

Haiti

Draft SDG#6 Strategy

Authors

Country case presenters

Samuel Diery Mondestin (National Program Officer Haiti, SDC), Sergio Perez Leon (Program Manager, Water, Climate Change, Division Latin America and the Caribbean, SDC)

Contributors

John Brogan (WASH/DDR Advisor, Terre des Hommes), Georges Burri (SHA WES Expert, SDC Regional Office Amman, Jordan), Cesarina Quintana Garcia de Parades (Senior National Programme Officer, SDC Global Programmes HUB Lima, Peru), Viet Hoang (Wetlands and Climate change Coordinator, WWF Vietnam), Niyorathan Pakkiyaretnam (WASH Coordinator, Terre des hommes), Douma Yeya (Expert in local governance, HSI), Anil Dutt Vyas (Head Civil Engineering, WASH & Urban Specialist, Manipal University Jaipur, India), José Luis Carrasco (Director, Aquasis Solutions), Jan Cassin (Director, Water Initiative, Forest Trends), Tunzhurbek Kudabaev (National Program Officer, Swiss Embassy in Bishkek, Kyrgyzstan), Prakash Chandra Amatya (Technical Advisor, GUTHI), Diana Rojas Orjuela (Programme Officer, SDC, Colombia)

Facilitators

Marc-André Bünzli (Head Expert Group Water and Environmental Sanitation, SDC/FDFA), Hanna Capeder (Programme Manager/ Water Policy Advisor, SDC – GPW)

Compiler

Tandiwe Erlmann (Project Manager, seecon gmbh)

Contents

Background	3
Introduction	3
Overview of the current situation	3
Basic outline of the country	3
Socio-economic	4
Institutional	4
Environmental	6
Technological and knowledge-related	6
Water supply	6
Sanitation	7
Water quality	7
Integrated water resources management	7
Water-related ecosystems	7
Progress towards achieving the Millennium Development Goal #7C	7
SDC's contribution to the MDG#7C.....	8
Key challenges and opportunities for the implementation of the SDG#6	8
Draft SDG#6 Strategy	8
Current state	8
Challenges	8
Desired outcomes	9
Strategic focuses	9
Achieve balance between water and sanitation at DINEPA.....	9
Protect water sources	10
Improve sustainability and productivity of agriculture	10
Restore ecosystem services	10
Strengthen the capacities of WASH and IWRM managers.....	10
Set-up coordination platforms	11
Principles	11
Means of implementation	12
Synthesis	14

Table of figures

Figure 1: Structure of DINEPA	5
Figure 2: Means of implementation.....	12
Figure 3: Graphic synthesis	14

Background

This draft SDG#6 strategy was developed during the 32nd AGUASAN workshop, held in Spiez, Switzerland, between June 26th and July 1st 2016. AGUASAN (www.aguasan.ch) is an interdisciplinary Swiss Community of Practice (CoP) that brings together a broad range of specialists to promote a wider and deeper understanding of key water and sanitation management issues in developing and transition countries. It builds on committed sector professionals from various specialised institutions involved in Swiss development cooperation, humanitarian aid and research.

Since 1984, the CoP provides an exemplary, vibrant and most pertinent exchange platform and think-tank serving the water sector, and constitutes an essential link to the innovation and knowledge management strategy of the Swiss Agency for Development and Cooperation (SDC).

During the annual AGUASAN workshop, water and sanitation specialists from all over the world gather for five days to collectively reflect on a cutting-edge topic of the water sector. The workshops provide a joint learning experience and utilise the broad knowledge of the participants to elaborate strategies and conceptual tools of practical use for development work and sector interventions at local, national and global level.

The 2016 AGUASAN workshop focused on means of implementation to achieve the dedicated water goal of the 2030 Sustainable Development Agenda (SDG#6). The workshop was structured around three country cases (Tanzania, Haiti and Macedonia), for each of which draft SDG#6 strategies were prepared. The strategies build on the current situation of the countries and include practical means of implementation inspired by practical examples presented and discussed during the workshop. The draft strategies can be used to inspire and support local decision makers in shaping the national development plans.

Introduction

The structure of the present document is roughly based on the course of the 2016 AGUASAN workshop:

- The first section provides a broad overview of the country's current situation as well as the specific challenges and opportunities of the sector.
- The second part outlines a draft strategy to reach the desired future state (desired outcomes) to be achieved by 2030, including general principles and a number of concrete means of implementation.
- The third part shows a graphic synthesis of the results of the working group (current state, challenges, strategy, outcomes and principles).

Overview of the current situation

Basic outline of the country

Haiti shares the island of Hispaniola with the Dominican Republic. Haiti's land area is 27,750 km². It is bordered by the Atlantic Ocean and the Caribbean Sea. The population amounts to 11 million with a density of 384 inhabitants/ km².

Five mountain ranges cover 75 % of Haiti's land surface. The highest peak rises to 2,680 meters. Haiti's rivers and streams originate in the mountains. Their flow depends on rainfall and ranges from torrential to totally dry. The country's largest river is the Artibonite with a length of 500 km. Lake Azuei and Lake Miragoane are the biggest lakes of the country. Haiti's annual rainfall occurs during two rainy seasons: April to June and August to October. Annual rainfall varies from 500 mm in the northwest to more than 2'540 mm in the South and East. Due to the El Niño effect precipitation has high variability between drought and heavy rains.

The climate of Haiti is tropical and semiarid depending on season, terrain and location. On the plains, the mean annual temperature is 27°C, while in the mountains, the mean annual temperature drops to 16°C. Frost frequently occurs above 400 meters' altitude during the cool season.

Socio-economic

Haiti is the only country in the Western Hemisphere to undergo a successful slave revolution in 1842; however, followed by a long history of instability: 32 coups, two interventions by the UN and one by the USA in 27 years. It is the poorest country in the Americas and one of the poorest in the world, with the lowest HDI (human development index) and GDP (gross domestic product) per capita of the continent and as such, part of the "least-developed countries" as defined by the UN.

With a GDP per capita of US\$ 820, the population in Haiti faces significant lack of basic services. 59% of Haitians live under the national poverty line of US\$ 2.42 per day and over 24% live under the extreme poverty line of US\$1.23 per day.

Haiti has a market economy with a growth rate of 2.5 %. Labour costs are lower than 5 US\$ per day. Two-fifths of Haitians depend on agriculture, mainly small-scale subsistence farming and remittances from the diaspora. Climate variability is a major threat to agricultural production and subsistence farmers' food security and livelihoods. Haiti exports 55% of agricultural products like vetiver oil, bananas, cocoa, and mangoes. Agriculture is one of the priority sectors of government. The tourism sector is growing with several new hotels and an increase in international travellers by nearly 20% in the last couple of years.

For the past 10 years more than 90 percent of the government's budget came from an agreement with Petrocaribe, a Venezuela-led oil alliance. The low price of oil considerably impacts Haiti's economy.

About 1.5 million people have lost their homes and became displaced (also called Internally Displaced People, IDPs), over 300'000 people were injured and 220'000 have died in the earthquake of 12 January 2010. The same year, Haiti was hit by a cholera epidemic that began in October 2010. The outbreak affected a very large number of Haitians throughout the country: according to the Ministry of Public Health and Population (MSPP), since the beginning of the epidemic until November 30, 2014, there were identified 719'377 suspected cases and 8'767 deaths from cholera. In 2013, 65'000 new cases were registered and more than 550 infected people died, according to the UN. Cholera is a very serious waterborne disease which falls under the "faecal peril". Its route of transmission is oral-faecal, by drinking water, dirty hands or contaminated food.

Institutional

Haiti is divided administratively into ten departments. The departments are further divided into 42 counties, 145 communes and 571 communal sections. The communes are managed by a council of mayors elected for a mandate of 4 years and the communal sections by an Administration Council (CASEC), whose members are supposed to be elected every four years.

Haiti is a semi-presidential republic. Executive power is exercised by the elected President and a Prime Minister (appointed) who together constitute the government. Legislative power is vested in both the government and the two chambers of the National Assembly. The governance is very centralized; 80% of the national budget is spent at the capital Port-au-Prince. High political instability and weak institutions resulting from corruption and lack of good governance are two major challenges the country is facing.

Numerous well charted and comprehensive environmental protection laws exist, but are not enforced because of corruption and lack of capacity. The Ministry of Environment that was created 15 years ago, still does not have an official organic law. The tax system is poorly established and tax income hence very low.

Sanitation and water management is under the responsibility of DINEPA (National Direction for Water and Sanitation). This government agency is in charge of implementing the water reform that was adopted in 2009. The main focus of this law is to transfer the water and sanitation management to the local level. The mandate of DINEPA is to:

- to improve the level of access to water and sanitation services
- to decentralize WASH management to the 10 departments and 145 communes

To date, DINEPA is present in all 10 departments plus on the island of La Gonave (belonging to the department “Ouest”) through the URD (Departmental Rural Unit) and in 142 out of a total of 145 communes through the TEPAC (Water and Sanitation Technicians).

A schematic explanation of the structure of DINEPA and its deconcentrated/ decentralized institutions can be found in Figure 1.

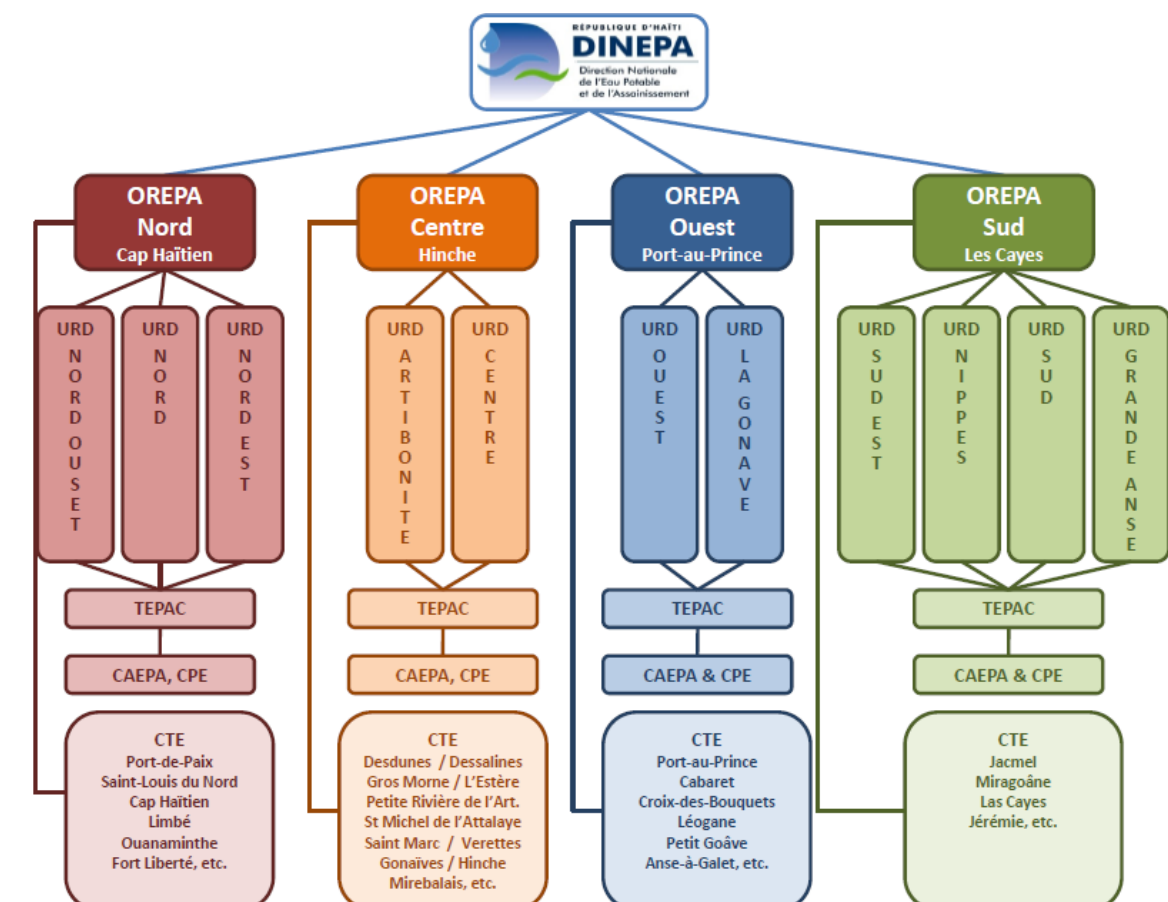


Figure 1: Structure of DINEPA

The country faces enormous challenges regarding the drinking water and sanitation sector (EPA – *eau potable et assainissement*). Access to public service remains very low, quality is far short of the standards required by the international community (WHO, UN, Donors) and municipalities cannot currently assume the ownership of WASH's infrastructures. The sector is still at the beginning of its decentralization phase. NGOs play an important role especially in rural areas and in underprivileged neighbourhoods. Development assistance remains a major support for this country.

In order to strengthen the EPA sector, an important sector reform was initiated in the second half of the 2000s. A major step in the reform was the establishment of the framework law on the organization of the Drinking Water Sector and Sanitation, published Wednesday, March 25, 2009. This law impulses the modernization of the sector, which officially launched the process of the reform of the Water Supply and Sanitation in Haiti sector.

The implementation of DINEPA's mandate is hampered because water and sanitation is not a priority for the government with only 0.17% of the national budget being allocated to WASH and 0.4% to environmental protection. The majority of the national budget goes to security, agriculture, public works (road infrastructure) and health. DINEPA is largely funded by international donors and one of the best functioning divisions of government. Focus on sanitation is low due to lack of qualified human resources and financial resources.

A sectoral group is in place for the coordination of donor institutions and the government. Its members are the Inter-American Development Bank, the World Bank, UNICEF, the Canadian International Development Agency (CIDA), the Spanish Agency for International Development Cooperation (AECID), the CDC Group (Center for Disease Control), SDC and other small stakeholders.

Environmental

Environmental degradation is a critical concern in Haiti. The virgin forests that once covered country have now been reduced to 4% of the total land area. This degradation started since the colonial period with the French who exported quality wood, later, after the independence, by US companies. Local habits considerably impact this situation: bad farming practices, use of trees for timber and household energy, unplanned extension of the cities in mountains, use of firewood in some small businesses (bakery, dry cleaning, others).

The degradation of watersheds linked to deforestation is the main cause of floods during hurricane period. For the last 20 years, at least 5'000 people have died from floods and a high degree of damage occurred to infrastructure (drinking water systems, roads, bridges, houses) and crops.

Other environmental issues such as sanitation and natural resources management confirm this difficult environmental situation. A lot of water sources, lakes and rivers are dried or face a flow's diminution, sanitation around the coastal cities has become a big challenge. Groundwater is subject to pollution because of bad waste (liquid and solid) management. The spread of cholera in the past 6 years is an example of this critical environmental situation. The big threat, in the near future, is the possibility to restart the mine's extraction.

Despite the environmental degradation Haiti has numerous well charted and comprehensive environmental protection laws. Not one is ever implemented because of corruption and/or lack of capacity. The Ministry of Environment created 15 years ago still doesn't have official organic law.

Technological and knowledge-related

The level of expertise, innovation and training is very basic in Haiti. Some initiatives are underway at national level for professional training. Affordable solutions are very rare. There is no clear policy and strategies to encourage innovation and knowledge transfer. Research is largely neglected at university level. The few research that is being done, is hardly fit for the challenges the country faces, especially in the WASH sector.

Water supply

58% of the population have access to potable water services between 10 and 24 hours per week. More than 60% of drinking water in rural areas comes from springs, surface water and boreholes. In urban areas 27-33% of drinking water is piped and 45-61% bottled. In rural areas the situation is worse, poorly managed and it is difficult to establish drinking water and sanitation.

The Metropolitan Region of Port au Prince and other urban areas of Haiti have no collective sewerage plant and public drinking water infrastructure is destroyed or degraded. Lack of networks in different poor neighbourhoods is overcome by setting up water kiosks.

To date there is no clear water pricing strategy. DINEPA charges lump sum payments by month. In slum areas the cost of water is from 10 to 20 US\$ per cubic meter for a private supplier. Clients of the public service pay from 2 to 20 US\$ per month depending on the location (rural or urban) and the frequency of the service.

Sanitation

28% of the population have access to basic sanitation services. Open defecation is widely practiced. Innovative and affordable sanitation solutions are hardly available. A latrine can cost between 400 and 2'000 US\$ per family. There is no subsidization from DINEPA or clear strategy for latrine construction. There has been a workshop with more than 150 stakeholders for exchange of experiences and finding consensus on a step by step approach for addressing this challenge, from the collection of waste at household level through transportation to recycling of the excreta.

Water quality

Many water sources like lakes and rivers are dried out or faced with flow diminution. Water pollution from lack of wastewater treatment around the coastal cities has become a big challenge. Groundwater is also subject to pollution because of bad wastewater and solid waste management.

For excreta treatment and recycling four treatment plants are existent (aerated lagoon method). Two are located in Port au Prince Area (the capital), one in the north (Limonade) and one in the south. Their management is very problematic; first because of the lack of capacity of the state to get the private sector operators (collectors and truck drivers) to use the plants (bring in the excreta) and secondly because of lack of competencies and resources of DINEPA. It is also necessary to note that the municipalities where these plants are located are not involved in the management and any kind of follow up.

The high increase in water-borne diseases like cholera in the past 6 years is an example of this critical environmental situation. The possible development of the country's mines and huge farms in the near future also pose a threat for the water quality.

For the whole country only one person is in charge of water quality at DINEPA. There are no national regulations on drinking water quality. In most cases water is being disinfected by chlorination. The capacity for disinfection is however very low in terms of tools, human resources and budget. Those that can afford it buy potable water from private suppliers who use reverse osmosis treatment.

Integrated water resources management

Water resource management is shared by 4 ministries: Agriculture, Environment, Collectivity (communes) and Public Works (DINEPA). Coordination between the ministries is challenging as legislation is old fashioned and no clear strategy is available for water resources management or transboundary collaboration.

Water-related ecosystems

Water-related ecosystems are under the responsibility of the Ministry of Environment, which has two agencies in place: the ANAP (National Agency for Reserved Areas) and the Direction of Ecosystems.

Progress towards achieving the Millennium Development Goal #7C

The capacity to measure and share information on the achievement of the MDG is very low. There is confusion on what has really been achieved between 2000 and 2015. The official DINEPA figures state that progress between 2000 and 2015 has been:

- 11 % increase in access to water (total access 58%, target: 75%)
- 8 % increase in access to sanitation (total access 28 %, target: 65%)

There was no clear leadership in the implementation of the activities related to the MDG. One big challenge was the reform of the water and sanitation sector in 2009. It caused a lot of changes in terms of strategy, processes, structures and leadership. Another big challenge was the 2010 earthquake and the following cholera outbreak; all the resources were put in the emergency response.

For this period (2000-2015) the average investment per user was estimated at around 360 US\$. This cost is due to constant reinvestment in existing facilities (lack of functionality), lack of quality work and lack of involvement of local authorities and users in the design of facilities.

SDC's contribution to the MDG#7C

250'000 users received access to an improved water source and 16'500 to basic sanitation services. Around 185'000 persons using existing water systems received access to treated water by chlorination (not funded by SDC). The interventions were mainly targeted at rural areas with an investment of 24'000'000 CHF during 18 years.

Key challenges and opportunities for the implementation of the SDG#6

The key challenges of Haiti for implementing the SDG related to restoring the watersheds and increasing access to WASH are:

- 360'000 new water users and 470'000 new sanitation users estimated per year
- 100 million US\$ of investment needed per year for the next 14 years
- Considerable action needed for watershed management, water quality management and maintaining the assets and services sustainable
- Limited capacity at local level
- Lack of coordination and uneven fund allocation (water vs. sanitation vs. IWRM, urban vs. rural)
- High dependence on foreign aid
- Lack of an integrated strategy for WASH and IWRM

The opportunities of Haiti for implementing the SDG related to restoring the watersheds and increasing access to WASH are:

- Agriculture being one of the priority sectors of government is an important entry point
- Informal sector existent (bottled water, pit emptying) and potential for closing the nutrient cycle

Draft SDG#6 Strategy

Current state

- Environmental degradation
- Extreme poverty
- El Niño effect (drought & heavy rains)
- Fragile food security & livelihood
- Political instability
- Lack of capacity to steer sector/ country
- Weak institutions
- Weak WASH setup

Challenges

- **Degraded watersheds**
 - Inadequate or obsolete environmental law
 - Surface water pollution around the coastal cities and groundwater pollution
- **Very limited access to WASH services**
 - Poor quality of service
- **Allocation and management of funds**
 - Financial sustainability is a central issue in Haiti
 - Investment in the WASH sector depend almost 100 % on international cooperation

- How to overcome the dependency on foreign funds?
- How to decide on allocation of funds for water supply? For sanitation? For integrated water resources management?
- Implementation of pricing rules that could contribute to financial and social sustainability.
- Continued investments including real rise of urban sanitation (excreta and liquid; solid waste is not within the competence of the DINEPA).
- **Limited capacity at local level**
 - Lack of confidence of the population in the capacity of DINEPA to provide adequate service
 - Lack of capacities of local construction companies
 - Continuation of the implementation of institutional reform
- **No integrated vision linking IWRM and WASH**
 - Need to ramp up sanitation to protect public health and water resources

Desired outcomes

- Improved access to drinking water and sanitation
 - Improved capacity of DINEPA to continue the development of WASH services at national level, regulate the sector, controlling players by promoting synergies
- Early victories! in improved drinking water quality
- Rehabilitated watersheds
 - Increased capacities of local authorities and other stakeholders on IWRM
- Strengthened role of private sector in providing sanitation services and good quality work
 - Focus on micro-entrepreneurs in closing nutrient cycle in urban areas, private sector as driver of good quality work
 - Focus on strengthening capacities of the local authorities and local actors to play the role of contract owner
- Increased food security for subsistence farmers

Strategic focuses

Achieve balance between water and sanitation at DINEPA

[Targets 6.1 (Access to drinking water) and 6.2 (Access to sanitation and hygiene)]

- Increase the coverage of the population with drinking water and sanitation in both urban and rural areas approaching the Millennium Development Goals
- Increase access of the population to safe drinking water controlled within parameters approved for human consumption by ensuring the necessary treatment at the source and the permanent control throughout the distribution network to the final user
- Ensure the implementation and monitoring of studies, supervision and permanent auditing
- Cover the drinking water supply and sanitation needs of vulnerable people
- Gradually transfer the ownership of WASH projects to local authorities
- Assess the EPA services provided by the managers of systems based on quality and established performance criteria
- Increase the quality and sustainability of services provided to the population through the consolidation of the new organizational structures, decentralization of management, improving operations, recovery of water charges, access to technology and private sector participation, promoting the progressive self-reliance and sustainability systems infrastructure
- Conduct research on ways to implement the right to water and sanitation, and share research results with all parties concerned

Protect water sources

[Targets 6.2 (Access to sanitation and hygiene) and 6.5 (IWRM & transboundary cooperation)]

- Supplying the population with adequate basic sanitation by the various existing contexts, to eliminate the risk and vulnerability to hydro-faecal-borne diseases by promoting appropriate technologies and practices as well as hygiene education
- Increase and improve access of the population to information of public interest on drinking water and sanitation, strengthening the importance of hygiene practices, responsible use of water resources, the price of water and sanitation, promoting social awareness and culture of payment for services
- Formulate a water resources protection policy in collaboration with key concerned stakeholder.

Improve sustainability and productivity of agriculture

[Targets 6.3 (Wastewater treatment & recycling) and 6.4 (Water use efficiency and sustainable withdrawal & supply)]

- Water management in small households and farms, reusing nutrients and retaining water, also involve private sector initiatives in centralized areas like slums
- Definition of public policy for the Watershed Management and Integrated Water Resources Management (IWRM)
- Coordinate with other relevant management bodies and environmental protection
- Manage and regulate protected areas in collaboration with local authorities
- Organize massive campaigns of information and awareness about water resource management and ecosystems
- Initiate action research on topics related to local management, the protection of the environment and development local skills
- Evaluate and capitalize on field experiences
- Boost research to provide thematic training base on local needs
- Experience significant technology in IWRM services
- Promote dissemination of adapted knowledge

Restore ecosystem services

[Target 6.6 (Protection & restoration of water-related ecosystems)]

- Prerequisite for healthy watersheds, sustainable water supply and food security
- Coordinate with other relevant management stakeholders and environmental protection
- Manage and regulate protected areas
- Define, promote standards for environmental protection in cooperation with the competent authorities
- Support actors in the definition, execution, control and monitoring of water resource protection activities and ecosystems
- Ensure the update of legislation and specific regulations on the protection of water resources and ecosystems
- Broadcast through the national environmental observatory progress made and challenges overcome

Strengthen the capacities of WASH and IWRM managers

[Target 6.a (International cooperation and capacity-building)]

- Focus on gender, farmer to farmer and local level
- Advocate to persuade the state to have progressive commitment to finance the WASH sector

- Harmonise and adapt their procedures to support the development sector more effectively
- Work on the establishment of a common fund to finance up access to water and sanitation, decentralization DINEPA, the local water governance and Integrated Water Resource Management
- Strengthen support to the local contracting processes in order to enable people and local communities to fully participate and to assert themselves as responsible partners in the various decisions spaces.
- Accompany DINEPA in the establishment of an effective framework to establish PPPs in the WASH sector
- Support the work of governments and communities by providing information, facilitating community organization and assisting communities

Set-up coordination platforms

[Target 6.b (Participation of local communities)]

- Complete the legal framework for decentralization and adopt an action plan to accelerate the transfer of resources and skills
- Coordinate and harmonize existing support for community capacity building
- Define with DINEPA, the terms of the transfer of the management of WASH services to local authorities
- Encourage local actors to participate/ contribute actively to the process of preliminary assessment, definition of intervention concepts, decision-making, implementation, management and monitoring
- Promote accountability notions of fairness and transparency in local management of the EPA services
- Strengthen the capacity of communities and the governments on issues related to water, including the rights and duties, management and technical information

Principles

Main principle (our mantra): No WASH without IWRM!

Additional principles:

- Patience (step-by-step implementation)
- Long-term commitment
- Have a clear vision (instead of/ before indicators)
- Participation of all stakeholders, including citizens and private sector
- Will to take risks or the courage to fail

Means of implementation

The means of implementation were classified into 3 clusters: WASH, environment and governance. They all have an impact on livelihoods, which is at the centre of all efforts (see Figure 2).

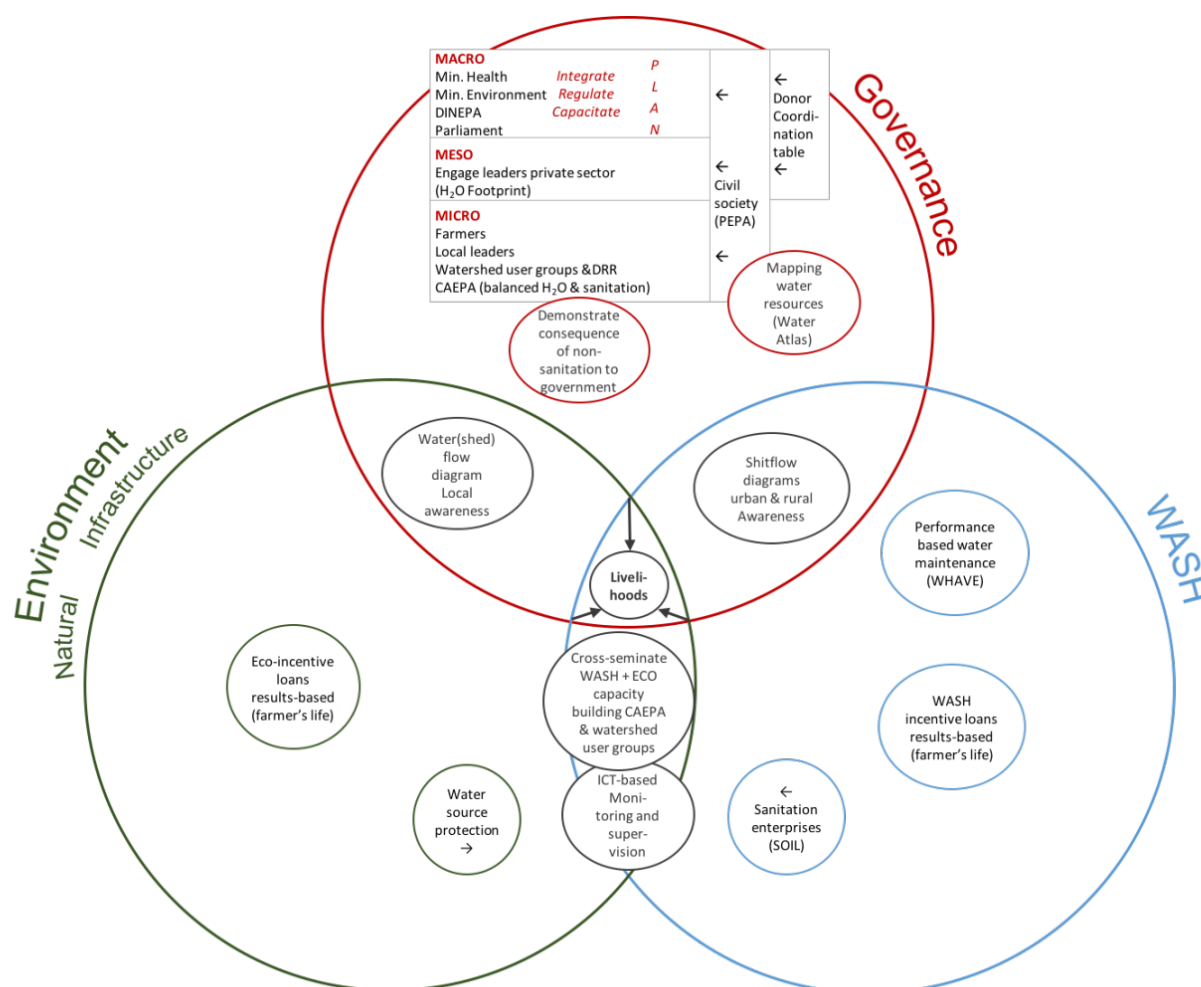


Figure 2: Means of implementation

Governance:

- The stakeholders at macro, meso and micro level are the drivers of the means of implementation.
 - MACRO: Strengthen the collaboration between DINEPA and Ministry of Environment, capacitate them and integrate WASH and environmental protection by bringing in technical experts in basin planning and IWRM.
 - MESO: Strengthen private sector involvement (including applying the water footprint concept).
 - MICRO: strengthen farmers' voice, support watershed user groups in integrating Disaster Risk Reduction (DRR) measures, support CAEPA in balancing out water and sanitation.
- Donor coordination group: strengthen multi-stakeholder group including government and bilateral donors for inclusive coordination of international funds. Set-up link with parliament for policy influencing. Pursue overall goal to empower DINEPA and handover coordination gradually.

- Civil society (PEPA – *Plateforme Eau Potable & Assainissement*): strengthen capacity building and create demand at all levels, especially local and water point level. Support local leaders to connect to policy makers.
- Extend the current initiative Water Atlas to show flow diagrams at urban level (Port-au-Prince) and watershed flow diagram at rural level.

WASH/ Environment:

- Sanitation enterprises: strengthen small-scale business models like SOIL (www.oursoil.org) with subsidies from government and develop demand with social marketing initiatives.
- Eco/ WASH loans: results-based incentive loans (higher loans and lower rates for improvements in hand-washing/ sanitation/ protection of water sources/ etc.).
- Performance-based water maintenance (www.whave.org).
- Cross-seminate WASH + Eco capacity building: CAEPA + Watershed user groups.
- ICT-based monitoring and supervision: need for indicators at local, regional and national level. Work with World Bank for setting up Monitoring & Evaluation system.
- Demonstrate consequences of non-sanitation to government

Synthesis

A graphic synthesis of the strategy proposed by the working group can be found in Figure 3.



Figure 3: Graphic synthesis