

Analysis of Quality Infrastructure Services Offered in Benin and Potential for Development

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On behalf of



On behalf of the Federal Government of Germany, the Physikalisch-Technische Bundesanstalt promotes the improvement of the framework conditions for economic, social and environmentally friendly action and thus supports the development of quality infrastructure.

1. Main findings from the Benin country study

A brief overview of the overall level of relevance of key sectors at national level, their priority in terms of climate change and opportunities identified for further development of quality infrastructure in Benin is presented in the following table.

Recommendations

Based on the results of the Benin country study, three main recommendations can be identified in relation to the overall relevance of analysed key sectors at the national level, their priority in the context of climate change and opportunities for future development of quality infrastructure therein.

1. In Benin, a national policy framework for dealing with both mitigation and adaptation to climate change exists. The institutional set-up for developing and coordinating initiatives and cooperation projects has been developed and is in place. However, given the limited financial and human resources available, interventions have been limited in scope and size. In many cases, pilot projects have thus far aimed at broadening the knowledge basis and experience of the Government of Benin. Against this background, any initiative for supporting the development of quality infrastructure services relevant for climate change mitigation and adaptation to climate change should be developed in close cooperation with the relevant institutions of the country and put a focus on capacity building and awareness raising.
2. Both the overall socioeconomic development strategy and climate change policy in Benin put their focus on the agricultural sector. Hence, a collaboration for strengthening quality infrastructure services should preferably focus on objectives which will support sustainable agriculture and economic growth, and which are also in line with the country's climate change targets. In the dynamic context of Benin's agricultural sector, in which cotton is the predominant export crop, linkages should be identified between the farming sector, water supply and meteorology.

3. Given Benin's important role as a transit country which is highly dependent on market dynamics in its neighbouring countries, a strong regional perspective for fostering quality infrastructure development should be taken. In this context, the Economic Community of West African States (ECOWAS) plays an important role. The specific needs in the region to address climate change could be considered in the follow-up project supporting quality infrastructure in the ECOWAS region. A triangular cooperation project with another country in the region, which already has more advanced quality infrastructure services, could also be of interest. With Tunisia and Morocco, for instance, connections are already established and collaborations in different areas (metrology, certification, including accreditation) are being considered.

2. Benin's background

Political and economic context of Benin

Transition from Marxist-Leninist single party-rule to democracy in Benin went smoothly and peacefully in the late 1980s (BMZ 2017). Politics in Benin are placed in a framework of a multi-party, presidential representative democratic republic, where the President is both head of state and head of government. The country's political system is derived from the 1990 Constitution and the subsequent transition to democracy in 1991.

Presidential elections held in March 2016 were won by the multi-millionaire and cotton sector tycoon, Patrice Talon. In December 2016, the new government adopted an ambitious development programme called "Programme d'Actions du Gouvernement" structured around 45 flagship projects aimed at improving the productivity and living conditions of the population (World Bank 2017).

Benin's economy has continued to grow stronger over the past years, with real GDP growth estimated at 4–5% over the past decade. The main driver of growth is the agricultural sector, with substantial employment and income arising from subsistence farming, and with cotton being the country's main export – accounting for roughly 40% of GDP and 80% of official export receipts (WITS 2017).

	Relevance at national level	Priority in climate change context	Opportunities for quality infrastructure development	
Renewable Energies & Energy Efficiency	<ul style="list-style-type: none"> The Government of Benin puts a focus on improving the overall energy supply system, the quantity and the quality of energy sources and on enhancing the efficiency of energy supply and demand. 	<ul style="list-style-type: none"> Some donor organizations support the Government of Benin in promoting renewable energies and high-performance economical homes, particularly in areas vulnerable to climate change, but there is no clear priority when compared to other sectors. 	<ul style="list-style-type: none"> Only basic services exist and there is no priority for future development. No priority in the context of multi- and bilateral donor cooperation. 	
Meteorology	<ul style="list-style-type: none"> Basic meteorological services exist for providing daily weather forecasts. 	<ul style="list-style-type: none"> Basic meteorological services exist; bulletins for seasonal weather forecasting are being published. 	<ul style="list-style-type: none"> Basic meteorological services exist and improvement is planned. 	
Agriculture	<ul style="list-style-type: none"> The agricultural sector is considered the main driver of growth for Benin, with substantial employment and income arising from farming (mostly cotton). 	<ul style="list-style-type: none"> Benin's economy is primarily based on agriculture which is mainly rain-fed. Climate change therefore has important impacts on the agricultural sector. 	<ul style="list-style-type: none"> Several relevant meteorological services are offered and planned to be developed. Relevant standards exist, but implementation lacking. Agriculture is one of three priority areas for BMZ in Benin. 	
Water	<ul style="list-style-type: none"> The further development of the water sector is a priority area for the government of Benin. Steady and ongoing progress has been experienced in improving the population's access rate to safe drinking water. However, many challenges persist concerning improvements in sanitation infrastructure. 	<ul style="list-style-type: none"> With very little research available, the results from existing studies reveal that the pressure on Benin's water resources might increase, leading to greater competition for surface water. 	<ul style="list-style-type: none"> Some relevant testing laboratories exist. There is a need for expansion of services and support in implementing quality management systems. Relevant standards exist, but implementation is lacking. Water and sanitation is one of three priority areas for BMZ in Benin. 	
Human Health	<ul style="list-style-type: none"> Ongoing improvement in the country's health care indicators and improvement in health care efficiency and cost. The focus of the Ministry of Health is on reducing preventable deaths among vulnerable populations in Benin. 	<ul style="list-style-type: none"> There is an emphasis on the country's overall approach to dealing with the high prevalence of malaria and subsequent high number of malaria morbidity and mortality. Climate change is expected to undermine successes made so far in reducing the number of malaria cases. 	<ul style="list-style-type: none"> New regulation for blood pressure meter verification is planned. Important testing capacities for food safety and public health are lacking. 	
Status of relevance/priority/opportunities		High	Medium	Low

Table 26: Relevance, priorities and opportunities for quality infrastructure development in relation to climate change in Benin

Services and regional trade contribute the largest part of GDP because of Benin's geographical location as a coastal country in the centre of Western Sub-Saharan Africa. Benin's industrial sector is not particularly well developed and focusses mainly on cement production, cotton ginning and wood processing (BMZ 2017).

Evidence of climate change in Benin

Effects of climate change and relevant hazards

In addition to being susceptible to multiple exogenous shocks, including in terms of trade shocks (cotton and oil prices) and developments in its neighbouring countries, Benin is also vulnerable to climate change. Available evidence suggests that the most certain manifestation of climate change on precipitation is an increase in variability while the directions of changes are much more uncertain.

Medium-term climate projections for the country's territory indicate important risks of insufficient levels of rain, increased evapotranspiration and more rainfall variability from one year to the next. Therefore, droughts are more likely to become more and more intensive (UNDP 2017).

These predicted changes in climate, despite uncertainties, are likely to have an impact on farmers who engage in subsistence or rain-fed agriculture, the landless who are usually dependent on on-farm labour opportunities and female headed households (UNDP 2017).

Additionally, coastal areas are expected to experience a sharp rise in sea level. The latter is expected to threaten the people living along the coast where both income and population density is higher than in other parts of Benin. Both biophysical and socioeconomic vulnerability is high due to limited adaptive capacity (MER 2015:1). The continued advance of the sea, coastal erosion and the rise in sea level, exacerbated by human activity on the coast, have medium- and long-term consequences which are already threatening vulnerable communities and disrupting the least-protected sensitive ecosystems (UNDP 2017).

Given these facts, the Government of Benin has identified droughts, floods, sea-level rise and late and violent rains as the main climatic risks (Dossou 2009).

Impacts of climate change on different areas

Climate change is expected to have severe consequences on Benin's socioeconomic development situation and on the environment. The expected impact of climate change, especially the projected rise in temperature and rainfall is likely to intensify the challenges already faced by the agriculture and other sectors, including (regional) services, trade and transport.

Agriculture and food security: Benin's economy is primarily based on agriculture which is mainly rain-fed. Climate change therefore has important impacts on the agricultural sector. Agro-climatic parameters are constraining for the agricultural and forestry sector, especially in the southwest and in the far north, regions which suffer frequent droughts. Rainfall has generally decreased over the past decades, leading to a reduction in the length of the agricultural season. Rainfall regimes and agricultural production systems are therefore modified.

Water: Few studies exist so far on how the water sector will be impacted by climate change in Benin. A study conducted by Höllermann et al. (2010) suggests that, generally, annual water availability per capita far exceeds the critical threshold of about 1,700 m³. But during the dry season, water scarcity occurs at the local scale. By aiming at analysing Benin's future water situation under different scenarios of socio economic development and climate change until 2025, results from the study show that the pressure on Benin's water resources will increase, leading to greater competition for surface water. Furthermore, financial and technological constraints hinder satisfactory development and exploration of groundwater and reservoir resources. The study concludes that improvements are most needed, especially in rural areas.

Energy: Climate-induced pressures negatively impact the energy sector in Benin. As average temperatures rise, the demand for electricity is increasing – as more intensive and longer use of air conditioning, ventilation and refrigeration are needed. Coupled with inefficient household and commercial equipment and the inefficient lighting of buildings, there are critical imbalances in the energy sector (UNDP 2017) which will be further aggravated by climate change.

Human Health: While the overall impact of climate change on human health in Benin has not been the focus of many analyses yet, Dossou (2009) describes in a study about ma-

laria in Cotonou how the disease may mutate and increase in the future due to climate change. The author describes how malaria constitutes a major public health problem in Benin where the disease occurs all year round. Malaria is particularly prevalent in areas subject to flooding and one immediate consequence of an increase in flood frequency is an increase in mortality due to malaria. Malaria is the cause for 34% of medical consultations and 20% of hospital admissions. It is the principal cause of mortality in Benin, causing more than 1,000 deaths per year.

Additionally, the economic implications of malaria for Benin are enormous. With climate change predictions suggesting temperature increases of between 1–2.5°Celsius by the year 2100, an increase in temperature could lead to the expansion of ecological zones suitable for the Anopheles mosquitoes, which carry malaria. Malaria therefore needs to be considered with special caution when analysing climate change impacts on human health in Benin.

Institutional and policy framework for climate change adaptation and mitigation

The Government of Benin takes a proactive and comprehensive strategic approach for responding to the forecasted impacts of climate change. Climate change is a major development concern for Benin due to its impacts on human health, food security, economic development, physical infrastructure and water resources. Benin's climate action plan – including the Intended National Determined Contributions (INDC) – was submitted to the UNFCCC ahead of the COP21 Paris Agreement (UNFCCC 2017).

The Ministry of Environment, Climate Change Management, Afforestation and Protection of Natural and Forest Resources (Ministère de l'Environnement Chargé de la Gestion des Changements Climatiques, du Reboisement et de la Protection des Ressources Naturelles et Forestières) of Benin is in charge of developing and coordinating the national climate change action plan. Besides the National Adaptation Programme of Action (NAPA) and the country's Intended National Determined Contributions, a national strategy which is called "Stratégie nationale de renforcement des ressources humaines, de l'apprentissage et du développement des compétences pour favoriser un développement vert, faible en émissions et résilient aux changements climatiques" has been adopted by the Government of Benin in 2013 with the aim to develop necessary skills and knowledge to effectively respond to the challenges posed by climate change.

Key sectors in which climate change-related initiatives have been and will be further developed primarily include agriculture, energy, water resources, forestry, human health and coastal zone management so far.

Climate change mitigation

In line with the Benin National Adaptation Programme of Action, the Government of Benin has started the promotion of renewable energies and high-performance economical homes, particularly in areas vulnerable to climate change and where lands are highly eroded (UNDP 2018).

This is also in line with the government's focus on improving the overall energy supply system, the quantity and the quality of energy sources and on enhancing the efficiency of energy supply and demand in Benin, "Strengthening the Resilience of the Energy Sector in Benin to the Impacts of Climate Change", a joint programme initiated by the Government of Benin and United Nations Development Programme, aims at enhancing the human, institutional and regulatory capacity for better planning and management of the energy resources; to increase the production, transport and distribution of the different forms of energy; and to improve poor rural access to energy. The main objective of the programme is to reduce the impacts of climate change and variability on Benin's energy sector (UNDP 2017).

Climate change adaptation

Based on the National Adaptation Programme of Action, first approaches for dealing with adaptation to climate change have been implemented in Benin for during the last few years. Priority sector-driven adaptation projects so far include, among others (UNDP 2017):

- Mobilization from surface waters in order to adapt to climate change in vulnerable areas in the centre and the North of Benin;
- Implementation of a climatic risk forecast and alert system for food security in four agro-ecological areas across the whole country area;
- Protection of the coastal area to counter the rising of sea level.

Overall then, the integration of adaptation into the agricultural sector will be crucial for reducing the vulnerability of the sector. Commissioned by GIZ, a five-year pilot project on "Adaptation of the agricultural sector to climate change in Benin" was launched in 2014 (GFA 2015).

The project intervenes in three neighbouring communities of the Pendjari National Park and the National Park W, where the impacts of climate change constitute a considerable burden on municipalities and their capacities to manage natural resources. The objective of the project is to strengthen relevant actors from governmental partner organizations, municipal authorities, the private sector, civil society and local producers in planning and adapting climate sensitive measures directed towards the sustainable management of watersheds.

However, it is apparent that adaptation to climate change has not yet been covered by a centrally located and efficient joint coordination and implementation mechanism. Many projects and initiatives still remain on a piloting level, in order to contribute to the knowledge basis of the Government of Benin for developing a clearer course of action over the mid- to long-term.

Multilateral and bilateral cooperation activities

Based on the National Adaptation Programme of Action of Benin, multilateral organizations and bilateral agencies have been working on supporting Benin's response to challenges posed by climate change.

Multilateral cooperation

United Nations Development Programme (UNDP): Among other areas of dedication, UNDP is working with the Government of Benin to ensure that a new tranche of USD 4.45 million is used to mainstream adaptation into broader development frameworks, reduce vulnerability to climate change and diversify and strengthen livelihoods and sources of incomes for vulnerable people in Benin. In this context, the "Strengthening the Resilience of Rural Livelihoods and Sub-National Government System to Climate Risks and Variability in Benin" project will work to ensure that climate change and gender are included in development plans and budgetary processes, improve agricultural infrastructure and human capacity to cope with changing rainfall patterns and diversify income-generating activities on the community level (UNDP 2017).

World Bank Group (WBG): In Benin, the World Bank particularly supports the country's poverty reduction strategy to increase growth, improve basic service access, governance and institutional capacity building. In its current project portfolio with Benin, the World Bank supports projects related to energy service improvement, agri-

cultural productivity and food health nutrition and rural and small town water supply and sanitation (World Bank 2017).

Bilateral cooperation

The Federal Republic of Germany has enjoyed excellent relations with the Republic of Benin since the West African country gained its independence in 1960.

Benin is one of the development partners with which Germany cooperates closely on the basis of intergovernmental agreements. Germany is one of Benin's main donors. At the government negotiations in September 2016, Germany pledged a total of EUR 69.9 million for development cooperation with Benin for the period 2017 to 2019. Of this, EUR 25 million was designated to financial cooperation and EUR 43 million for technical cooperation. In 2015, an additional EUR 12.9 million was made available to modernize a hydropower station and to secure funding for the Pendjari Biosphere Reserve. A further EUR 1.9 million were provided for programmes within the special initiative "One World – No Hunger".

Agreement was reached with the Government of Benin to continue working in the following priority areas of development cooperation:

- Decentralization and municipal development
- Agriculture
- Integrated water resource management, water supply and sanitation.

In addition to these priority areas, Germany is also engaged in the fields of macroeconomic advisory services, primary education and energy supply.

German Society of International Cooperation (GIZ): GIZ operates in more than 10 locations throughout Benin, with their head office being located in Cotonou. In line with German priority areas of development with Benin, GIZ focusses its work on three priority areas, i.e. a) decentralization and municipal government (good governance), b) agriculture and adaptation to climate change (including activities under the BMZ special initiative "One World – No Hunger") and c) rural/urban water supply and sanitation, including integrated management of water resources. Other fields of activity include supporting Benin's Development Ministry in implementing the national poverty reduction strategy and building the capacities of

the Ministry of Preschool and Primary Education and the education authorities to improve learning opportunities for the country's young people. GIZ participates in a regional programme to expand the West African electricity market and provides funding to supply rural areas with electricity from renewable sources under the Energising Development initiative (GIZ 2017).

German Development Bank (KfW): KfW supports Benin with regard to its water supply, rural development, education and the decentralization of administrative structures (KfW 2017).

3. Analysis of thematic focus areas

Renewable energies and energy efficiency

Energy consumption in Benin is characterized by a heavy dependency on wood and a substantially low level of access to electricity (28 % in 2012) and modern energy sources for cooking such as gas and kerosene. In 2010, the percentage of wood energy consumption, i.e. firewood and charcoal, was 77.5 % of the total energy consumption in households, while kerosene had a share of 20.3 %, electricity of 1.8 % and gas a share of 0.4 %.

In 2010, national consumption of wood was about 6.25 million tons; however, in that year there was a sustainable production of just 4.5 million tons. This has led to pressure on the supply of wood resources in the central and northern parts of the country, especially in urban areas where population growth is relatively high. Vast expenses are therefore made on common energy sources such as kerosene, petrol, candles and batteries. A household without electricity can spend an average of 20 % of its income on energy.

At the national and sub-regional level, renewable energy production is marginal or even non-existent. Yet the potential of photovoltaic solar energy is very high in Benin. In fact, sunlight is abundant and ranges between 3.9 and 6.1 kWh/m²/day.

Meteorology

In Benin, the institution in charge of meteorological services is the Agence Nationale de la Météorologie (Météo-Bénin), which plays a key role for monitoring weather and climatic data in the country.

Concerning climate change, the main task of Météo-Bénin is to “regarder l’avenir en face” (“facing the future head on”), mainly by taking a close look at a couple of meteorological signals including temperature, dry spells and precipitation/rainfall levels (acotonou 2016). The agency publishes periodic and seasonal climate forecasts which are then disseminated through local radio stations and published by national news agencies (Adaptation Insights 2010).

Generally, it remains clear that meteorological services as a whole need to become more efficient and effective in order to contribute meaningfully to the country's response to climate change. Moreover, even though some pilot projects have been implemented over the past couple of years (e.g. UNDP has financed a project on developing a sub-regional climate risk forecast and early warning for the farming population), the meteorological sector of Benin has not yet been the subject of much discussion in the framework of Benin's climate change strategy.

Water

Among recent development successes of Benin is the country's steady and ongoing progress in improving the population's access rate to safe drinking water. By 2015, the Government of Benin had successfully achieved its target access rate of 73 %: By then, 85 % of the population in urban areas and 72 % in rural areas had access to drinking water. The same cannot be said for sanitation, however: With an access rate to sanitation services of just 36 % in urban areas (3 % in rural areas) in 2015, Benin failed to reach its 2015 target of 69 % (UNWATER 2017).

With the adoption of the National Water Policy in 2009, which was combined with Benin's Growth Strategy for Poverty Reduction, the sector has become more structured. Water supply and sanitation are identified as priority sectors within Benin's Poverty Reduction Strategy Paper. The implementation of a sector-wide approach, the adoption of clear and focussed policy and strategy documents as well as the development of multi-year investment plans for water supply have contributed to a considerable improvement in the sector (WSP 2015). However, it is clear that greater effort is still required in the sanitation sector, which should be considered a priority in the near future.

Agriculture

Agriculture is the second most important pillar of Benin's economy. It makes up one third of the GDP. Cotton is the most important export crop. However, Benin is only a minor player in the global cotton market. The country's cotton farmers have hardly any hope of competing with the large, highly subsidized producers in other countries. The sector also faces problems within Benin itself, for instance when it comes to treating and processing raw cotton.

Despite the given challenges, it is especially the agricultural sector which has potential for poverty reduction in the country. That is why the government has developed an agriculture strategy with the main goal of boosting performance in the agricultural sector. The cotton industry in particular, which is so important for Benin's economy and which has seen earnings fall over the last few years, is set to be reinforced in the future and reformed with the involvement of the private sector (BMZ 2017).

Human Health

Until the late 1980s, less than 30% of the population of Benin had access to primary health care services. Consequently, Benin had one of the highest death rates for children under the age of five in the world: Its infant mortality rate stood at 203 deaths for every 1000 live births.

The Bamako Initiative changed that dramatically by introducing a community-based health care reform, resulting in more efficient and equitable provision of services (WHO 2017). However, Benin still has one of the highest rates of maternal mortality in the world (WHO n.d.). Additionally, malaria remains a problem in Benin where it is a leading cause of morbidity and mortality among children younger than five years.

Starting from the 1990s onwards, a comprehensive approach strategy was developed and extended to all areas of health care, with subsequent improvement in the health care indicators and improvement in health care efficiency and cost. In this context, Benin's five-year health strategy for 2015–2020 is focussed on reducing preventable deaths among vulnerable populations in Benin (Malaria.com 2017). The focus of the Ministry of Health is scaling up health interventions which reduce avoidable deaths and address maternal, newborn and juvenile health challenges.

Emphasis needs to be put on the country's overall approach to dealing with the high prevalence of malaria and the subsequent high number of malaria morbidity and mortality throughout the country. In this regard, the Ministry of Health aims at combining prevention and treatment activities, including bed net distribution and social marketing; case management of simple and complicated malaria in young children; intermittent prevention of malaria in pregnant women; and improved malaria diagnosis with both microscopy and rapid diagnostic tests. Additionally, international donor funding also supports the National Malaria Control Programme in implementing reforms which improve the health commodity supply chain system.

4. Quality infrastructure services in relevant areas

Quality policy, regulation and important institutions

Until recently, Benin's quality infrastructure was regulated by several laws, empowering distinct organizations to carry out the related services in the country. In January 2017, the National Agency for Standardization, Metrology and Quality Control (Agence Nationale de Normalisation, de Metrologie et du Contrôle Qualité – ANM) was established through Decree n°2017- 031. The ANM replaces the previously established Agency for Standardization and Quality Management of Benin (Agence Béninoise de Normalisation et de Gestion de la Qualité – ABeNOR), which was created in November 2010, as well as the Metrology and Quality Control Agency of Benin (Agence Béninoise de la Métrologie et de Contrôle de la Qualité – ABMCQ), which was formed in 2015 (République du Bénin 2017a, 2010, 2015).

Altogether, the ANM is comprised of four separate departments operating in the fields of metrology, standardization, inspection and control services and the administration of the organization (Interview 1). ANM is placed under the Ministry of Industry, Commerce and Craft (République du Bénin 2017a). The organization has 75 employees, of which 37 are financed by the state and 38 are paid with the organization's own revenue. At the moment, the organization meets its expenditures mainly through its earnings from metrology services offered and to a lesser extent through the provision of standardization services (Interview 1).

Quality infrastructure status	Metrology	Standardization	Testing	Certification & inspection	Accreditation
Renewable energy					
Energy efficiency					
Meteorology					
Agriculture					
Water					
Human health					

Quality infrastructure development status	High	Medium	Low	No information

Table 27: Development of quality infrastructure in relevant sectors

Currently, a decree on a National Quality Policy is being finalized (Interview 1). Moreover, quality issues are addressed in regulations for many sectors, including the ones treated in this study:

- The energy sector is governed by the Benin Rural Electricity and Energy Control Agency (l'Agence Béninoise d'Electrification Rurale et de Maîtrise d'Énergie – ABERME), which is placed under the Ministry of Energy and has been created by decree in 2009 to regulate rural electrification, energy control and consumption (République du Bénin 2001, 2017b, 2009).
- With regards to agriculture, a study carried out by the World Bank in 2015 suggested that the adoption of an agricultural quality strategy in line with the regional quality policy defined in the Economic Community of West African States (ECOWAS) would be recommendable. Decree n° 2017-101 recently established the Territorial Agencies of Agricultural Development (Agences Territoriales de Développement Agricole – ATDA) to promote Benin's agriculture.
- Regarding water, Decree n° 2001-094 defines the quality requirements for drinking water in Benin.

Metrology

As mentioned in the previous section, ANM is responsible for metrology in Benin (ANM 2017a). Currently, there are no secondary calibration laboratories in the country (Interview 1). ANM is a member of the West-African Metrology Secretariat (Secrétariat Ouest-Africain de Métrologie

– SOAMET), and as such is a member of the Intra-Africa Metrology System (AFRIMETS) (AFRIMETS 2017). Moreover, ANM is a corresponding member of OIML (OIML 2017) but is not yet a member of the BIPM (BIPM 2017). In the development of metrological capacities, ANM has collaborated with the national metrology institutes of Germany and Turkey. Currently, collaborations with Tunisia and South Africa are considered (Interview 1).

ANM provides metrological services for mass, temperature, pressure and volume. The mass calibration laboratory (Laboratoire d'Étalonnage des Masses – LEMA), has been accredited by the French Accreditation Committee (Comité Français d'Accréditation – COFRAC) in accordance with ISO 17025 (ANM 2017b). It is planning to also become accredited for temperature and pressure. The procedures for quality management are in place and contacts are being established to carry out intercomparison measurements. So far, however, no such measurements have taken place. Beyond this, ANM plans to develop capacities in the areas of dimensional metrology, force and pH. In legal metrology, a focus lies on the verification of tank trucks, tanks and containers (Interview 1).

For the thematic areas considered in this study, the following priorities and developments are of interest:

Energy efficiency and renewable energies

Recently, a test bench for electricity meters was installed at the electricity laboratory of ANM with the support of PTB (Interview 2). This creates a basis for future activities in the areas of energy efficiency and renewable energies.

Meteorology

In the field of meteorology, existing services in temperature are of relevance. However, no information about the use of existing services or a possible collaboration between the ANM's metrology department and the National Metrology Agency (Agence Nationale de la Météorologie – Météo-Bénin) could be retrieved.

Agriculture

The development of metrological services for the agricultural sector is viewed as a priority at the moment. Especially quality assurance for fish, cotton, cashews, shea, soy and pineapple products is crucial for the local economy (Interview 1). The existing metrological services in mass, volume, temperature and pressure, as well as the planned services for pH and force are relevant for agricultural products and their processing.

Human health

With regards to health, it is planned to provide verification of blood pressure meters. A new technical regulation is under discussion with the respective ministry (Interview 1).

Standardization

ANM's standards department is the National Standardization Body of Benin. It actively participates in standards development at the regional level within the ECOWAS Standards Harmonization Model (ECOSHAM). Moreover, it is a member of the ARSO (ARSO 2017), the Standards and Metrology Institute for Islamic Countries (SMIIC) and of the ISO. Within ISO, Benin is a participating member in the ISO/PC 305 Committee of Sustainable non-sewered sanitation systems and has observer status in the ISO/TC 34 Committee of Food Products. Benin further has observer status in the Policy Development Committee on developing country matters (ISO/DEVCO) (ISO 2017).

Over 200 national standards exist. They are published in the national standards catalogue. The majority of the national standards are of interest for the agricultural and water sectors. Eighteen standards are currently under revision. Standardization is carried out in line with harmonization efforts among the ECOWAS member countries (Interview 1). Regarding the sectors selected for this study, specific information regarding agriculture and health could be gathered:

Agriculture

As is the case for metrology, the main focus for standardization lies on agricultural primary products such as shea, cashews, pineapple and poultry farming (Interview 1). A study by the Food, Agriculture and Natural Resources Policy Analysis Network carried out in 2012 addressed standards in the area of post-harvest losses and found that several standardization challenges remain due to inadequate coordination between different actors in the creation of the necessary policy framework, in standards development itself and in the application of existing standards by industry or farmers (Anihouvi et al. 2014).

Human health

For the health sector, some standards are developed directly by the National Directorate of Public Health (Direction Nationale de la Santé Publique – DNSP) under the Ministry of Health (Interview 1).

Testing

Several bodies offer testing services in Benin. Most testing services are focussed on the agricultural sector. However, available testing services do not always deliver reliable results and only a few tests are accredited by an internationally recognized accreditation body. Currently, Benin has three accredited testing laboratories, one of which offers services for the agricultural sector, while the other two offer services for civil engineering (COFRAC 2016). Some international organizations support the accreditation of testing laboratories. However, it is difficult for laboratories to maintain and renew their accreditation without help since the laboratories do not have the necessary financial resources to cover the renewal costs of the accreditations (Osseni et al. 2015). A laboratory association or network which could support individual laboratories does not exist (Interview 1).

The National Food Safety Agency (Agence Béninoise de Sécurité Sanitaire des Aliments – ABSSA) is worth mentioning. It was established in 2012 through Decree n°2011-113 (République du Bénin 2012), has several laboratories, among which the Central Laboratory of Food Safety Control (Laboratoire Centrale de la Sécurité Sanitaire des Aliments – LCSSA) and is present throughout Benin. It is a state-funded organization with over 250 employees (Interview 1). ABSSA carries out seed and plant analyses, physical-chemical analyses, contaminant control (e.g. pesticides, DDT, heavy metals), toxin control (e.g. mycotoxins and aflatoxin), input control, food control and

market and restaurant control (see section on “Inspection” below) (République du Bénin 2012).

Additionally, private laboratories operate in specific market niches. The Regional Institute of Industrial Engineering, Biotechnology and Applied Sciences (IRGIB-Africa), for example, focusses on petroleum and food products (Interview 1).

With respect to the focus areas of the study, the following observations can be made:

- *Energy efficiency and renewable energies* are currently not a focus area for quality infrastructure in Benin. The Agency for Control of Interior Electric Installations (Agence de Contrôle des Installations Électriques Intérieures – CONTROLEC) carries out tests to ensure the safety and quality of electrical and electronic equipment. Additional capacities in these fields exist mainly at universities. It should be noted, however, that several projects are currently being developed. In the second phase of the project carried out by the Millennium Challenge Corporation of the United States, the installation of a laboratory for air conditioners and refrigerators at ANM is planned. Moreover, a laboratory to enable the development of renewable energies is considered within the framework of a collaboration project with the European Union (Interview 1).
- Several important services for the agricultural sector and for assurance of food safety are lacking or need to be improved, e.g. testing for bromate, vitamin content or heavy metals.
- Regarding the water and human health sectors, there are currently no accredited water testing laboratories in Benin. However, within the framework of an ongoing project of the GIZ (German Society for International Cooperation), the accreditation of the laboratory for drinking water analysis of the Ministry of Health is being pursued (Interview 3). The Benin National Drug Quality Control Laboratory (Laboratoire National de Contrôle de la Qualité des Médicaments – LNCQ) received equipment for high pressure liquid chromatography by USAID in February 2017 (Ahouansè 2017).

Certification and inspection

Next to ANM, the most relevant public inspection bodies are run by the following institutions:

- The National Food Safety Agency (Agence Béninoise de Sécurité Sanitaire des Aliments – ABSSA)
- The Directorate of Fishery (Direction de Pêche – DP)
- The Directorate of Hygiene and Sanitary Base (Direction de l’Hygiène et de l’Assainissement de Base – DHAB)
- The Directorate General for Trade (Direction Générale du Commerce – DGC)
- The Directorate General for Industry Development (Direction Générale du Développement Industriel – DGDI)
- The Agency of Air Navigation Security of Africa and Madagascar (Agence pour la Sécurité de la Navigation Aérienne en Afrique et à Madagascar – ASECNA) is responsible for the analysis of air traffic, telecommunication and aviation meteorology of Western Africa and Madagascar.

Because of lacking resources, equipment and capabilities, in many cases the inspection bodies mentioned above cannot perform their missions properly and often rely on only visual inspections. This leads to a lack of faith in the reliability of the organizations and to difficulties in receiving accreditation (World Bank 2015).

ANM is defined as the national certification body of Benin. The process of preparing the organization for an accreditation is being supported as part of an ECOWAS programme. For certification, collaborations with Tunisia and Morocco are planned (Interview 1).

ABSSA and the Department of Animal Husbandry of the Ministry of Agriculture, Livestock and Fisheries test food products and issue certifications for import and export (International Trade Administration 2016).

Accreditation

Benin does not have a National Accreditation Body. Accreditation, among other things, is currently performed by the French Accreditation Body COFRAC. Collaborations with Tunisia and Morocco, especially for the accreditation of certification bodies are planned (Interview 1).

Benin is involved in the process of creating an ECOWAS accreditation system. In May 2017, a scheme was approved with the plan of establishing two organizations in the ECOWAS region responsible for accreditation: one for the Anglophone and one for the Francophone countries of the region (Interview 1).

Quality assurance in the WAEMU and ECOWAS

Benin is part of the West African Economic and Monetary Union (WAEMU, it is also known by its French acronym, UEMOA), which brings together eight West African countries. The union uses French as a working language and supports among other things quality infrastructure in the region. With regulation No. 01/2005/CM/UEMOA, the member countries defined a quality infrastructure scheme with the intention of harmonizing quality infrastructure related activities in the region. The following regional quality infrastructure institutions have been established within the WAEMU (UEMOA 2005):

- The West-African Secretariat for Metrology (Secrétariat Ouest Africain de Métrologie – SOAMET) is the association of national metrology institutes of the WAEMU and a member of the continental metrology institution AFRIMETS
- The Regional Secretariat of Standardisation, Certification and Quality Promotion (Secrétariat Régional de la Normalisation, de la Certification et de la Promotion de la Qualité – NORMCERQ) is responsible for the harmonization of standards and conformity assessment
- The West-African Accreditation System (Système Ouest Africain d'Accréditation – SOAC) is responsible for accreditation (Osseni et al. 2015).

Moreover, Benin is part of the Economic Community of West African States (ECOWAS), which brings together 15 countries in the region and fosters regional integration (ECOWAS 2017a). Quality infrastructure harmonization is also an important topic within this larger community. A regional organization tasked with the harmonization of standards already exists in the

form of the ECOWAS Standards Harmonization Model (ECOSHAM). Moreover, in April 2017, the region's Ministers of Industry signed a decree on the adoption of the West African Quality System (WASQ) within ECOWAS. The creation of the WASQ is supported by UNIDO and the European Union (Interview 2). The system will be in operation in all three regional languages (English, French and Portuguese) and is planned to comprise the following institutions:

- The Community Quality Counsel (CCQ) will advise the ECOWAS Commission on quality-related issues
- The ECOWAS Quality Agency (ECOWAQ) will be the independent executing agency which implements decisions of the CCQ
- The Regional Accreditation System (RAS) will be responsible for accreditation in the region and provide accreditation services in English and French
- The Community Conformity Assessment Committee (CCAC) will support the harmonization of services provided by national conformity assessment bodies
- The Community Committee for Metrology (CCM) shall provide the definition and implementation of a community policy on metrology, which aims to reach international levels. (ECOWAS 2017b)

However, it is still unclear how the organizations will be set up and financed. Also, the interconnections with national quality infrastructure institutes and sub-regional organizations still need to be defined (Interview 2).

The meeting of Ministers in charge of industry and agriculture of ECOWAS member states also signed an agreement on the industrial development of cashews and cocoa in April 2017. It encourages the promotion of the products' agricultural value chains through the regional quality infrastructure (ECOWAS 2017c).

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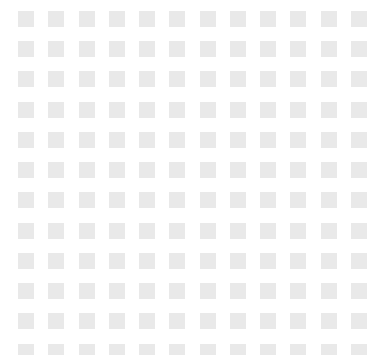
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