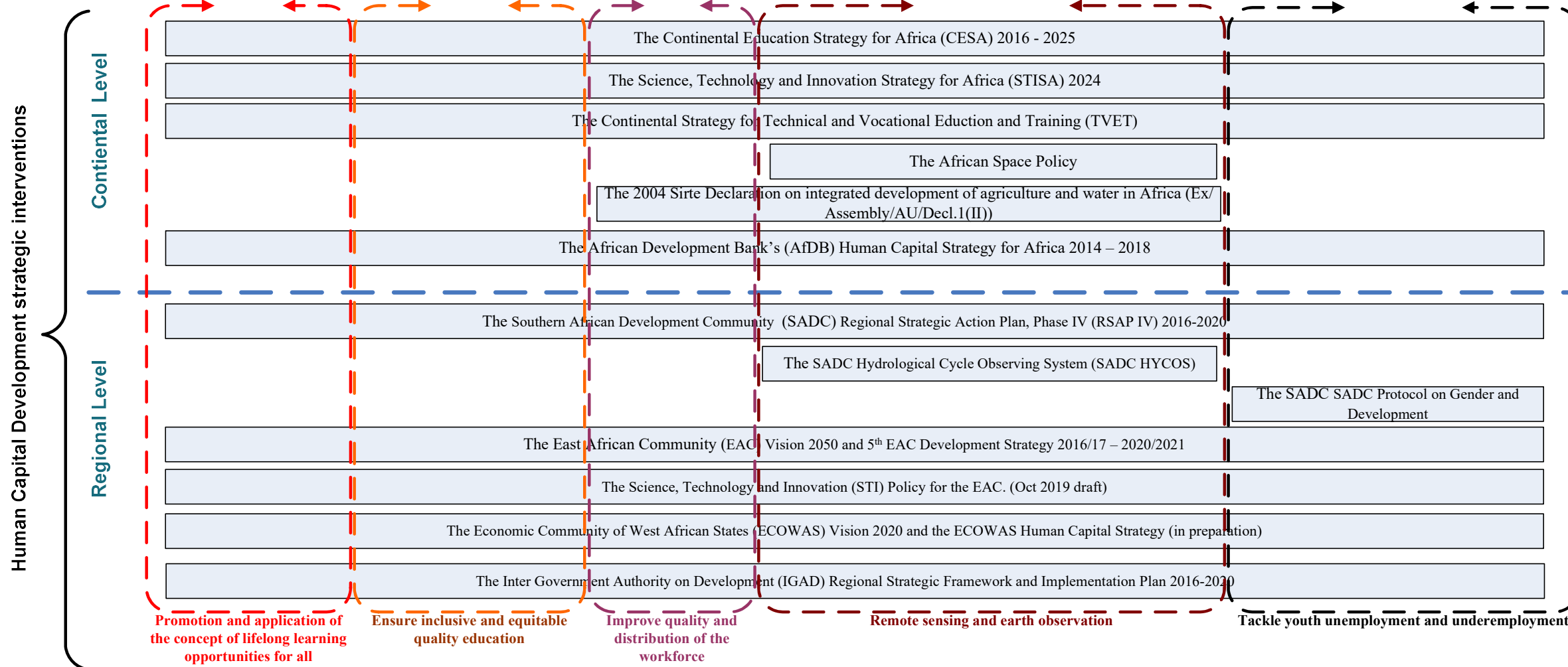
The analysis is extended to the related policy instruments and tools designed to foster regional integration; social inclusion; and labour mobility. In this respect, the spotlight is shone on the strategic goals of the RECs that deal with human capital development; gender mainstreaming and social inclusion; education reforms; and water resources assessment, monitoring and management.

A schematic representation of the interlinkages is presented in Figure 1 below:

²The natural resources base is the source of water and most of the potential wealth of countries, but is easily degraded if it is not protected and managed sustainably This comprises of wildlife; natural vegetation (grasslands, forests, wetlands, scrubland); land (including soils); water (groundwater, streams, rivers, lakes, waterfalls); and minerals.

Figure 1: Schematic representation of HCD relevant policies and strategies

AFRICAN UNION AGENDA 2063										
	Goal 1	Goal 2	Goal 3	Goal 4	Goal 5	Goal 6	Goal 7	Aspiration 6:	Goal 17	Goal 18
Aspiration 1: A prosperous Africa based on inclusive growth and sustainable development	A high standard of living, quality of life and wellbeing for all citizens	Well educated citizens and skills revolution underpinned by science, technology and innovation	Healthy and well-nourished citizens	Transformed economies	Modern agriculture for increased productivity and production	Blue/ ocean economy for accelerated economic growth	Environmentally sustainable and climate resilient economies and communities	An Africa, whose development is people-driven, relying on the potential of African people, especially its women and youth, and caring for children	Full gender equality in all spheres of life	Engaged and empowered youth and children
Priority Areas	<ul style="list-style-type: none"> Incomes, jobs and decent work Poverty, inequality and hunger Social security and protection incl. persons with disabilities Modern and liveable habitats and basic quality services 	Education; and Science, Technology and Innovation (STI) skills driven revolution	<ul style="list-style-type: none"> Health and nutrition 	<ul style="list-style-type: none"> Sustainable and inclusive economic growth STI driven manufacturing / industrialization and value addition Economic diversification and resilience Hospitality/tourism 	<ul style="list-style-type: none"> Agricultural productivity and production 	<ul style="list-style-type: none"> Marine resources and energy Ports operations and marine transport 	<ul style="list-style-type: none"> Sustainable natural resource management & biodiversity conservation Sustainable consumption and production patterns Water security Climate resilience and natural disasters preparedness and prevention Renewable energy 	<ul style="list-style-type: none"> Women and girls empowerment Violence & discrimination against women and girls 	<ul style="list-style-type: none"> Youth empowerment and children 	



2.1 The African Union Agenda 2063 and the Africa Water Vision 2025

The African Union Agenda 2063 and the Africa Water Vision respectively prioritise – among others: i) assuring water security; and ii) improving water wisdom.

UN-Water defines water security as the capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability (UN Water, 2013). Thus, the economy as a whole is directly or indirectly dependent upon the output of sectors for which water is an important input³, and is – by inference – sensitive to capacity constraints in the water sector. In this respect, improving water wisdom is a necessary condition for realising Africa’s development agenda as encapsulated in Agenda 2063.

The African Union Agenda 2063: “*The Africa We Want*” provides the framework and roadmap to achieve the African Union Vision by 2063. It is premised on assuring self-reliance, regional integration, industrialisation and enhanced partnerships through:

- promoting science, technology and innovation;
- investing in human capital development;
- managing natural resources in a sustainable manner;
- effective private and public sector development and the promotion of public-private partnerships; and,
- innovative resources mobilisation.

Agenda 2063 describes the vision of Africa, in 50 years’ time from 2013, with respect to different aspects of human wellbeing and socio-economic development. The vision comprises seven key aspirations of the people of Africa for the year 2063 with set quantitative targets. The aspirations are elaborated in the table below.

Table 1: The seven aspirations, goals and priority areas of Agenda 2063

Aspiration	Goals	Priority Areas
<p>Aspiration 1: A prosperous Africa based on inclusive growth and sustainable development.</p>	(1) A high standard of living, quality of life and wellbeing for all citizens	<ul style="list-style-type: none"> • Incomes, jobs and decent work • Poverty, inequality and hunger • Social security and protection including persons with disabilities • Modern and liveable habitats and basic quality services
	(2) Well educated citizens and skills revolution underpinned by science, technology and innovation	<ul style="list-style-type: none"> • Education and STI skills driven revolution
	(3) Healthy and well-nourished citizens	<ul style="list-style-type: none"> • Health and nutrition
	(4) Transformed economies	<ul style="list-style-type: none"> • Sustainable and inclusive economic growth • STI driven manufacturing / industrialization and value addition • Economic diversification and resilience • Hospitality/tourism
	(5) Modern agriculture for increased productivity and production	<ul style="list-style-type: none"> • Agricultural productivity and production
	(6) Blue/ ocean economy for accelerated economic growth	<ul style="list-style-type: none"> • Marine resources and energy • Ports operations and marine transport

³ These include agriculture, forestry, mining, energy resource extraction, manufacturing, electric power production, and labour/public water supply.

Aspiration	Goals	Priority Areas
	(7) Environmentally sustainable and climate resilient economies and communities	<ul style="list-style-type: none"> • Sustainable natural resource management and biodiversity conservation • Sustainable consumption and production patterns • Water security • Climate resilience and natural disasters preparedness and prevention • Renewable energy
Aspiration 2: An integrated continent; politically united and based on the ideals of Pan-Africanism and the vision of Africa's Renaissance.	(8) United Africa (federal or confederate) (9) Continental financial and monetary institutions are established and functional (10) World class infrastructure criss-crosses Africa	<ul style="list-style-type: none"> • Framework and institutions for a united Africa • Financial and monetary institutions • Communications and infrastructure connectivity
Aspiration 3: An Africa of good governance, democracy, respect for human rights, justice and the rule of law.	(11) Democratic values, practices, universal principles of human rights, justice and the rule of law entrenched (12) Capable institutions and transformative leadership in place	<ul style="list-style-type: none"> • Democracy and good governance • Human rights, justice and the rule of law • Institutions and leadership • Participatory development and local governance
Aspiration 4: A peaceful and secure Africa.	(13) Peace security and stability is preserved (14) A stable and peaceful Africa (15) A fully functional and operational apsa	<ul style="list-style-type: none"> • Maintenance and preservation of peace and security • Institutional structure for au instruments on peace and security • Fully operational and functional APSA pillars
Aspiration 5: An Africa with a strong cultural identity, common heritage, shared values and ethics.	16) African cultural renaissance is pre-eminent	<ul style="list-style-type: none"> • Values and ideals of pan Africanism • Cultural values and African renaissance • Cultural heritage, creative arts and businesses
Aspiration 6: An Africa, whose development is people-driven, relying on the potential of African people, especially its women and youth, and caring for children.	(17) Full gender equality in all spheres of life (18) Engaged and empowered youth and children	<ul style="list-style-type: none"> • Women and girls empowerment • Violence & discrimination against women and girls • Youth empowerment and children
Aspiration 7: Africa as a strong, united, resilient and influential global player and partner.	(19) Africa as a major partner in global affairs and peaceful co-existence (20) Africa takes full responsibility for financing her development	<ul style="list-style-type: none"> • Africa's place in global affairs. • Partnership • African capital market • Fiscal system and public sector revenues • Development assistance

Source: (AUC, 2014a)

The Africa Water Vision 2025 (AWV2025) constitutes one of the strategic continental policy frameworks for the realisation of Aspiration 1 of Agenda 2063 – that is: “a prosperous Africa, based on inclusive growth and sustainable development” (AUC, 2014a).

A framework for action towards attainment of the vision was defined along with milestones and quantitative, time-bound targets. The Vision's framework of indicators and targets are categorised under four themes namely (1) improving governance of water resources; (2) improving water

wisdom; (3) meeting urgent water needs; and (4) strengthening the financial base for desired water future. These are presented in the table below.

Table 2: Targets of the Africa Water Vision for the year 2025

Africa Water Vision 2025 Targets

1. By 2025, 100% of countries should have completed development of IWRM policies and carried out institutional reform.
2. By 2025, enabling environment for regional cooperation on shared waters should be in place for 100% of river basin organisations in Africa should have in place
3. By 2025, systems for information generation, assessment and dissemination should be established in 100% of countries and 100% of transboundary water basins.
4. By 2025, review of global experiences should be completed, and sustainable financing for information generation and management implemented in 90% of the countries, and in three established basins.
5. By 2015, public awareness on capacity building for Integrated Financial Resource Management (IFRM) completed in 100% of countries; partnerships for strategic assistance formed in 60% of the countries; national research institutes should be established in 2 countries; and gender and youth concerns mainstreamed in 100% of countries.
6. By 2025, reduce by 95% the proportion of population without access to safe and adequate water supply, and safe and adequate sanitation.
7. By 2025, increase by 60% the water productivity of rain-fed agriculture and irrigation; and increase by 100% the size of irrigated area.
8. By 2025, develop 25% of potential of water for agriculture, hydropower, industry, tourism, and transportation at national level.
9. By 2025, implement in 100% of river basins measures for conservation and restoration of environment, biodiversity, and life-supporting ecosystems.
10. By 2025, measures for effective management of drought, floods and desertification should be operational in 100% of countries.
11. By 2025, 100% of countries should be implementing pricing and full cost recovery for water investments; there should be increasing participation of the private sector in water and sanitation financing, and the financing required for urgent water needs should be secured from national and international measures.

Source: (AU; UNECA; AfDB, 2000)

2.2 The AfDB Human Capital Strategy for Africa

The African Development Bank's (AfDB) Human Capital Strategy for Africa 2014 – 2018 seeks "to harness the potential of one billion Africans by building skills and promoting technologies for better jobs, equal opportunities and workforce competitiveness" (AfDB, 2014). It details the Bank's operational framework to build human capital⁴ in Africa. This is aligned to the implementation of the AfDB Strategy 2013 – 2022, which emphasises skills and technology as crucial for a productive workforce and competitive economies towards inclusive and green growth agenda for Africa.

The strategy is premised on the following specific objectives:

- i) Cashing in on the demographic dividend.
- ii) Building a knowledge economy based on productivity and competitiveness.

⁴ Human capital is in economic terminology, an input (a necessary condition) to achieving inclusive and green growth. The World Economic Forum defines it as "the acquisition and deployment of skills, talent, knowledge and experiences of individuals and/populations and their value to organisations, economies and society". The four key aspects of human capital are education; workforce and employment; wellness including health services; and enabling environment including safety nets. Together, they result in returns on human capital and human development outcomes.

- iii) Tackling the issues of youth and women unemployment and underemployment; job creation; and retaining skilled workers.
- iv) Improving the quality of education and training services provision.
- v) Attracting more investments, improving accountability, and providing more value for money in education and training services delivery.
- vi) Tackling widening income inequality and gender disparities.

2.3 The Continental Education Strategy for Africa

A key goal of Agenda 2063's Aspiration 1 is to deliver a "**well educated** [African **citizenry** through a] **skills revolution underpinned by science, technology and innovation**". In this regard, the Assembly of the African Union adopted the Continental Education Strategy for Africa (CESA 16-25) as the framework for transforming education and training systems in Africa (AUC, 2015). To cover all aspects of the education system from pre-vocational education to tertiary education, CESA 16-25 emphasises the concept of the education-and-training continuum.

CESA 16-25 is driven by the desire to set up a "qualitative system of education and training to provide the African continent with efficient human resources adapted to African core values and therefore capable of achieving the vision and ambitions of the African Union. Those responsible for its implementation will be assigned to reorient Africa's education and training systems to meet the knowledge, competencies, skills, innovation and creativity required to nurture African core values and promote sustainable development at the national, sub-regional and continental levels" (AUC, 2015, p. 7).

The strategy articulates 12 strategic objectives as follows.

- i) Revitalise the teaching profession to ensure quality and relevance at all levels of education.
- ii) Build, rehabilitate, preserve education infrastructure and develop policies that ensure a permanent, healthy and conducive learning environment in all sub-sectors and for all, so as to expand access to quality education.
- iii) Harness the capacity of ICT to improve access, quality and management of education and training systems.
- iv) Ensure acquisition of requisite knowledge and skills as well as improved completion rates at all levels and groups through harmonisation processes across all levels for national and regional integration.
- v) Accelerate processes leading to gender parity and equity.
- vi) Launch comprehensive and effective literacy programmes across the continent to eradicate the scourge of illiteracy.
- vii) Strengthen the science and math curricula in youth training and disseminate scientific knowledge and culture in society.
- viii) Expand TVET opportunities at both secondary and tertiary levels and strengthen linkages between the world of work and education and training systems.
- ix) Revitalise and expand tertiary education, research and innovation to address continental challenges and promote global competitiveness.
- x) Promote peace education and conflict prevention and resolution at all levels of education and for all age groups.
- xi) Improve management of education system as well build and enhance capacity for data collection, management, analysis, communication, and use.
- xii) Set up a coalition of stakeholders to facilitate and support activities resulting from the implementation of CESA 16-25.

2.4 The Science, Technology and Innovation Strategy for Africa 2024

The Science, Technology and Innovation Strategy for Africa – 2024 (STISA-2024) is the “continental framework for accelerating Africa’s transition to an innovation-led, knowledge-based economy within the overall framework of the AU Agenda 2063” (Assembly/AU//Dec.520(XXIII)⁵). Human capital development; innovation; value addition; industrialisation; and entrepreneurship are singled out as the focus areas of the strategy to foster social transformation and economic competitiveness (AUC, 2014b).

The focus of STISA-2024 is to address the aspirations identified under the Agenda 2063. It also aims to link those achievements realised under ongoing implementation of the Consolidated Plan of Action (CPA)⁶, together with future opportunities from the development of Science, Technology and Innovation (STI) in Africa. STISA-2024 is a short term incremental strategy designed to address Africa’s challenges, with the ultimate goal of contributing significantly to the AU vision. STISA-2024 responds to the demand for science, technology and innovation to impact on critical sectors including agriculture, energy, environment, health, infrastructure, mining, security and water among others (AUC, 2014b).

2.5 The African Space Policy

The African Space Policy (HRST/STC-EST/Exp./15 (II)) is aimed at providing the framework for an enabling environment for the development of a knowledge-based economy. To this end, the policy (AUC, 2017) focuses on releasing the potential benefits of applying space science and technology for the improvement of the quality of life and the creation of wealth for all in part through knowledge generation and exploitation. Key among the specific objectives of the policy, is the need to develop the requisite human resources for addressing user needs that include improving weather forecasts for effective early warning systems for, among others, ecosystem and geological events; heavy or lack of precipitation; heat waves; dust storms; health risks; and, red tides and tsunamis. The other potential benefits are listed as:

- monitoring and conducting assessments of the environment;
- managing the use of natural resources;
- providing early warnings of and managing natural disasters;
- providing education and health services in rural and remote areas;
- improving access to transportation services;
- pro-active management of disease outbreaks;
- peace keeping missions and conflict resolution; and,
- connecting Africa with people around the world.

The African Space Policy is the first step to instituting a continent-wide regulatory framework to guide the implementation of a continental space programme. And, in turn, systematically coordinate the development and utilisation of Africa’s space resources towards the improvement of the quality of life and the creation of wealth for all in part through knowledge generation and exploitation. One such example of collaborative development of space resources for livelihoods

⁵ Assembly/AU//Dec.520(XXIII): African Union Decision on Strategy for Science Technology and Innovation in Africa 2024 – Doc. EX.CL/839(XXV)

⁶ The CPA was approved to be implemented to address the following clustered key flagship research and development programmes: Cluster 1: Biodiversity, Biotechnology and Indigenous Knowledge: Including (i) Conservation and Sustainable Use of Biodiversity; (ii) Safe Development and Application of Biotechnology; and (iii) Securing and Using Africa’s Indigenous Knowledge Base; Cluster 2: Energy, Water and Desertification: Including (i) Building a Sustainable Energy Base; (ii) Securing and Sustaining Water; and (iii) Combating Drought and Desertification; Cluster 3: Material Sciences, Manufacturing, Laser and Post-Harvest Technologies: Including (i) Building Africa’s Capacity for Material Sciences; (ii) Building engineering capacity for Manufacturing; (iii) Strengthening the African Laser Centre (ALC); and (iv) Technologies to Reduce Post harvest Food Loss; Cluster 4: Information and Communication Technologies: Including (i) Information and Communication Technologies and (ii) Establishing the African Institute of Space Science; and (5) Cluster 5: Mathematical Sciences: including the Next Einstein Initiative.

improvement is the agreement on the African resources management satellite constellation highlighted below.

2.6 Agreement on the African Resources Management Satellite Constellation (ARMC)

The initiative, involving Algeria, Kenya, Nigeria and South Africa, is aimed at developing a constellation of satellites to provide real time, unrestricted and affordable access to satellite data to support effective environmental and resources management in Africa. A Memorandum of Understanding signed by the governments of the four countries on 7 December 2009, lays the foundation for easing access to satellite data for disaster management, food security, public health, infrastructure, land use, and water resources management (Adebola, 2009).

2.7 The continental strategy for TVET

The continental strategy for Technical and Vocational Education and Training (TVET) is aimed at preparing Africa's youth to become more of job creators⁷. This is motivated by the urgent need to address the negative public perception – in Africa – of TVET as a refuge for those who failed in academic education. The Strategy posits that even the most sophisticated qualifications require prior training, which is within the broader framework of TVET (AUC, 2015). The proposed approaches thus cover all aspects of training and skills acquisition – formal, non-formal and informal – as well as continuous learning.

This strategy thoroughly examines the possibilities of TVET as a response to facilitate the promotion of national development, social cohesion, political stability, poverty reduction and regional integration. It draws on recent regional and international initiatives aimed at promoting TVET to foster youth employment. The main objective of the strategy is to promote skills acquisition through training focused on the response to the demand of the social economic milieu through employability tests, sustainable livelihoods and responsible citizenship; and also building capacity to create and innovate, anchored on a spirit of entrepreneurship and inventiveness.

The specific objectives are summarised as follows:

- i) Promoting an efficient and cost-effective system of quality TVET.
- ii) Ensuring the relevance of training and employability of trainees.
- iii) Developing creativity, innovation and entrepreneurship.
- iv) Improving the legal and political environment as well as coherence and management of training provision.
- v) Promoting continuing apprenticeship.
- vi) Strengthening the status and attractiveness of TVET.

2.8 The 2004 Sirte Declaration (Ex/Assembly/AU/Decl.1(II))

In the 2004 Sirte Declaration on integrated development of agriculture and water in Africa, the African Union Heads of State and Government (AU-HoSG) commit to: i) developing the continent's human resource potential through education, training, skills development and exchange of expertise; and, ii) ensuring gender balance in access to training, education, land, natural resources, loans and development programmes.

2.9 The July 2008 Sharm el-Sheikh Declaration [Assembly/AU/Decl.1(XI)]

At the 11th Ordinary Session of the Assembly of the African Union in Sharm El-Sheikh, Egypt in June/July 2008, the AU-HoSG undertook to accelerate the achievement of water and sanitation goals in Africa. Of particular relevance to the AMCOW HCD programme for the water sector is the commitment to "*build institutional and human resources capacity at all levels ... for programme*

⁷ Assembly / Dec.525 (XXIII): African Union Decision on the AU Continental TVET Strategy –Doc. EX.CL/840(XXV)

implementation; enhanc[ing] information and knowledge management, as well as strengthen[ing] monitoring and evaluation”.

Activities to implement the Sharm el-Sheikh Declaration have resulted in the formulation and ongoing implementation of the understated capacity development policies and strategies:

1. The African Ministers’ Council on Water (AMCOW) Strategy 2018 – 2030.
2. The **2014 AMCOW Policy and Strategy for Youth in the Water and Sanitation Sector in Africa** – to address constraints to youth engagement including: inadequate education, limited knowledge; an inability to access information, and lack of marketable skills.
3. The **2011 AMCOW Policy and Strategy for Mainstreaming Gender in the Water Sector in Africa**, which serves as a guiding framework for AU Member States and other stakeholders, to mainstream gender in their sector policies, programmes, actions and investments (AMCOW, 2011). A clarion call is made to undertake strategic research and collection of operational information on gender; develop human and institutional capacity to support gender equality interventions; and allocate adequate human and financial resources to gender mainstreaming.

2.10 Regional water sector capacity development and research policy initiatives

Subsidiary implementing arrangements for the continental policies and strategies are fostered at regional level by the Regional Economic Communities (RECs) and River and Lake Basin Organisations (RLBOs) – for water sector related issues. Table 3 below captures the related regional instruments for furthering human capacity development in Africa.

Table 3: Regional level instruments for Human Capacity Development in Africa

Region	Instrument	Goal
Southern African Development Community (SADC)	Regional Strategic Action Plan, Phase IV (RSAP IV) 2016-2020	<p>Programme 4: Human Capacity Development and Research</p> <p>Objective: implement the SADC Strategic Human Capacity Development Plan for the water sector (2014-2020), strengthen institutions and support research in water on agreed themes. According to Beukman (2018, p. 13), of particular relevance to the ACE-Water project are the following:</p> <ul style="list-style-type: none"> • That capacity development will form a continuum from addressing knowledge gaps into skills and meta-competencies in support of the implementation of the RSAP IV. • That WaterNet is entrusted by SADC to play a leading role in the implementation of the capacity development component of the RSAP IV, as WaterNet is a subsidiary institution of SADC. Other implementing agencies for the regional water programme will be chosen based on their already existing capacity to carry out the implementation. • The Capacity development in the RSAP IV is focused on individual capacity development. • SADC commissioned a consultative project in 2014 (during the RSAP III implementation) to develop the <i>SADC Water Sector Human Capacity Development (SHCD) Plan (2014-2020)</i>. The RSAP IV capacity development programme prioritises the implementation of this SHCD plan
	SADC Hydrological Cycle Observing System (SADC HYCOS)	<p>SADC-HYCOS IV: a regional component of the World Hydrological Cycle Observing System (WHYCOS)</p> <p>Objective: develop and/or strengthen national and regional capacity in the fields of water resources assessment, monitoring and management. Phase III of the project – implemented between 2011 and 2015 – focussed on achieving a fully functional and calibrated monitoring network, as well as strengthening the capabilities of the National Hydrological Services (NHS) to effectively manage their water resources (SADC, 2008; Mbaziira, SADC Hydrological Cycle Observing System (SADC HYCOS): A Regional Approach to water related Disaster Risk Reduction, 2019a). This included, among others, i) the implementation of the Hydstra Hydrological Information System; ii) Data Exchange; and, iii) development of Hydrological Products to meet varying user needs</p>
	<p>i. SADC Protocol on Gender and Development; and,</p> <p>ii. the SADC Handbook on Gender Mainstreaming in the Water Sector</p>	<p>Goal: facilitate gender mainstreaming into systems and institutions, for the attainment of gender equality and equity at national and regional level</p> <p>Specifically: institute an inclusive approach to transboundary water management that ensures adequate incorporation of all voices and gender equality concerns. The SADC Protocol on Gender and Development has several provisions that seek to facilitate gender mainstreaming into systems and institutions, for the attainment of gender equality and equity at national and regional level through gender responsive planning and budgeting initiatives; policy development and implementation; gender capacity building and training; and the collection of gender disaggregated data (SADC, SARDC, 2016; Mbaziira, 2019b). The SADC Handbook on Gender Mainstreaming (SADC, 2015) in the Water Sector</p>

		recommends a strategic approach to gender mainstreaming centred on i) reducing gender inequalities; ii) creating conditions for equal participation in planning; iii) women empowerment; and iv) enhancing both service provision and sustainability.
East African Community (EAC)	i. EAC Vision 2050 ii. 5 th EAC Development Strategy 2016/17 – 2020/2021	Human Capital Development Pillar Goal: Well-educated and healthy human resources, as well as equipping the youth with the right skills to enter the workforce.
	Science, Technology and Innovation (STI) Policy for the EAC. (Oct 2019 draft)	Goal: application of STI, in terms of human skills; capital goods; practices; and organisations, to drive economic growth and sustainable development in the EAC. The East African Regional STI Policy is anchored on the following pillars: i) Capacity building for skills and STI Infrastructure; ii) Research, Innovation and Entrepreneurship; iii) Resource mobilisation, partnerships and collaborations; and iv) Enabling environment. On the other hand, the priority (sector) areas for the East African Regional Policy for Science, Technology and Innovation (STI) are: (1) Agriculture and Food; (2) Health and Life Sciences; (3) Human Resource Development/ Education; (4) Infrastructure; (5) Energy; (6) ICT and Big Data (7) Industrialization and Trade; (8) Environment and Natural Resources Management; (9) Climate Change; (10) Traditional and Indigenous Knowledge; and (11) Space Science and Technology. Earth Observation tools
Economic Community of West African States (ECOWAS)	i. ECOWAS Vision 2020 ii. ECOWAS Human Capital Strategy (in preparation)	<i>Education, Skills and Labour participation</i> is one of the 3 priority thematic areas for the advancement of the HCD agenda in the region towards Vision 2020 of “ <i>an inclusive society achieved through human capital development and empowerment.</i> ” It underlies ongoing activities to develop an integrated human capital development strategy for the ECOWAS region
Inter Government Authority on Development (IGAD)	IGAD Regional Strategy	Two of the strategic outputs of the IGAD Regional Strategic Framework and Implementation Plan 2016-2020 are: Capacity building; and Research, science and technology. They underpin aspirations for “ <i>a more peaceful, prosperous, and socio-economically and politically stable IGAD region.</i> ”
Union du Maghreb Arabe (UMA)		a “new social contract” between governments and citizens to, among others, turn a disempowered citizenry into a knowledge-based, productive society by improving human capital and promoting social inclusion (Larbi & Christensen, 2017).

3 HCD Priorities deriving from the continental and regional education policy and strategy framework

The demand for human capacity development in the water sector is defined by the role water plays in Africa's ambitions for socio-economic development as elaborated in Agenda 2063. To the extent that every sector of the economy is influenced by water⁸, the realisation of sustained economic growth and social transformation in Africa is dependent on ensuring water security. The observed trends in Africa's population growth; urbanisation and lifestyle changes have implications for water demands. The anticipated impacts of climate variability and climate change will ravel the form, intensity and timing of water demand; affect water availability; and increase the risk of water-related hazards. A high level of technical ingenuity is, therefore, required to develop the requisite water infrastructure base to release Africa's development potential. A similar level of social ingenuity is also required to adjust to water scarcity and prepare for the adverse impacts of climate change.

Ergo, the need for improved water wisdom. First, to cope with and compensate for the consequences of the anticipated changes in water demands in all economic sectors. And, more importantly, to reliably satisfy those demands to deliver robust, competitive and climate resilient economies; and inclusive socio-economic development and livelihoods improvement.

Implementation of the decision of the Executive Committee of AMCOW – EXCO/11/2013/CAIRO/17 – to *"...develop a Human Capacity Development Programme aimed at addressing junior professional and technician level capacity challenges in the water sector"* reflects the broad continental sentiment to underpin aspirations of a prosperous Africa on a skills driven revolution. The African Union Specialised Technical Committee on Education, Science and Technology (STC-EST) is mandated to develop the requisite human capital to sustain the vision of an integrated, prosperous and peaceful Africa. To this end, the STC-EST is spearheading implementation of strategic reforms in the education and training sector as highlighted in the preceding chapter. These are broadly categorised into:

1. science, technology, innovation and skills development;
2. application of space science and technology;
3. technical and vocational education and training (TVET); and,
4. non-formal and informal education and training (NFET).

The HCD programme – and the overall drive to improve water wisdom – represent one of the facets of the STC-EST's mandated revolution to a knowledge-based and productive society. And as such, the water sector HCD priorities presented in Table 4 are identified within the framework of the strategic reforms in the education and training sector.

The table also provides a list of key partners and stakeholders contributing to and or influencing implementation of specific reform themes. The specific roles of key strategic partners in the reform process are summarised in Figure 2 and reiterated in Appendix I.

⁸ According to Kenessy (1987), direct use of water in the extraction sectors (agriculture, forestry, mining, energy) creates a ripple effect in the processing (utilities, manufacturing, and construction); delivery (transportation, trade); and information (finance, insurance, real estate, public administration) sectors as goods and services are produced and transferred through supply chains until they reach the final consumer.

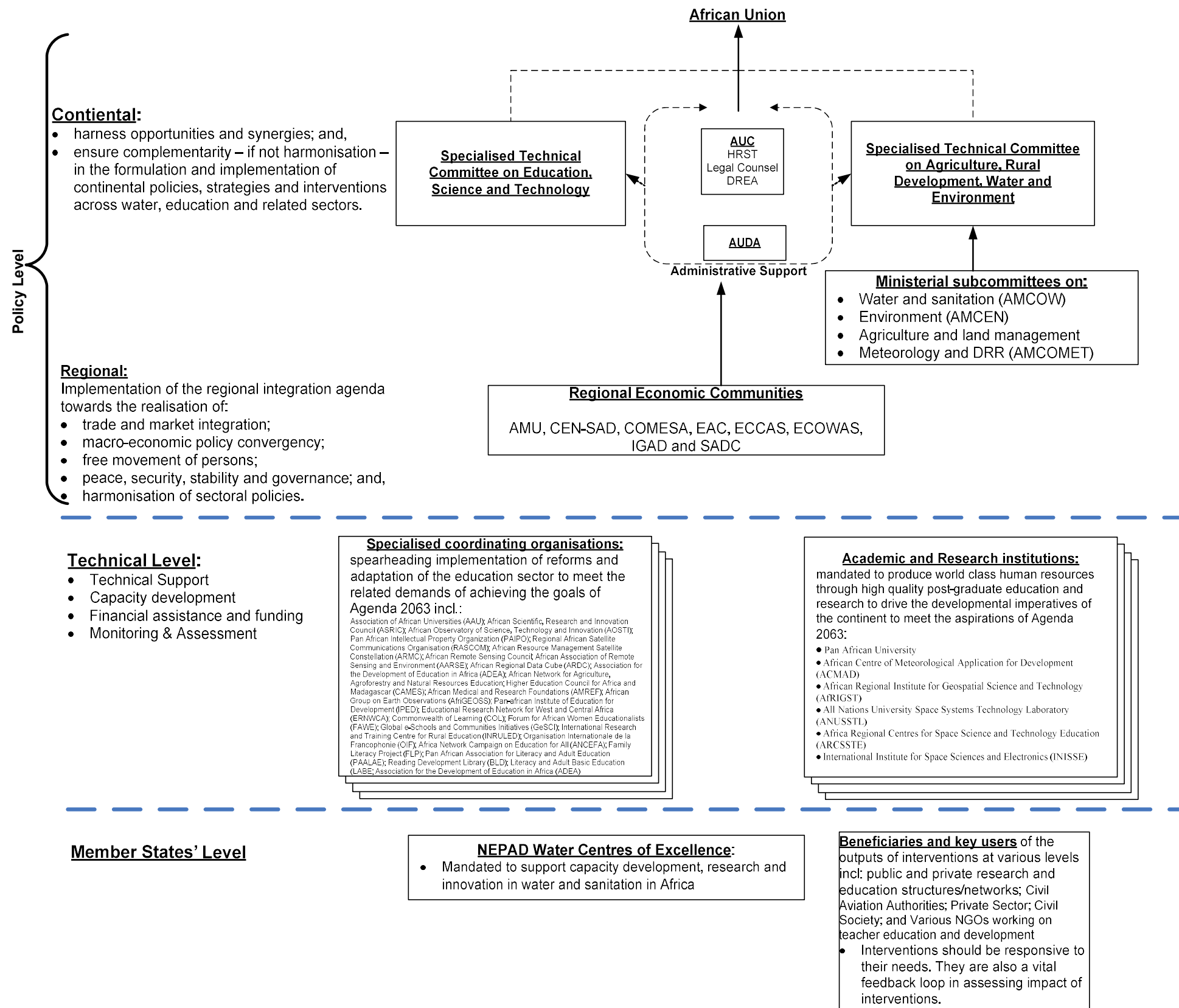
Table 4: Water sector HCD Priorities and key actors derived from continental and regional policies and strategies

Thematic Goal	Key General Priorities	Water related/impacting objectives	Water sector-specific priorities			Partners/ stakeholders
			Scientific	Technical	Institutional	
Science, technology, innovation and skills development	<ol style="list-style-type: none"> Skills, Human Capital, and Education Revolution; Ensure inclusive and equitable quality education; and, Promote lifelong learning opportunities for all 	<ol style="list-style-type: none"> Knowledge generation and application to assure water security Blue/ ocean economy for accelerated economic growth 	<ol style="list-style-type: none"> Research on new water science and technology directions in Africa incl.: <ul style="list-style-type: none"> transitioning to a green economy in water economic analysis of green water technologies water saving management, incl. reimagining urban water infrastructure towards efficient water use Sustainable Urban Drainage Systems tools for environmental sustainability evaluation as applied to water systems appropriate technologies for climate variability and climate change mitigation; marine resources development and utilisation improving low commodity yields, and practicable mechanisms for assuring stability of farm-gate prices entrepreneurial innovation based on Open Data 	<ol style="list-style-type: none"> Design and operationalisation of decision support systems for water security and climate resilient development Technological adaptation and promotion of climate smart water services and water resources management Piloting low-cost green water provision and water use technologies e.g. <ul style="list-style-type: none"> onsite grey water and non-potable water reuse systems water consumption monitoring systems solar and wind powered piped water systems rainwater harvesting (in-situ and ex-situ) information exchange; and development of experiential learning tools for establishing and managing marine legal and institutional frameworks developing and implementing flagship programmes on water vis-à-vis eradication of hunger; nutrition, food and energy security; public health and human well-being; physical and intellectual mobility; wealth creation; and social transformation Big Data and Internet-of-Things (IoT) solutions for precision agriculture water management 	<ol style="list-style-type: none"> Strengthening implementation of education policies and strategies as relates to the water sector through: <ul style="list-style-type: none"> consolidation and expansion of water centres of excellence as well as identifying and providing support to related educational think tanks curriculum development for water related disciplines; targeted teacher training, deployment, professional development and improvements in working and living conditions; development and upgrading of research and innovation facilities (teaching and engineering laboratories); development and upgrading of physical and digital infrastructure and resources; establishment and operationalisation of National Research and Education Networks; institutionalisation of regulatory frameworks for monitoring quality and relevance; and, provision of requisite learning materials Design and implementation of continuous learning programmes for the water and sanitation sector aimed at achieving cross-sectoral human capital development policy objectives Cross-sectoral coordination and integration of water knowledge/education objectives into national development plans and complementary interventions in all sub-sectors; Harmonisation – at all levels – to define a common range of skills and knowledge according to age and grade level; Development and implementation of a policy framework and strategy(ies) for: <ul style="list-style-type: none"> green technology research in the water sector blue economy; and, financing innovation Facilitating the implementation of incubator projects and mentorship programs within the water and sanitation sector Strengthening Intellectual Property Rights (IPR) and regulatory regimes at all levels through sensitisation and training on use of patent information and intellectual property rights for creation of new water technologies and their translation into everyday use Resource mobilisation, partnerships and collaborations 	<ul style="list-style-type: none"> African Union Specialised Technical Committee on Education, Science and Technology African Union Development Agency (AUDA-NEPAD) African Scientific, Research and Innovation Council (ASRIC) African Observatory of Science, Technology and Innovation (AOSTI) Pan African Intellectual Property Organization (PAIPO) RECs and Member States’ public and private research and education structures/networks African Ministers’ Council on Water (AMCOW) NEPAD Water Centres of Excellence Pan African University Association of African Universities (AAU) Association for the Development of Education in Africa (ADEA) African Network for Agriculture, Agroforestry and Natural Resources Education Higher Education Council for Africa and Madagascar (CAMES) African Medical and Research Foundations (AMREF) Civil Aviation Authorities Academic and Research institutions UN Agencies – UNESCO, UNICEF etc International Institute for Space Sciences and Electronics (INISSE) Regional African Satellite Communications Organisation (RASCOM) African Resource Management Satellite Constellation (ARMC) African Remote Sensing Council African Group on Earth Observations (AfriGEOSS) African Association of Remote Sensing and Environment (AARSE) African Centre of Meteorological Application for Development (ACMAD)
Space Science and Technology	Remote Sensing and Earth Observation	1. Monitoring and conducting assessments of the environment;	1. Research on use of space technologies for:	1. Aerial surveys and evaluation of remote sensing images/photographs	1. Mobilising political commitment for the introduction of space education in national curricula, as well as the	

Thematic Goal	Key General Priorities	Water related/impacting objectives	Water sector-specific priorities			Partners/ stakeholders
			Scientific	Technical	Institutional	
		<ol style="list-style-type: none"> 2. Managing the use of natural resources; 3. Providing early warnings of and managing natural disasters; 4. Providing education and health services in rural and remote areas; 	<ul style="list-style-type: none"> • urban and land use planning for water and related services provision • maritime and sub-maritime exploration, as well as improving knowledge of the water cycle, river systems and river basin management; • improving weather forecasts for effective early warning systems for ecosystem and geological events; heavy or lack of precipitation; heat waves etc • water-related aspects of managing natural resources and the environment; disaster risks; and marine and coastal areas; • assuring energy and food security, and climate change mitigation and adaptation; and, • exploitation and management of mineral, forest, aquatic and marine resources 	<ol style="list-style-type: none"> 2. Provision of technological know-how, data access, and operational services and products on, among others: <ul style="list-style-type: none"> • surface water bodies, aquifers, hydrography, ambient water quality, pollution • Coastal zone degradation and fishing potential • Meteorological services • Ecosystems, biodiversity, vegetation and land cover • agricultural production, crops distribution, soil and land suitability, pests and disease vectors • water and environment related risk and vulnerability • infrastructure networks and intelligent transportation systems 3. Enabling easy access to open data and processing tools to facilitate capacity development in the use and dissemination of geospatial data and information 	<p>development of space programmes and related industries</p> <ol style="list-style-type: none"> 2. Disseminating information on the application of space technologies for efficient, cost effective and sustainable utilisation of Africa's natural resources 3. Developing a regulatory framework to support space programmes in Africa, including a protocol on cooperation on meteorological services 4. Developing space education programmes and necessary tools for promoting widespread use of space technologies for, among others, enhancing early warning systems. 5. Strengthening the capacity of the Pan African University Space Science Institute, as well as establishing regional and sub-regional centres of space competencies 6. Building and operating requisite earth observation infrastructure 7. Establishing platforms for joint management of infrastructure and programmes of mutual interest, as well as cooperation on data management, sharing and documentation 8. Leveraging Africa's strategic location to attract mega-science projects in astronomy and space physics studies 9. Develop optical fibre networks across Africa to secure broadband capacity 	<ul style="list-style-type: none"> • African Regional Institute for Geospatial Science and Technology (AFRIGST) • All Nations University Space Systems Technology Laboratory (ANUSSTL) • Africa Regional Centres for Space Science and Technology Education (ARCSSTE) • African Regional Data Cube (ARDC) • Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) • Private Sector • Civil Society • Funding agencies
Technical and Vocational Education and Training (TVET)	<ol style="list-style-type: none"> 1. Tackle youth unemployment and underemployment 2. Improve quality and distribution of the workforce 	<ol style="list-style-type: none"> 1. Meeting demand for water management and services skills; 2. Improving employability and versatility; 3. Improving ability for self-employment; and, 4. Providing opportunities for retraining and continuing apprenticeship 	<ol style="list-style-type: none"> 1. Improving environmental sector skills development, planning and implementation within the national education, training and skills development system 	<ol style="list-style-type: none"> 1. Mainstream indigenous water and pollution management knowledge, learning systems, technological preferences, cultural practices and local values, 2. Specialised technical training in: <ul style="list-style-type: none"> • Water and environmental planning and management (social and strategic impact assessments; problem-based environmental technology development; statistical and modelling tools for water quality monitoring and assessment at watershed level; application of conceptual and computational models for maintaining environmental integrity in relation to human development) • Municipal Water and Infrastructure (operating and maintaining public and private water treatment plants; water distribution systems; wastewater treatment plants and wastewater collection systems; wastewater disposal and the regulated treatment of waste; water quality analysis and wastewater treatment supervision) • Water Management (developing, monitoring and maintaining surface water control structures; river bank and beach management; catchment management; flood control, including operating and maintaining barrages, reservoirs and holding tanks; water resources monitoring and regulation, including ambient water quality) 	<ol style="list-style-type: none"> 1. Raise the level of TVET enrolment as a first step to its elevation as a priority policy area. 2. Develop and institute officially recognised vocations for the water and wastewater sectors. 3. Develop and implement water and sanitation sector pre-employment; retooling/retraining; and upgrading training programmes. 4. Strengthen national regulatory frameworks and strategies; and review of curricula to facilitate: <ul style="list-style-type: none"> • streamlining of TVET management and policy implementation structures for: i) improved system efficiencies; ii) effectiveness of inter-sectoral linkages; and iii) creation of common platforms for joint TVET initiatives for all sectors • raising the level of prestige and attractiveness of TVET in general; and sanitation related occupations in particular (waste disposal, wastewater management) • water sector skills development from the basic level to the higher education level • inter-sectoral linkages and collaboration between training institutions and employers for targeted and demand-driven skills development 	<ul style="list-style-type: none"> • African Union Commission (AUC), the Regional Economic Communities (RECs) and UN Economic Commission for Africa (ECA) • Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) • UNESCO International Institute for Capacity Building in Africa (IICBA) • UNESCO Regional and National Offices and National Commissions for UNESCO in Africa • Association for the Development of Education in Africa (ADEA) • Pan-african Institute of Education for Development (IPED) • Educational Research Network for West and Central Africa (ERNWCA) • Commonwealth of Learning (COL) • Forum for African Women Educationalists (FAWE) • Global e-Schools and Communities Initiatives (GeSCI)

Thematic Goal	Key General Priorities	Water related/impacting objectives	Water sector-specific priorities			Partners/ stakeholders
			Scientific	Technical	Institutional	
				<ul style="list-style-type: none"> • Water Engineering (modelling techniques and information technology for water management; water resources quality and quantity assessment; environmental survey and planning; coastal engineering design techniques; technologies for irrigation, drainage, flood protection, land reclamation and consolidation; hydraulic, hydrological and geotechnical engineering), • Meteorology • Customer care and business orientation • Data management (GIS) 	<ul style="list-style-type: none"> • accreditation and regulation of training structures for all types of training (formal, non-formal, informal) • standardisation and quality assurance of evaluation and certification; and – in turn – portability of qualifications • elimination of gender inequities; • bridging the funding and investment gap for TVET in general 	<ul style="list-style-type: none"> • International Research and Training Centre for Rural Education (INRULED) • Organisation Internationale de la Francophonie (OIF) • Various NGOs working on teacher education and development.
Non-formal and informal education and training (NFET)	Application of the concept of lifelong learning for all	Developing a society with an aptitude for sustainable living, as well as water and environment management			<ol style="list-style-type: none"> 1. Providing community learning centres in both rural and urban areas 2. Establishing a NFET qualifications framework to offer official recognition of the knowledge and skills developed through NFET and thus expand learning opportunities 3. Instituting community-based mechanisms for: <ul style="list-style-type: none"> • providing life skills and other key aptitudes such as sustainable living; • promoting the passing-on of traditional water and environment management knowledge in local languages; • systematising data collection and analysis on NFET; and, • promoting indigenous scientific knowledge and culture 	<ul style="list-style-type: none"> • Africa Network Campaign on Education for All (ANCEFA) • Family Literacy Project (FLP) • Pan African Association for Literacy and Adult Education (PAALAE) • Reading Development Library (BLD) • Literacy and Adult Basic Education (LABE)

Figure 2: Roles of key strategic partners in the pursuit of water sector HCD priorities



UN Agencies with mandates related to realisation of sustainable development goals relating to water, sanitation and education incl. UNESCO International Institute for Capacity Building in Africa (IICBA) UNESCO Regional and National Commissions for UNESCO in Africa; and UNICEF

4 HCD Implementation, Monitoring and Evaluation

AMCOW's Human Capacity Development Programme (HCD Programme) constitutes one of the key actions of Strategic Priority 1 (***ensure water security***) of the AMCOW Strategy 2018 – 2030. As such, the framework and mechanisms for implementing, monitoring, evaluation and reporting approved for the AMCOW Strategy 2018 – 2030 applies to the HCD programme. The principles of accountability, transparency, integrity, horizontal and vertical coherence and efficacy that underlie the implementation arrangements for the AMCOW Strategy 2018 – 2030 shall be upheld and reflected in ongoing regular and annual work plans for the programme.

The AMCOW Secretariat and the regional nodes of the AU-NEPAD African Network of Centres of Excellence in Water Sciences and Technology (CoEs) – SANWATCE, WANWATCE and CEANWATCE – alone, however, cannot impact all the HCD priorities outlined in The demand for human capacity development in the water sector is defined by the role water plays in Africa's ambitions for socio-economic development as elaborated in Agenda 2063. To the extent that every sector of the economy is influenced by water, the realisation of sustained economic growth and social transformation in Africa is dependent on ensuring water security. The observed trends in Africa's population growth; urbanisation and lifestyle changes have implications for water demands. The anticipated impacts of climate variability and climate change will ravel the form, intensity and timing of water demand; affect water availability; and increase the risk of water-related hazards. A high level of technical ingenuity is, therefore, required to develop the requisite water infrastructure base to release Africa's development potential. A similar level of social ingenuity is also required to adjust to water scarcity and prepare for the adverse impacts of climate change.

Ergo, the need for improved water wisdom. First, to cope with and compensate for the consequences of the anticipated changes in water demands in all economic sectors. And, more importantly, to reliably satisfy those demands to deliver robust, competitive and climate resilient economies; and inclusive socio-economic development and livelihoods improvement.

Implementation of the decision of the Executive Committee of AMCOW – EXCO/11/2013/CAIRO/17 – to *"...develop a Human Capacity Development Programme aimed at addressing junior professional and technician level capacity challenges in the water sector"* reflects the broad continental sentiment to underpin aspirations of a prosperous Africa on a skills driven revolution. The African Union Specialised Technical Committee on Education, Science and Technology (STC-EST) is mandated to develop the requisite human capital to sustain the vision of an integrated, prosperous and peaceful Africa. To this end, the STC-EST is spearheading implementation of strategic reforms in the education and training sector as highlighted in the preceding chapter. These are broadly categorised into:

5. science, technology, innovation and skills development;
6. application of space science and technology;
7. technical and vocational education and training (TVET); and,
8. non-formal and informal education and training (NFET).

The HCD programme – and the overall drive to improve water wisdom – represent one of the facets of the STC-EST's mandated revolution to a knowledge-based and productive society. And as such, the water sector HCD priorities presented in Table 4 are identified within the framework of the strategic reforms in the education and training sector.

The table also provides a list of key partners and stakeholders contributing to and or influencing implementation of specific reform themes. The specific roles of key strategic partners in the reform process are summarised in Figure 2 and reiterated in Appendix I.

Table 4. The AMCOW Secretariat is, therefore, committed to leading by example and will continue cultivating partnerships with the European Commission’s Joint Research Centre (EC-JRC), UNESCO-IHP, as well as other organisations and entities interested in supporting implementation of different elements of the HCD priorities.

Furthermore, due cognisance is taken of the need to align pursuit of the identified HCD priorities with ongoing implementation of the strategic and operational plans of the individual centres of excellence within the network. The ACE-WATER II project – and or its successor intervention – will thus aim to build synergies and complementarities, and – above all – strive to avoid duplication of efforts, while making optimal use of available resources to maximise results and impacts.

4.1 Implementation Arrangements

Table 5 presents the hierarchy of roles within the implementation, monitoring and evaluation framework for the AMCOW HCD programme.

Table 5: Implementation structure

Level	Role
AMCOW Secretariat	<ol style="list-style-type: none"> 1. mobilise political leadership for the HCD Programme to address junior professional and technician level capacity challenges in the water sector in Africa 2. provide over-arching programme oversight and institutional coordination 3. provide leadership in formulation, implementation and monitoring of strategic operational plans 4. ensure effective liaison with, and two-way information flow on programme implementation among AU Member States, RECs, RLBOs and implementing and funding partners
AMCOW Governing Council African Union Commission (AUC) European Commission (EC) Relevant organs of RECs and RLBOs	<ol style="list-style-type: none"> 1. Leverage high level political support for the realisation of water sector HCD priorities 2. Leverage financial, technical and material resources from a variety of sources including the private sector
EC Joint Research Centre (EC-JRC), UNESCO-IHP	<ol style="list-style-type: none"> 1. Provide HCD Programme support 2. Provide ACE-Water project management oversight and accountability for resources and results 3. Prepare progress reports for the consideration of the policy organs of AMCOW as well as the relevant organs of the African Union and the European Union 4. Monitoring, evaluation and reporting on the HCD Programme to the AMCOW Secretariat as well as funding partners 5. Provide support to resources mobilisation and technical backstopping to regional networks
Regional Networks – SANWATCE, WANWATCE and CEANWATCE	<ol style="list-style-type: none"> 1. Coordinate the preparation and implementation of complementary work programmes and work plans among constituent centres of excellence 2. Develop an appropriate M&E system and indicator framework for monitoring pursuit of HCD priorities at all levels 3. Coordinate regular reporting to AMCOW, RECs, RLBOs and partners 4. Coordinate resources mobilisation activities
Individual Centres of Excellence	<ol style="list-style-type: none"> 1. Technically facilitate development, coordination and implementation of strategies and action plans to achieve water sector HCD priorities at national level 2. Ensure mainstreaming of water sector HCD priorities into national planning processes 3. Engage national and regional level actors towards implementation of priorities 4. Resources mobilisation

Level	Role
	5. Manage the monitoring and evaluation cycle 6. Provide inputs for periodic reporting, budgeting, and accountability at all levels 7. Provide technical backstopping to national level actors

4.2 Stakeholders Engagement

The AMCOW Secretariat has over the years established and maintained mechanisms for building partnerships with stakeholders and other actors – particularly with the Member States, AUC, AUDA-NEPAD, RECs, R/LBOs and partners – in advancing Africa’s water and sanitation agenda.

The African Union Commission (AUC) and the African Union Development Agency (AUDA, formerly the NEPAD Planning and Coordination Agency – NPCA): mechanisms are in place for regular consultation, joint planning and operationalisation and review on water issues. Similarly, various fora exist for engagement with the Regional Economic Communities (RECs) and River and/or Lake Basin Organisations (R/LBOs) to ensure seamlessness between regional priorities and Africa’s continental agenda. In addition, and as stipulated in the ongoing reforms of the African Union, the RECs and AUDA will play a leading role in efforts to integrate continental and regional strategy, policy and legal frameworks into national development plans and laws; as well as ensuring implementation, monitoring and evaluation at national level.

On relationships with other **AU Organs**, the AMCOW Secretariat – through both the AUC Department for Rural Economy and Agriculture (DREA) and the Specialised Technical Committee on Agriculture, Rural Development, Water and Environment (STC-ARDWE) – has been closely working with the Permanent Representatives Committee (PRC) on various policy matters relating to implementing its mandate. This includes leadership of the sub-committee on Water and Sanitation of the STC on ARDWE to spearhead implementation of related programmes.

Outside the AU, the partnership with EC-JRC and UNESCO-IHP has been instrumental in mobilising technical and financial resources to support implementation of the HCD programme. Continuity of these arrangements is expected in the course of implementing the ACE-Water II project, as well as soliciting new commitments for partners to contribute to efforts pursue the identified water sector HCD priorities. In the same vein, deliberate measures shall be taken to fully implement existing and new engagement plans to realise agreed results to the mutual benefit of all the partnering organisations.

4.3 Monitoring, Evaluation and Reporting

The AMCOW Strategic Operational Plan 2019-2024 (AMCOW SOP) details a monitoring and evaluation framework. The framework is guided by the principles of:

- participation by all to ensure joint ownership of processes and outcomes;
- transparency to ensure openness and support consistent and convergent behaviour by all parties;
- accountability assigned to technical and implementing partners; and,
- SMART indicators and targets.

It specifically intends to:

- i. provide information on an annual basis to the policy organs of AMCOW on progress towards the level of attainment of the anticipated results/milestones;
- ii. serve as the platform for regular review and updates of the inputs, actions, outputs, indicators and the targets;
- iii. enhance evidence-based decision making at operational level; and,

- iv. link results/outputs to resources (human and financial) expended – to ensure operational efficiency.

The ACE-Water project facilitates monitoring of progress towards attainment of the relevant capacity development targets of the AMCOW Strategic Operational Plan 2019-2024, including analytically monitoring:

- i) the inputs from the centres of excellence;
- ii) the breakdown of the outputs/deliverables; and,
- iii) the financial resources associated with each supported activity.

In doing this, emphasis is placed on monitoring and evaluating the project's contribution to the HCD programme in terms of Relevance, Efficiency and Effectiveness.

4.4 Implementation plan

The European Commission Joint Research Centre (EC-JRC), in collaboration with the UNESCO-IHP, were responsible in the framework of the ACEWATER phase II project for:

- i) coordinating elaboration of both a comprehensive strategy, and an action plan to achieve the identified water sector HCD priorities; and,
- ii) operationalising a monitoring and reporting system.

Oversight in this process, as well as facilitation of reporting to the policy organs of AMCOW and the African Union was provided by the AMCOW Secretariat, with support from relevant administrative structures of participating RECs and RLBOs.

4.5 Enabling conditions

Targeted and concerted actions are underway to leverage the political commitment and aspirations of AMCOW, the AU and the EU towards ensuring provision of the enabling conditions that follow:

- i. Buy-in from key stakeholders based on demonstrated value addition of the HCD programme to their interests. In this regard, the need cannot be overemphasised for the formulation and implementation of a sustained advocacy and awareness creation campaign.
- ii. Commitment by Member States to the implementation of the required institutional interventions, reforms, and sector investment.
- iii. Operational efficiency, synergy and effective coordination of implementing arrangements among and within all centres of excellence and implementing partners.
- iv. Adherence to the principles of prioritisation, accountability and transparency, harmonisation, subsidiarity and complementarity within the AU-NEPAD African Network of Centres of Excellence in Water Sciences and Technology (CoEs) and between the AUC, AMCOW-Sec, AUDA-Nepad, RECs and RLBOs.
- v. Aligned, effectively coordinated and harmonised support by partners.
- vi. Existence of a robust Monitoring and Evaluation mechanism
- vii. Enhancement of the HCD programme management staff complement commensurate with the requirements for partners' coordination and technical facilitation.

5 HCD - Conclusion and Recommendations

The summary recommendations that follow derive from the review of the relevant continental and regional policies and strategies highlighted in the Section 2 of this report.

5.1 Skills, technological empowerment, e-education and adaptive learning

These elements should underlie implementation of the Water Sector HCD priorities. The focus should be to build critical skills – particularly as relates to sustainable development, utilisation and management of water and related resources – to enhance economic growth and social transformation.

It is, thus, imperative to grow and strengthen the AU-NEPAD African Network of Centres of Excellence in Water Sciences and Technology (CoEs) into a fully functional, Africa-wide knowledge and excellence network fostering opportunities for development and water knowledge sharing across all AU Member States. The CoEs should, in turn promote innovation to tackle challenges of labour market skills mismatch; and low productivity. They should equip African youth with flexible skills needed for tomorrow's job market through facilitating the development of such new skill profiles as digital water management specialists and green/smart water use technologists.

5.2 Foster transformation in Technical and Vocational Education and Training (TVET)

Invariably, all continental and regional policy and strategy documents reviewed for this study emphasise the need to integrate flexibility, adaptability and continuous learning in education and training supply. As such, transformation of the TVET sector is necessary to make it suited to impart skills in all areas of training and learning, be they formal, informal or non-formal. This is vital to improve employability, relevance and distribution of the workforce.

Key first steps for the water and sanitation sector include:

1. Developing and instituting officially recognised vocations for the water and wastewater sectors.
2. Raising the level of prestige and attractiveness of sanitation related occupations in particular (waste disposal, wastewater management), as well as eliminating gender inequities.
3. Review of curricula to facilitate water sector skills development from the basic level to the higher education level.

5.3 Support space science and astronomy research, teaching and outreach

Potential abounds for the application of space science and technology to improve the quality of life and the create wealth for all in Africa. This includes:

- i) monitoring and conducting assessments of the environment;
- ii) managing the use of natural resources;
- iii) providing early warnings of and managing natural disasters; and,
- iv) providing education and health services in rural and remote areas.

In essence, space-based solutions are necessary for the effective management of resources such as water, land, forests, marine ecosystems and their productive utilisation. Indeed, many of the space-derived services and products currently used in Africa are imported.

To actualise the vision of "*an integrated, prosperous and peaceful Africa, driven by its own citizens and representing a dynamic force in the global arena*", the development of indigenous capacity to operate and maintain core space capabilities cannot be overemphasised. For the water sector, the implications are clear and germane. Developing remote sensing and earth observation capabilities will enhance the effectiveness of early warning systems. In turn, this will

- i) improve related disaster risk preparedness;

- ii) assure water, energy, food and ecosystems security; and, therefore,
- iii) ensure climate resilient development.

Against the background of the foregoing, the NEPAD-CoEs should – through the HCD Programme – champion:

- i. the development of skills and expertise in earth observation and remote sensing applications and their use;
- ii. the development of earth observation services and products;
- iii. development of specialised curricula, materials and teaching aids to introduce:
 - space science teaching and research at universities; and,
 - space science and astronomy teaching and outreach at primary and secondary education level
- iv. awareness raising among the public, users, and policy and decision makers; and,
- v. knowledge sharing among African experts, users and stakeholders

5.4 Recognition of competences from non-formal and informal education and training (NFET)

There is an urgent need to mainstream indigenous water and pollution management knowledge into lifelong learning systems through:

- i. adopting a competence-based approach to curriculum reform within a lifelong learning framework;
- ii. improving understanding of, and responding to the demands for individual, community and societal core skills and competences;
- iii. creating more opportunities for adult education and community learning opportunities (including NFET schools); and,
- iv. tapping into existing technological preferences, cultural practices, local values and traditions of community learning and imparting of life skills.

6 Relevance of Water, Food and Energy Nexus perspectives to EU-AU Cooperation Priorities

The Water, Energy, Food and Ecosystems for Development (WEFE4Dev) work programme of the Water and Marine Resources Unit implements initiatives in collaboration with the directorates of International Cooperation and Development (DG DEVCO) and Environment (DG ENV) on WEFE Nexus assessment in relevant river basins in Africa. The integrated multi-sectoral approach to water management at river basin level is combined with proactive and all-inclusive cooperative dialogues. The dialogues draw participation from the policy organs and decision makers of such African institutional partners as River Basin Organisations (RBOs); Regional Economic Communities (RECs); and research and academic institutions – including the AU-NEPAD Water Centres of Excellence.

Ongoing areas of cooperation include:

- i) developing regional knowledge management systems and decision support tools to support institutions and policy-makers in Africa;
- ii) encouraging collaborative research to understand and quantify the inter-linkages between WEFE resources; and,
- iii) building the capacity of existing institutions and decision-makers to implement such an integrated approach.

7 Water for Africa's economic growth and transformation: a situation analysis

The political agenda of the Member States of the African Union is currently dominated by the urgent need to industrialise as a first step to alleviating persistent poverty⁹. The ambition is to build robust, competitive and climate resilient economies; accelerate employment and labour productivity growth; and, as a result, deliver inclusive socio-economic development and livelihoods improvement. It is also to ameliorate the current situation that is summed up by the facts and figures in Text Box 1 below.

Text Box 1: Situation Analysis

- a) Floods, droughts, and water pollution are the greatest threats to water resources in Africa. In only the 8 most prone countries in Africa (Algeria, Egypt, Ethiopia, Gabon, Madagascar, Morocco, Nigeria and Tunisia), flooding is projected to cause direct losses of an estimated US \$1.4 billion per annum (UN, 2015)*.
- b) Information available from the African Water and Sanitation Sector Monitoring and Reporting (WASSMO) System indicates Africa's installed hydropower capacity as ranging between 45,936 and 90,696MW out of a reported economically and technically feasible hydropower potential of 304,350 MW (AMCOW, 2016).
- c) Water use in the agricultural sector was reported as 275 km³, in 2016, accounting for about 73.4% of the total water withdrawals in Africa (AMCOW, 2016). Coupled with a generally continuing trend of a diminishing contribution of the sector to GDP in Africa, significant challenges and limitations are noted in efforts to achieve the targets of the Africa Water Vision 2025 relating to increasing agricultural water productivity; and increasing the size of the area under irrigation in Africa.
- d) Member States that provided data to the 2014 Africa Water and Sanitation Sector Report indicated having satisfied, in 2013, just 26.05% of the minimum economic, social and environmental water demands, which in turn gives an indication of the extent to which Africa's water infrastructure is underdeveloped. Similarly, as an indicator of the long-term sustainability of Africa's socio-economic growth and transformation, the figure raises major concerns for Africa's development aspirations especially when it is considered that the underdevelopment of water infrastructure accounts for up to 2% of Africa's lost annual GDP growth (AUC - AMCOW, 2016)!
- e) Rainwater harvesting to, on the one hand, augment supply for domestic and agricultural uses, and, on the other hand, manage storm water, is yet to be fully capitalised on by Member States. The continent reported that the contribution of rainwater to the total municipal water consumption accounted for only 1.49% in 2013, compared to the set target of 10% by the year 2015 (AUC - AMCOW, 2014).
- f) More than 340 million Africans are still lacking potable water – let alone access to sufficient water to satisfy their basic daily needs – while more than 547 million Africans lack access to basic sanitation (AMCOW, 2016)! The failings in this respect are shown to contribute significantly to: (i) a significant number of the 5,000 people that die each day due to water and sanitation diseases that are easily preventable being from Africa; (ii) estimates of annual losses of 5% of the continent's GDP being due to inadequate provision of basic sanitation services, and, (iii) reductions in household incomes and savings, as well as school attendance – due to the impacts of ailments related to poor sanitation on the labour force – which, in turn, adversely affect economic productivity and the pursuit of poverty eradication goals (AUC - AMCOW, 2014).
- g) These challenges have been further exacerbated by the COVID-19 crisis. Frequent washing of hands with soap is a key protective measure against the virus. By contrast though, World Bank figures show that 63% of the urban population in sub-Saharan Africa cannot wash their

⁹ Whereas most recent estimates show that the share of the African population living on \$1.90 a day or less did decline from 56% in 1990, it was still at 43% in 2012 (Beegle, Christiaensen, Dabalen, & Gaddis, 2016).

hands due to constraints in accessing basic water services (Ndaw, 2020). It is noteworthy that urban centres are the main clusters of the virus. It, therefore, goes without saying that ensuring the availability of safe water for all is vital to keep up the fight against the spread of COVID-19 and future pandemics. Improving access to water, sanitation, and hygiene systems holds promise for bringing down the overall disease burden; and reducing the number of deaths to disease.

- h) In Eastern Africa, the COVID-19 pandemic is one aspect of a triple crisis that includes the worst locust outbreak in 70 years; and disease outbreaks associated with flooding due to exceptionally high rainfall in 2019 and 2020 (Marsham, et al., 2020). In 2018/19, the impacts of climate variability over the Indian Ocean; the Arabian Peninsula; and Eastern Africa contributed to a locust outbreak (Gilliland, 2020). Combined, the two factors – climate variability and a locust outbreak – underlie the growing hazard of acute food insecurity in the Eastern Africa region. The result is increased COVID-19 vulnerability given the reduced capability of the population to engage in social distancing and to practice basic hygiene!
- i) 153 million individuals, about 26% of the population above 15 years of age in sub-Saharan Africa, suffered from severe food insecurity in 2014/15 (FAO, 2017)**
- j) Moreover, Africa’s water and environmental resources, which are critical to the release of Africa’s development potential as well as sustaining growth and development, are faced with severe degradation in part due to inadequate sanitation. Whereas it is yet to be covered within the scope of data collection of the Africa Water and Sanitation Sector Report, information from the Member States indicates that about 90% of wastewater is discharged directly into rivers and lakes without any treatment!
- k) The total domestic expenditure in the water and sanitation sector in Africa for 2013 was reported as US \$18.48 billion, falling way short of the annual requirement of US \$50 billion determined by the AfDB and AMCOW as the minimum required to assure the actualisation of the Africa Water Vision 2025 (AUC, AMCOW, AfDB, GWP, 2019). That, in turn, threatens Africa’s aspirations for social progress and productivity of its population.

Sources: The African Water and Sanitation Sector Monitoring and Reporting (WASSMO) System, <http://www.africawat-sanreports.org/IndicatorReporting/report?view=overview&category=fact&level=region>
AUC-AMCOW (2016), African Water Resources Management Priority Action Programme 2016 – 2025 (WRM – PAP).

* UN (2015). The 2015 Global Assessment Report on Disaster Risk Reduction. New York: United Nations Office for Disaster Risk Reduction.** FAO (2017). Regional Overview of Food Security and Nutrition in Africa 2016. The challenges of building resilience to shocks and stresses. Accra: United Nations Food and Agriculture Organisation

8 Underlying policy environment for Africa's water development in a WEF nexus context

As highlighted in the Africa Water Investment Programme (AIP) (AUC, AMCOW, AfDB, GWP, 2019, pp. 6 - 7), a number of continental policy decisions and declarations have been taken by the African Union (AU) and AMCOW to foster the implementation of the African water agenda in pursuit of the Africa Water Vision 2025 (AWV2025). These include:

1. Ex/Assembly/AU/Decl. 1(II): Sirte Declaration on the Challenges of implementing integrated and sustainable development of agriculture and water in Africa. Second Extraordinary Session, 27 February 2004. Sirte, Libya;
2. the 2008 Tunis Ministerial Declaration on Accelerating water security for Africa's socio-economic development;
3. Assembly/AU/Decl.1(XI): Declaration: Sharm El-Sheikh Commitments for Accelerating the achievement of Water and Sanitation Goals in Africa, Eleventh Ordinary Session, 30 June – 1 July 2008, Sharm El-Sheikh, Egypt;
4. the 2008 Sirte Declaration on Water for Agriculture and Energy in Africa: the Challenges of Climate Change; and,
5. the 2010 Maputo Declaration (AU/MIN/Energy/Decl.) that not only adopted the AU Conference of Ministers in Charge of Energy (CEMA) but also resolved to cooperate with AMCOW and AMCEN "to promot[e] cross-border river basins development and regional electric energy production and exchange networks" and to request AUC to "mobilise the Regional Economic Communities (RECs) and Member States to participate actively in the conduct of the study on the Programme for Infrastructure Development in Africa (PIDA) and to spare no effort to ensure implementation of the policies and programmes deriving therefrom".

Deriving their mandate from the policy framework in the foregoing, the mandated institutions – in collaboration with partners and stakeholders – have conducted various studies; and prepared plans and programmes to mobilise action and funding towards in-country implementation of the declarations. Key among these initiatives have been:

1. the **Africa Food Crisis Response** and the **Comprehensive Africa Agriculture Development Programme (CAADP)** to enhance access to agricultural water and irrigation, as well as improving rural infrastructure as part of activities to intensify agricultural production and productivity;
2. the **20-point Action Plan on Economic Growth** through water and energy of the African Ministerial Conference on Hydropower and Sustainable development that focussed on planning and construction of water infrastructure, including 130 dams, to support Africa's growth aspirations. In collaboration with the AfDB, a target was set to increase Africa's water storage capacity by at least 8.5km³ in the period 2008 - 2013;
3. **Regional Strategic Action Plans** for integrated water resources development and management in the SADC and ECOWAS regions; the **Nile Basin Initiative (NBI)**; the **World Hydrological Cycle Observing System (WHYCOS)** project; the **TIGER (Technology Informatics Guiding Education Reform) Initiative**; the **Water, Climate and Development Programme (WACDEP)**; and the **Climate for Development Initiative for Africa (ClimDev-Africa)**, all developed with the overarching goal of improving day-to-day water management and, in turn, contributing to the delivery agenda of economic, social and environmental change;
4. the **Programme for Infrastructure Development in Africa (PIDA)**, the Priority Action Plan of which includes nine transboundary water infrastructure project; and,
5. the **African Water Resources Management Priority Action Programme 2016 - 2025 (WRM-PAP)** of targeted interventions to achieve four broad goals, namely: i) ensuring water security in Africa; ii) enhancing resilience to climate change and water related disaster risks; iii) strengthening information systems for water resources monitoring and

assessment; and iv) improving environmental integrity through wastewater and water quality management.

Additional relevant EU-AU policy initiatives framing the demand for the WEFE nexus approach to water development in Africa are summarised in Text Box 2 below.

Text Box 2: Summary of the AU-EU policy basis framing the demand for the WEFE Nexus

1. Sustainable Development Goals:

- a. SDG 2: *End hunger; achieve food security and improved nutrition; and promote sustainable agriculture*
- b. SDG 6: *Ensure availability and sustainable management of water and sanitation for all*
- c. SDG 7: *Ensure access to affordable, reliable, sustainable and modern energy for all*
- d. SDG 9: *Build resilient infrastructure; promote inclusive and sustainable industrialisation; and foster innovation;*
- e. SDG 13: *Take urgent action to combat climate change and its impacts*
- f. SDG 15: *Protect, restore and promote sustainable use of terrestrial ecosystems; sustainably manage forests; combat desertification; and halt and reverse land degradation; and halt biodiversity loss*

2. **The Joint Africa-EU Strategy (JAES) Roadmap for 2014-2017** which provides for: "... *ensur[ing] better management of water resources for greater access to drinking water and sanitation and strengthen the water-energy-food nexus ...*";

3. **The Final Declaration of the 5th AU-EU Summit 2017** on *Investing in Youth for Accelerated Inclusive Growth and Sustainable Development* in which the political leadership of the AU and EU commit to, among others, "*increase efforts in research and innovation for sustainable development, including through the launch of a partnership on climate change and sustainable energy, and to deepen collaboration between researchers and innovators*".

4. **The Joint Consultation Paper (2015)** "Towards a new European Neighbourhood Policy", and **MEMO_15_4143** "A global partnership for poverty eradication and sustainable development" identify the need for "... *fostering synergies across economic, social and environmental policy areas*" to address "*health security, threats to the environment and climate change as common challenges with impacts across borders*", while addressing cross-sectoral issues in Africa and neighbouring countries in the Mediterranean region.

5. **The Joint Declaration of the 7th AUC-EC College-to-College meeting** (Brussels, 2015) in which the leadership of both institutions undertake to "... *continue ... in-depth cooperation on infrastructure and jointly ensure cross sectoral coordination in relation to transport, energy, water and... access to drinking water and sanitation (item #27)*".

6. **The New European Consensus on Development**, which integrates the social, economic and environmental dimensions of sustainable development around People, the Planet, Prosperity, Peace and Partnership. It includes the following commitments, among others:

- a. "*The EU and its Member States will support the poorest communities in improving access for all to land, food, water, and clean, affordable and sustainable energy avoiding any damaging effects on the environment, the sustainable and integrated water management as well as more efficient use of water and water recycling including through a more strategic approach to regional development and integration*".
- b. "*The EU will support the conservation and sustainable management and use of natural resources, and the conservation and sustainable use of biodiversity and ecosystems, including forests, oceans, coastal areas, rivers basins and other ecosystems, for the provision of ecosystem services*".

7. **The Framework for Action to actualise the Africa Water Vision 2025**, of '*an Africa where there is an equitable and sustainable use and management of water resources for poverty*

alleviation, socio-economic development, regional cooperation and the environment sets clear targets for all elements of the WEF nexus as follows:

Actions	Targets for 2025
<p>1. <i>Proportion of people without access</i></p> <ul style="list-style-type: none"> • to safe and adequate water supply • to safe and adequate sanitation 	<p>Reduce by 95%</p> <p>Reduce by 95%</p>
<p>2. <i>Water for achieving food security</i></p> <ul style="list-style-type: none"> • Water productivity of rain-fed agri. and irrigation • Size of irrigated area 	<p>Increase by 60%</p> <p>Increase by 100%</p>
<p>3. <i>Development of water for agriculture, hydropower, industry, tourism & transportation at national level</i></p>	<p>Increase by 25%</p>
<p>4. <i>Conservation and restoration of environment, in biodiversity, and life-supporting ecosystems</i></p> <ul style="list-style-type: none"> • Allocation of sufficient water for environmental sustainability. • Conserving and restoring watershed ecosystem 	<p>Implemented in 100% of river basins</p>

Adapted from: the WEF African Flagship Report

9 Emerging water development priorities vis-à-vis the energy and agriculture sectors

Projections of an African population of 1.6 billion by 2030 translate into a need to produce at least 50% more food, and, at least, a tenfold increase in water needs for energy production to support modernisation of economies and social progress. Rapid urbanisation and industrialisation will both increase the water demand and, on the basis of current trends in sanitation services provision, increase environmental degradation and the pollution of water bodies. Coupled with the anticipated impacts of climate change on water availability, the need to protect and better manage Africa's freshwater resources – to avert the growing risks and uncertainties to economic productivity and political stability – cannot be overemphasised.

Source: 2014 Africa Water and Sanitation Report

Collectively, the above-mentioned initiatives are comprehensive and hold promise for achieving the goals of Agenda 2063. Focus is, therefore, on developing and operationalising delivery mechanisms at a scale required to assure water, food and energy security for the people of Africa. Necessary first steps include, first, addressing challenges of weak institutional capacities. And, secondly addressing the absence of a compelling business case for investments in water that can catalyse sustained financing commensurate with Africa's development ambitions. In this respect, ongoing and planned interventions have strategically been prioritised as highlighted in the sections that follow.

9.1 A new narrative: "Investing in Water is investing in Jobs"

Africa's economic growth is challenged and highly vulnerable to water availability, commodity prices and weather patterns (AUC, AMCOW, AfDB, GWP, 2019). The two examples on Zambia and Ghana in the text boxes that follow illustrate this.

In 2016, Zambia made international headlines as droughts devastated the economy on account of low water levels in the country's Kariba Dam on the Zambezi River. According to reports by Bloomberg and the New York Times, Kariba Dam reached dangerous water levels with only 14% in 2016 compared to 51% in 2015. With 95% of Zambia's electricity generation from hydropower, low dam water levels resulted in unprecedented energy deficits forcing the mining sector to shut down some operations. Over 10,000 jobs were lost while several households and small scale businesses endured power rationing for as long as 14 hours a day.

To avert an impending economic and political crisis, the Zambian government spent \$480 million on emergency power imports in 2016 alone. Of great concern is that despite the evidence of low water levels precipitating energy deficits, the crisis was widely reported by senior government officials and media as an energy crisis rather than a water crisis.

Source: Africa Water Investment Programme, 2019

In 2011, Ghana's economy grew at 14% with the onset of its first production of oil (GSS, 2012). However, in 2015 the growth rate was expected to be only 3.9% (Okudzeto, Mariki, Senu, & Lal, 2015). This can be attributed to a great extent to the failure to provide the basic water and energy infrastructure to meet the needs of a rapidly growing economy. Ghana is mainly dependent on the Akosombo hydroelectric dam on the Volta River for electricity. Due to reduced inflows from low rainfall, the hydroelectric dam was operating merely at half of its capacity in 2015 (The Africa Report, 2015). This was exacerbated by disruptions mainly in geothermal plants. In June 2015, all electricity was being rationed at 12 hours on, and 24 hours off. Though this is extreme, it reinforces the need for water infrastructure to sustain production and jobs in the nascent African economies. Anecdotal evidence from Trade Unions and Employers in Ghana indicate that tens of thousands of stable jobs were lost in 2015, the investment climate turned sour, forcing Ghana to seek IMF macro-economic bailout.

Source: The United Nations World Water Development Report 2016

A new narrative on water that recognises the full potential of water in the economy is thus urgently required to further Africa's future development needs. This is especially given, and as posited by the AIP (AUC, AMCOW, AfDB, GWP, 2019) that:

1. three out of four jobs are water-dependent;
2. up to 80% of ailments impacting on the productivity of the labour force in Africa can be attributed to poor hygiene and sanitation;
3. water scarcity and supply disruptions limit economic growth and, in turn, jobs;
4. water scarcity (exacerbated by climate change) is a contributing factor to migration; and,
5. the transition to a greener economy enhances opportunities for decent jobs.

The new narrative on water should foster an appreciation of the vitality of water in economic growth; job creation; and industrialisation. It should also raise the business case and profile of water in national and regional development. Indeed, aggressive efforts are required to:

- i) position water better in the economy;
- ii) accelerate the pace of water infrastructure investments;
- iii) increase awareness of water's critical role in enhancing job creation; and,
- iv) build on the foundations of integrated water resources management to advocate for approaches such as the water-energy-food-ecosystem nexus.

9.2 Strengthening the business case for water investments in Africa

Africa's sustainable development largely depends on goods and services derived from its environment and natural resources. As Africa pursues rapid and sustainable growth pathways via structural transformation, the management of natural capital, especially water resources, is critical. Water is at the core of Sustainable Development Goals given its vitality to nearly every aspect of sustainable generation of social, economic, financial and other wellbeing related benefits.

There are challenges, though, facing AU Member States. With a rapidly growing population, by 2050 more than 60% of Africa's population will reside in urban areas. The population is young, with more than 40% below 15 years old in most countries: a large proportion of which is unemployed (AUC, 2014a). Migration within Africa and across the Mediterranean to southern Europe has reached crisis levels, in part, due to political instability in some parts of Africa, but also due to a general lack of economic opportunities (AUC, AMCOW, AfDB, GWP, 2019).

Over the last decade, Africa has recorded sustained and impressive economic growth on the back of rising commodity prices. A dip in commodity prices during 2015 combined with droughts in the Horn of Africa and part of southern Africa, revealed structural challenges in African economies with most economies not diversified and heavily dependent on mineral resources. Most countries now face fiscal challenges with mounting debts and low absorption capacity. Although one quarter of the countries grew an average of about 7% or more, and some were among the fastest-growing countries in the world, future sustained growth will need to be diversified and inclusive, building on Africa's natural capital endowments especially agriculture – the largest employer on the continent (AfDB, 2018). The limiting factor is undeniably water insecurity, exacerbated by complex hydrology and climate change.

The economies of many countries in Africa are extremely vulnerable to climate variability and climate change as they are largely based on natural resources (water, land, energy, forests/ecosystems). Lack of investments to enhance human and institutional capacities, build infrastructure and improve information systems to support water management exacerbate the difficulties. As highlighted in Section 2 of this report, only 15 – 30% of Africa's hydropower potential is tapped (AMCOW, 2016). Neither is the huge irrigation potential in its 64 shared river basins being harnessed to assure food and nutritional security.

- a. Many SIDS are faced with rising sea levels and coastal erosion, which threatens their territorial integrity and – in some cases – their very existence.
- b. A single natural disaster could, due to its disproportionate impact relative to SIDS' national capacities, destroy vital infrastructure, displace a significant number of the national population or impact on a nation's sustainable economic growth trajectory.
- c. Climate change [is] a risk multiplier: exacerbating existing security and development challenges. Rising sea levels, dying coral reefs and the increasing frequency and severity of natural disasters exacerbate the conditions leading to community displacement and migration. They also threaten to increase tensions over resources and affect domestic and regional stability.
- d. SIDS are faced with the challenge of energy insecurity caused by dependence on expensive fossil fuels. Up to a third of the total import bill of SIDS is the cost of oil for electricity: on average 10% per cent of their GDPs!
- e. The size of the SIDS also contributes to their vulnerabilities. Often with Exclusive Economic Zones larger than their land areas, SIDS face the challenge of managing fisheries and preventing illegal, unreported and unregulated fishing, which undermines economies and contribute to insecurity. Indeed, their size and capacity limitations make them a target for transnational criminal networks, including those involved in piracy or the smuggling of people, among others.

Source: Excerpts adapted from the United Nations Security Council Open Debate 30 July 2015: Peace and Security Challenges Facing Small Island Developing States

Also deserving of specific mention are the challenges to the attainment of sustainable development by Africa's Small Island Developing States (SIDS), which are particularly exacerbated by exposure to global environmental issues. Concerted efforts are required for African SIDS to combat climate change; promote sustainable development; and address their environmental and natural resources related vulnerabilities.

In order to achieve rapid, sustained growth in a climate change context, strategic partnerships for water infrastructure development; institutional strengthening; and political leadership are urgently required. Coupled with measures to assure inclusivity of the vulnerable, especially women and youth, resilience to the shocks caused by climate risks will be enhanced. And nowhere more so than in Africa's SIDS where building resilience is integral to deriving full benefit from their often limited resource base. In turn, climate resilient development will lead to sustainable growth and improved livelihoods.

To achieve the SDGs, it is imperative for African Union and AMCOW to champion a paradigm shift in the approach to developing, utilising and managing Africa's water and related resources. The urgency and need for governments, societies and the private sector to fully embrace the concept of environmental security cannot be overemphasised.

9.3 Re-examining water, development, the economy and society: the development of water as a means-to-an-end

Recent advances in the appreciation of the principles of Integrated Water Resources Management (IWRM) have necessitated broadening the perspective to an outcome-oriented notion of:

- i) harnessing water's productive potential;
- ii) mitigating its destructive risks;
- iii) improving the sustainability of the natural resources base; and, thus,
- iv) spurring national and regional development as a whole.

This is confirmed by the findings of the *Africa Water and Sanitation Sector Reports*; and the 2012 and 2018 editions of the *AU/AMCOW Status Report on the Application of Integrated Approaches to Water Resources Management in Africa*. They indicate significant improvements in – on the one hand – the Member States' internalisation and involvement in the implementation of international

and regional policies and strategies; and – on the other hand – the application at a national level of generally accepted principles of effective water resources development, management and utilisation. An urgent need, though, is highlighted for targeted interventions to overcome particular challenges in mobilising the investment required to meet the targets of the Africa Water Vision 2025 for:

- i) water productivity in industry, irrigated agriculture, energy, tourism and transport;
- ii) conservation and restoration of environments; and
- iii) developing appropriate tools and indicators for measuring the contribution of water to development, and thus provide a basis for highlighting the pivotal role of water resources as an essential ingredient in the advent of a green economy and sustainable development in Africa.

In this respect, water infrastructure development should be advocated for and promoted as a means to provide a service – which is water – to the economy in order to enable growth and development to happen. Water sector interventions, especially for such resource management functions as water storage and flood control, should not be designed and marketed from the perspective of ‘water sector development’. Rather, the approach to packaging them for investment should be centred on their eventual utility – from an economic perspective – in terms of providing water for food and energy production. This is to make use of the synergies between these three sectors optimising efforts towards water, food and energy security. This should be extended to the opportunities for employment and wealth creation: not to mention peace, social security and political stability.

9.4 Promoting the application of the UN High Level Panel on Water Principles on Valuing Water

Strategies to improve the investment outlook for water and related resources development will also benefit from the application of the High Level Panel on Water (HLPW) principles for valuing water. The principles provide a guideline for determining the real value of proposed investments; the associated costs; and the benefits that can be expected. In essence, they serve the purpose of improving the appreciation of the economics of water in a country, river basin or region.

The High Level Panel on Water (HLPW)¹⁰ was co-convened in 2016 by the UN Secretary General and the World Bank President to provide the leadership required to tackle one of the world's most pressing challenges – an ever growing water crisis. It identified ways in which the world could accelerate progress towards ensuring availability and sustainable management of water and sanitation for all (SDG 6). A summary of the Panel's headline recommendations is provided in table below.

¹⁰ The HLPW membership comprised of 11 sitting Heads of State and Government from Australia, Bangladesh, Hungary, Jordan, South Africa, Mauritius (co-chair), Mexico (co-chair), Netherlands, Peru, Senegal and Tajikistan; and a Special Advisor.

Table 6: HLPW headline recommendations

FOUNDATIONS FOR A WATER SAFE, SECURE, RESILIENT, SUSTAINABLE AND INCLUSIVE ACCESS WORLD	
Understand Water	Commit to making evidence-based decisions about water, and cooperate to strengthen water data, such as through the HLPW World Water Data Initiative
Value Water	Use the <i>HLPW Principles on Valuing Water</i> to recognize the values that societies accord to water and its uses, to shape how water is allocated, how water and sanitation services are priced, and how water resources are managed and sustained.
Manage Water	Implement integrated approaches to water management at local, national and transboundary levels, strengthen water governance, and ensure social inclusion.
LEADING AN INTEGRATED AGENDA AT THE LOCAL, COUNTRY AND REGIONAL LEVELS.	
Ensure Universal Access to Safe Water & Sanitation	Address gaps in service delivery models, technology and behavior change which limit access to sustainable drinking water and sanitation for all – including the needs of women, girls, people with disabilities and communities in vulnerable situations.
Build Resilient Societies and Economies, Reducing Disaster Risk	Shift focus of disaster management from response to preparedness and resilience.
	Take action where water-related risks may exacerbate fragility, conflict, or migration.
	Create incentives for water users, including irrigators, to not waste or pollute water, and promote its reuse.
Increase Water Infrastructure Investment	Improve the enabling environment for investment in sustainable water-related infrastructure and services to attract the greatly increased levels of investment required.
Nurture Environmental Water	Value environmental contributions to water management, prevent degradation and pollution of watersheds, rivers, lakes and aquifers, and where necessary, restore and maintain acceptable environmental conditions and water quality.
Develop Sustainable Cities	Implement an integrated approach to urban water management in line with the Habitat III New Urban Agenda.
CATALYSING CHANGE, BUILDING PARTNERSHIPS AND INTERNATIONAL COOPERATION	
Promote Innovation	Support programs, such as the HLPW Water Innovation Engine, which foster the uptake of new water-related business models and technologies.
Strengthen Partnerships	Motivate all water use sectors to embrace water stewardship, strengthen their collaboration, and participate in integrated water resource management.
Increase Global Water Cooperation	Strengthen the UN-System’s support to member states and its coordination of water matters, and use the UNGA <i>Water Action Decade</i> as a platform for exchanges of best practices and building partnerships, dedicating each year of the Water Action Decade to one of the above ten HLPW Action Areas.

Source: HLPW Outcome Document, March 2018

The HPLW Principles on valuing water are summarised in the table below:

Table 7: HLPW Principles on valuing water

Headline Recommendation	Use the <i>HLPW Principles on Valuing Water</i> to sustainably, efficiently and inclusively allocate and manage water resources, and to deliver and price water services accordingly.
Detailed Recommendations	Apply the “HLPW Principles on Valuing Water” in order to recognise the various values that societies accord to water and its uses, take these into account in political and business decisions, and in decisions to price water and sanitation services appropriately.
	Conduct all processes to reconcile values in ways that are equitable, transparent, and inclusive, and value, manage, and protect all sources of water, including watersheds, rivers, aquifers, associated ecosystems, and used water flows for current and future generations. Promote education and public awareness about the intrinsic value of water and its essential role in all aspects of life and ensure adequate investment in institutions, infrastructure, information, and innovation to realize the many different benefits derived from water and reduce risks.
Principles for valuing water	
Recognise and Embrace Water’s Multiple Values	Identify and take into account the multiple and diverse values of water to different groups and interests in all decisions affecting water.
Reconcile Values and Build Trust	Conduct all processes to reconcile values in ways that are equitable, transparent, and inclusive.
Protect Sources	<i>the</i> Value, manage, and protect all sources of water, including watersheds, rivers, aquifers, associated ecosystems, and used water flows for current and future generations.
Educate and Empower	<i>to</i> Promote education and public awareness about the intrinsic value of water and its essential role in all aspects of life.
Invest and Innovate	<i>and</i> Ensure adequate investment in institutions, infrastructure, information, and innovation to realise the many different benefits derived from water and reduce risks.

The application of the above listed principles, together with targeted interventions to catalyse change, holds promise for responding to the three generally accepted bottlenecks in the delivery of sustainable solutions for assuring water for energy, food and environmental security in Africa, namely:

- i) the need for investment guarantees for water management, the fundamental aspects of which are not only a public responsibility, but also require 15 – 25 years for the tangible benefits to be realised;
- ii) the need for effective transaction management to enable development planning to be effectively translated into both tangible infrastructure assets and related solutions, which will contribute to sustainable growth and prosperity for all; and,
- iii) the need for Member-States-led, integrated economic analyses to:
 - a. highlight the pivotal role of effective water management and adequate sanitation and related services provision in the economy; and,
 - b. where development is most urgently required to facilitate growth.

9.5 Investment led transboundary management and governance of water and environmental resources

The focus of transboundary water management in Africa has so far been on the application of the principles of Integrated Water Resources Management (IWRM) planning at basin level to facilitate regional dialogues promoting transboundary and regional cooperation. Prominent examples of such interventions include:

- i) the 2011 – 2013 and 2014 – 2016 AMCOW Work Programmes, as well as the AMCOW Strategy 2018 – 2030;
- ii) the ANBO project on “Strengthening of Institutions for Transboundary Waters in Africa (SITWA)”;
- iii) the work of Regional Economic Communities (RECs) and River and Lake Basin Organisations (R/LBOs) to strengthen institutional capacities for IWRM planning.

The cooperation and governance arrangements that have been born of these initiatives form a firm foundation for the application of WEFE nexus perspectives to determine intersectoral trade-offs and implement solutions that optimise overall benefit. To consolidate the achievements to date of those interventions, focus must now shift to facilitating investment in strategic water management solutions with transboundary, if not regional, benefits. To this end, the African Water Resources Management Priority Action Programme 2016 – 2025 (WRM-PAP); the AMCOW Strategy 2018 – 2030; and the Africa Water Investment Programme (AIP) promote the following strategic initiatives:

9.5.1 Establishing economic accounting for water as a discipline to, among others, improve the financing and investment outlook for water resources management in Africa

The strategy was adopted by AU Member States as part of ongoing efforts to revitalise and inject new approaches into delivering on the commitments of the Sharm el-Sheikh declaration relating to financing transboundary cooperation. The aim is to make an economic case for:

- i) better prioritisation of water resources management in domestic economic planning and financial allocation; and,
- ii) cross-sector financing/investment to assure viability of investments in water dependent productive sectors (municipal water supply, energy, agriculture, agri-processing, mining, tourism).

The concept and framework of economic accounting for water, once institutionalised in Africa – and direct linkages made with the African Water and Sanitation Sector Monitoring and Reporting (WASSMO) System – has potential for a paradigm shift in the water sector financing policies through:

- i) reforming regulations to promote efficiencies in current reporting arrangements;
- ii) identifying and quantifying water flows and their relationship with both climatic variables and economically valued inputs – if not limiting factors – to domestic supply, agriculture, industry, mining, energy production and various service industries;
- iii) supporting strategic planning processes for use of land and related resources so that water resource utilisation and environmental conservation are optimised; and
- iv) providing instruments to support public and investor confidence in the amount of water being traded, extracted for consumptive use, recovered and managed for environmental and other public benefit outcomes.

9.5.2 Improving national-level capacities for collecting complete and reliable hydro-meteorological and piezometrical data in all of Africa’s 64 shared river basins

The success of plans to establish economic accounting for water as a framework for identifying, measuring, recording and reporting information about water in Africa depends to a large extent on the availability of reliable, complete and legitimised primary source data. Similarly, the African

Water and Sanitation Sector Monitoring and Reporting System is designed to extract information from data in the custody of the Member States. Therefore, its functionality – as well as the utility and completeness of the information generated – depends on the availability at a national level of reliable hydrological, meteorological, piezometrical (groundwater), water quality and other resource monitoring data.

Information from the majority of Member States' departments and agencies responsible for the function of water resources monitoring and assessment points to inadequate gauging of both surface water basins and groundwater aquifers. This has highlighted a pressing and urgent need for support towards the efforts of Member States to establish and operate representative and reliable networks of hydro-meteorological, river gauging and water quality stations to monitor the state of the quantity and quality of the water resources in their territory.

The goal is to rehabilitate and expand national monitoring systems for water resources to meet the internationally accepted minimum, if not optimum, standards for collecting complete and reliable data and information. Also related to this, and taking into consideration the impacts – both ongoing and projected – of climate variability and climate change on the hydrological cycle, plans are underway to update and recalibrate the rating curves of many surface water resources gauging stations in Africa.

9.5.3 Applying nexus perspective solutions to assure water, food and energy security in Africa

The WRM-PAP posits that water and energy resources are essential drivers of investments in land. This is highlighted by the fact that in Africa about 66% of large-scale foreign investments in land are directed to energy crops. Invariably all the foreign investments in land are subject to the availability of water. Large-scale foreign investments in land lead to changes in land use and, consequently, in hydrological fluxes through abstraction of water for irrigation and changes in the pattern of rainfall. The impacts go beyond the externalities on water resources and include severe changes in local livelihoods and surrounding ecosystems.

Adopting approaches informed by the nexus perspective is, therefore, emphasised as being important to:

- i) ensure effectiveness and sustainability of government programmes, and,
- ii) provide the private sector with safeguards to mitigate risks while seizing opportunities.

Water, energy and food security can only be achieved if the cross-sectoral interlinkages are taken into account. The nexus perspective is crucial to deal with trade-offs and identify synergetic solutions to pressing resource issues. Furthermore, investment and funding are needed to implement innovative solutions at large-scale.

Responding to this additional demand in a manner that does not jeopardise immediate and long-term food security goals is still a challenge in several countries in Africa. It is in this regard that regional approaches are being undertaken to address trade-offs amongst water, energy and food security, as well as the implications to private and public investments. Focus has also been turned to capacity development activities relating to valuing ecosystem services, trade-offs and payment for ecosystem services at regional and sub-regional levels.

9.5.4 Improving agricultural water management

The African Union's aspirations to increase nutrition levels while, at the same time, assuring food security for a rapidly growing population, translate into an exponential increase in the demands and pressures on Africa's water resources. None more pronounced than the demand to meet the required increases in agricultural production. Innovative mechanisms to manage demand and improve efficiency in the production, supply and utilisation of water in agriculture are therefore required.

The need is not only to increase productivity, but also to assure resilience of the sector to anticipated limitations to water availability due to climate uncertainties. This is in line with the Africa

Water Vision 2025 target to increase the agricultural water productivity by 60% in the period 2000 to 2025, while at the same time doubling the area under irrigation.

Yet against such aspirations, monitoring of water use in the agriculture sector in Africa is largely based on estimates relying on secondary information sources. Mechanisms are required to empirically monitor agricultural water extraction in Africa as a first step to providing targeted, evidence-based – and therefore impactful – incentives to improve agricultural water use efficiency and productivity. Against a backdrop of:

- i) agriculture accounting for over 73.4% of water withdrawals in Africa (AMCOW, 2016); as well as,
- ii) taking into consideration the chemical and fertiliser pollution potential of the agricultural water returned to the environment,

it goes without saying that improvements in agricultural water use and management are a critical factor in efforts to sustainably assure availability of freshwater resources for other sectors.

Related interventions include:

- i) promoting innovative mechanisms, at national level, to manage demand and improve efficiency in the production, supply and utilisation of water in agriculture to increase productivity, but also assure resilience of the sector to floods and droughts;
- ii) instituting mechanisms to facilitate the use of waste as a resource in agriculture at national level;
- iii) turning the tide against the pollution of Africa's water and environmental resources, and,
- iv) sustainably and ecologically increasing agricultural production at all levels.

9.5.5 Implementing the PIDA priority transboundary water and energy projects

As highlighted by the Programme for Infrastructure Development in Africa (PIDA), Africa has the lowest water storage capacity and irrigated agriculture in the world. In contrast: i) an estimated 250 million people in Africa are currently exposed to increased water stress; and, ii) about half of the continent is either water stressed or facing water scarcity.

Through the **PIDA Water Programme**, efforts are underway to leverage US \$10 billion in investments (AUDA, GWP-SA, AMCOW, 2018) to 9 water projects; 3 water aquifer projects; 1 river basin management project; 5 multipurpose water reservoir projects; and 10 hydropower projects by 2025 (see Annexes 1 and 2). Activities are aimed at:

- i) advancing planned water storage infrastructure under PIDA; and
- ii) promoting and facilitating multifunctional "green" basin development centred on natural and built infrastructure to provide a continuum of water storage solutions.

Given the relatively lower investment requirements and higher probability of sustainability, natural options spanning household rainwater harvesting, ponds and tanks through to the utilisation of wetlands, lakes and natural or artificial groundwater recharge, among other methods are being promoted. Similarly, the development of multi-purpose reservoirs optimising the total benefit stream – water, food, energy, trade, ecosystems and disaster management – is vigorously promoted.

9.5.6 Enhancing use of wastewater and sludge, as appropriate and acceptable, for nutrient recovery in agriculture and bio-gas energy production

Experiences on planned reuse and the technologies applied to assure safety of effluent for return to the environment in AU Member States, including South Africa, Tunisia and Namibia, are being documented, promulgated and replicated. The activities are centred on:

- i) instituting tariff systems targeted towards better cost recovery in wastewater collection and treatment, while at the same time safeguarding affordability;

- ii) facilitating safe use of wastewater in urban farming; and,
- iii) bio-gas energy production.

9.5.7 Other related initiatives

These include:

1. Standardising regulatory frameworks for agricultural water management across Africa.
2. Developing and adopting legal, policy and institutional frameworks for the collection and treatment of wastewater to a minimum water quality standard before discharge into transboundary water courses and aquifers.
3. Supporting Member States, R/LBOs and RECs to conduct water resources assessments – including assessing the availability of groundwater resources and the impact of climate change on freshwater availability – as well as supporting them to monitor and manage groundwater use.

10 Water in the Agri-Energy sector: Conclusions

On the basis of the information in the foregoing sections of this report, it is evident that political attention is being dedicated to the vitality of investing in activities to assure water, food and energy security. It is recognised that environment and natural resources, particularly freshwater, are critical to the productivity of sectors such as energy, agriculture, industry and fisheries.

In the preceding sections, a review is provided of the key policy priorities and initiatives comprising of i) the African Water Resources Management Priority Action Programme 2016 – 2025 (WRM-PAP); ii) the Comprehensive Africa Agriculture Development Programme (CAADP); and the priority water and energy projects of the Programme for Infrastructure Development in Africa (PIDA). From a WEF nexus perspective, the emerging water sector development priorities can be summarised as presented in table below.

Table 8: Summary of water sector development priorities from a WEF nexus perspective

Priority for the water sector	WEFE nexus synergies and opportunities		
Water	Food	Energy	Environment
<p>Strengthening the business case for water investments in Africa</p>	<p>Aspirations for increased agricultural production and productivity, espoused by the CAADP are dependent on commensurate and reliable water access. Its thus imperative that investments into land for agricultural production factor in water development.</p>	<p>Projections of an African population of 1.6 billion by 2030 translate into, at least, a tenfold increase in water needs for energy production to support modernisation of economies and social progress. Implementation of the 19 PIDA water and energy projects (see Appendix 2) is vital not only to increase energy production and access, but also to improve navigation and irrigation development.</p>	<p>Water investments are a precursor to environmental security and, in turn, climate resilient – and therefore – sustainable development</p>
<p>Application of the UN-HLPW Principles on Valuing Water</p>	<p>Create incentives for water users, including irrigated agriculture, to not waste or pollute water, and to promote its reuse</p>	<p>Prioritise investment in innovative development of energy infrastructure to serve multiple purposes including reducing water related disaster risks and economic shocks.</p>	<p>Value environmental contributions to water management; prevent degradation and pollution of watersheds, rivers, lakes and aquifers; and, where necessary, restore and maintain acceptable environmental</p>

Priority for the water sector	WEFE nexus synergies and opportunities		
			conditions and water quality
A new narrative: "Investing in Water is Investing in Jobs"	Utilise the water-energy-food-ecosystem nexus approach to: <ul style="list-style-type: none"> i) position water better in the economy; ii) accelerate the pace of water infrastructure investments; and, iii) increase awareness of water's critical role in enhancing job creation; economic growth; and industrialisation. 		
Development of water as a means-to-an-end	Pursuit of the Africa Water Vision targets of: <ul style="list-style-type: none"> i) realising, by 2025, at least 25% of the development potential of water for agriculture; hydropower; industry; tourism and transportation ii) putting in place and fully implementing mechanisms and measures for the conservation and restoration of environment, biodiversity, and life supporting ecosystems 		
Investment led transboundary management and governance of water and environmental resources	<ul style="list-style-type: none"> i) cross-sector financing/investment to assure viability of investments in water dependent productive sectors (municipal water supply, energy, agriculture, agri-processing, mining, tourism) ii) identifying and quantifying water flows and their relationship with both climatic variables and economically valued inputs – if not limiting factors – to domestic supply, agriculture, industry, mining, energy production and various service industries; iii) supporting strategic planning processes for use of land and related resources so that water resources utilisation and environmental conservation are optimised; and iv) providing instruments to support public and investor confidence in the amount of water being traded, extracted for consumptive use, recovered and managed for environmental and other public benefit outcomes v) capacity development vis-à-vis valuing ecosystem services, trade-offs and payment for ecosystem services at regional and sub-regional levels vi) managing demand and improving efficiency in the production, supply and utilisation of water in agriculture – including use of waste as a resource in agriculture vii) promoting and facilitating multifunctional "green" basin development centred on natural and built infrastructure to provide a continuum of water storage solutions viii) instituting tariff systems targeted towards better cost recovery in wastewater collection and treatment, while at the same time safeguarding affordability; ix) facilitating safe use of wastewater in urban farming; and, x) bio-gas energy production. 		

It evident in the foregoing that freshwater availability is critical to releasing Africa's development potential, as well as sustaining economic growth and social transformation. It is a key determining factor in efforts to ensure food and energy security as well as for increasing industrial production.

The quality of freshwater ecosystems has a direct impact on the wellbeing and productivity of the population and, by inference, on the sustainability of economic growth and development at a national level. The benefits of investing in improved water resources management and access to clean water and sanitation therefore remain clear and germane.

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Appendix 1: Roles of key strategic partners in the pursuit of water sector HCD priorities

	Category of key strategic partners	Mandate/Role in Africa's Human Capital development aspirations
1	<ul style="list-style-type: none"> • African Union Specialised Technical Committee on Education, Science and Technology • African Union Specialised Technical Committee on Agriculture, Rural Development, Water and Environment 	<p>Specialised technical committees of the African Union mandated to: i) harness opportunities and synergies; and, ii) ensure complementarity – if not harmonisation – in the formulation and implementation of continental policies, strategies and interventions across water, education and related sectors. They are policy level organs of the African Union with technical coordination structures supported by the relevant department of the African Union Commission, namely: the department of rural economy and agriculture (ARDWE); the department of science, technology and human resources management (EST); the office of the Legal Counsel</p>
2	African Union Development Agency (AUDA-NEPAD)	<p>The development agency of the African Union, coordinating and executing priority regional and continental development projects to promote regional integration towards the accelerated realisation of Agenda 2063 – Africa's vision and action plan. Mandated to strengthen capacity of Member States and regional bodies.</p>
3	Regional Economic Communities	<p>Recognised as the building blocks of the African Union. There are eight, namely: AMU, CEN-SAD, COMESA, EAC, ECCAS, ECOWAS, IGAD and SADC.</p> <p>They are responsible for the implementation of the regional integration agenda towards the realisation of: i) trade and market integration; ii) macro-economic policy convergency; iii) free movement of persons; iv) peace, security, stability and governance; and, v) harmonisation of sectoral policies. These goals constitute the pillars of the African Union vision.</p>
4	African Ministers' Council on Water (AMCOW)	<p>Leadership of the sub-committee on Water and Sanitation of the STC on ARDWE. Mandated to implement the Human Capacity development programme for the water sector</p>
5	<ul style="list-style-type: none"> • Association of African Universities (AAU) • African Scientific, Research and Innovation Council (ASRIC) • African Observatory of Science, Technology and Innovation (AOSTI) • Pan African Intellectual Property Organization (PAIPO) • Regional African Satellite Communications Organisation (RASCOM) • African Resource Management Satellite Constellation (ARMC) • African Remote Sensing Council • African Association of Remote Sensing and Environment (AARSE) • African Regional Data Cube (ARDC) 	<p>Technical level specialised coordinating organisations spearheading implementation of reforms and adaptation of the education sector to meet the related demands of achieving the goals of Agenda 2063</p>

	Category of key strategic partners	Mandate/Role in Africa's Human Capital development aspirations
	<ul style="list-style-type: none"> • Association for the Development of Education in Africa (ADEA) • African Network for Agriculture, Agroforestry and Natural Resources Education • Higher Education Council for Africa and Madagascar (CAMES) • African Medical and Research Foundations (AMREF) • African Group on Earth Observations (AfrigeOSS) • Pan-african Institute of Education for Development (IPED) • Educational Research Network for West and Central Africa (ERNWCA) • Commonwealth of Learning (COL) • Forum for African Women Educationalists (FAWE) • Global e-Schools and Communities Initiatives (GeSCI) • International Research and Training Centre for Rural Education (INRULED) • Organisation Internationale de la Francophonie (OIF) • Africa Network Campaign on Education for All (ANCEFA) • Family Literacy Project (FLP) • Pan African Association for Literacy and Adult Education (PAALAE) • Reading Development Library (BLD) • Literacy and Adult Basic Education (LABE) • Association for the Development of Education in Africa (ADEA) 	
6	<ul style="list-style-type: none"> • Pan African University • African Centre of Meteorological Application for Development (ACMAD) • African Regional Institute for Geospatial Science and Technology (AfRIGST) • All Nations University Space Systems Technology Laboratory (ANUSSTL) • Africa Regional Centres for Space Science and Technology Education (ARCSSTE) • International Institute for Space Sciences and Electronics (INISSE) 	Academic and Research institutions mandated to produce world class human resources through high quality post-graduate education and research to drive the developmental imperatives of the continent to meet the aspirations of Agenda 2063
7	<ul style="list-style-type: none"> • NEPAD Water Centres of Excellence 	Mandated to support capacity development, research and innovation in water and sanitation in Africa
8	<ul style="list-style-type: none"> • UNESCO International Institute for Capacity Building in Africa (IICBA) • UNESCO Regional and National Offices and National Commissions for UNESCO in Africa • UNICEF 	UN Agencies with mandates related to realisation of sustainable development goals relating to water, sanitation and education

	Category of key strategic partners	Mandate/Role in Africa's Human Capital development aspirations
9	<ul style="list-style-type: none"> • Member States' public and private research and education structures/networks • Civil Aviation Authorities • Private Sector • Civil Society • Various NGOs working on teacher education and development 	Beneficiaries and key users of the outputs of interventions at various levels. Interventions should be responsive to their needs. They are also a vital feedback loop in assessing impact of interventions.
10	<ul style="list-style-type: none"> • Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ). 	Funding and or implementing agencies

Appendix 2: PIDA Water priorities

Project Name	Sector	Sub Sector	Location	REC	Stage
Sambangalou Hydropower Plant	Energy	Hydro Power Plant	Guinea, Senegal	ECOWAS-CEDEAO	S4A: Tendering
Ruzizi III Hydropower Plant	Energy	Hydro Power Plant	Democratic Republic of Congo, Rwanda	EAC	S3B: Transaction Support & Financial Close
Rusumo Falls III Hydropower Plant	Energy	Hydro Power Plant	Rwanda	EAC	S4A: Tendering
Polihali Hydropower Dam and Transfer Tunnel to Katse Dam	Energy	Hydro Power Plant	Lesotho	SADC	S2A: Pre-Feasibility
Mpanda Nkuwa Hydropower Plant (HMNK)	Energy	Hydro Power Plant	Mozambique	SADC	S3B: Transaction Support & Financial Close
Kobong Pumped Storage Dam and Hydropower Plant	Energy	Hydro Power Plant	Lesotho	SADC	S1: Project Definition
Kaléta Hydropower Plant	Energy	Hydro Power Plant	Guinea	ECOWAS-CEDEAO	S4C: Operation
Inga 3 Hydropower Plant	Energy	Hydro Power Plant	Democratic Republic of Congo	SADC	S3A: Project Structuring
Grand Ethiopian Renaissance Dam (GERD)	Energy	Hydro Power Plant	Ethiopia	COMESA	S4B: Construction
Batoka Gorge Hydro Electric Power Scheme	Energy	Hydro Power Plant	Zambia, Zimbabwe	SADC	S3A: Project Structuring
Palambo Multi-purpose Dam	Water	Multi-purpose Reservoir	Central African Republic, Democratic Republic of Congo	CEEAC-ECCAS	S2A: Pre-Feasibility
Noumbiel Multi-purpose Dam	Water	Multi-purpose Reservoir	Burkina Faso, Ghana	ECOWAS-CEDEAO	S2B: Feasibility
Koukoutamba (ex-Gourbassy) Multi-purpose Dam	Water	Multi-purpose Reservoir	Mali, Senegal	ECOWAS-CEDEAO	S3A: Project Structuring
Fomi Multi-purpose Dam (Niger River Basin)	Water	Multi-purpose Reservoir	Guinea	ECOWAS-CEDEAO	S3B: Transaction Support & Financial Close

Okavango Basin Opportunity Studies	Water	River Basin Management	Angola, Botswana, Namibia	SADC	S4C: Operation
Nubian Sandstone Aquifer System	Water	Water Aquifer Management	Chad, Egypt, Libya, Sudan	IGAD,UMA-AMU	S4A: Tendering
North-West Sahara Aquifer System (NWSAS)	Water	Water Aquifer Management	Algeria, Libya, Tunisia	UMA-AMU	S3A: Project Structuring
Iullemeden Aquifer System	Water	Water Aquifer Management	Mali, Niger, Nigeria	ECOWAS-CEDEAO	S2A: Pre-Feasibility
Lesotho Highlands Water Project (LHWP) Phase II	Water	Water Supply	Lesotho	SADC	S4B: Construction

List of abbreviations and definitions

ACE-Water	African Networks of Centres of Excellence on Water Sciences and Technology
AfDB	African Development Bank
AIP	Africa Water Investment Programme
AMCEN	African Ministerial Conference on the Environment
AMCOW	African Ministers' Council on Water
ARMC	African Resources Management Satellite Constellation
AU	African Union
AUC	African Union Commission
AUDA	African Union Development Agency
AU-HoS	African Union Heads of State and Government
AWV 2025	African Water Vision 2025
CAADP	Comprehensive Africa Agriculture Development Programme
CEANWATCE	Central-Eastern Africa Network of Water Sciences and Technology Centres of Excellence
CEMA	(African Union) Conference of Ministers in Charge of Energy
CESA	Continental Education Strategy for Africa
ClimDev-Africa	Climate for Development Initiative for Africa
CPA	Consolidated Plan of Action
DG DEVCO	Directorate General for International Cooperation and Development of the European Commission
DG ENV	Directorate General for Environment of the European Commission
DREA	Department of Rural Economy and Agriculture, African Union Commission
EAC	East African Community
ECA/UNECA	United Nations Economic Commission for Africa
EC-JRC	European Commission Joint Research Centre
ECOWAS	Economic Community of West African States
EU	European Union
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
HCD	Human Capacity Development
HYCOS	Hydrological Cycle Observing System
HLPW	High Level Panel on Water
ICT	Information, Communication and Technology
IGAD	Inter Government Authority on Development
M&E	Monitoring and Evaluation
NBI	Nile Basin Initiative
NEPAD	New Partnership for Africa's Development
NHS	National Hydrological Services

PIDA	Programme for Infrastructure Development in Africa
PRC	Permanent Representatives Committee of the African Union
RLBO	River/Lake Basin Organisation
REC	Regional Economic Community
SADC	Southern African Development Community
SANWATCE	Southern Africa Network of Water Sciences and Technology Centres of Excellence
SHCD	SADC Water Sector Human Capacity Development Plan (2014-2020)
SIDS	Small Island Developing States
SMART	Specific, Measurable, Achievable, Relevant and Time-bound
STC-ARDWE	Specialised Technical Committee on Agriculture, Rural Development, Water and Environment
STC-EST	African Union Specialised Technical Committee on Education, Science and Technology
STI	Science, Technology and Innovation
TIGER	Technology Informatics Guiding Education Reform [initiative]
TVET	Technical and Vocational Education and Training
UMA	Union du Maghreb Arabe
UNESCO-IHP	United Nations Educational, Scientific and Cultural Organisation International Hydrological Programme
UNICEF	United Nations Children's Fund
WACDEP	Water, Climate and Development Programme
WANWATCE	Western Africa Network of Water Sciences and Technology Centres of Excellence
WASSMO	African Water and Sanitation Sector Monitoring and Reporting System
WEFE	Water, Energy, Food and Ecosystems
WHYCOS	World Hydrological Cycle Observing System
WMO	World Meteorological Organization
WRM-PAP	African Water Resources Management Priority Action Programme 2016 - 2025

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