

COUNTRY REPORT FOR BENIN REPUBLIC

By Geofery Luntsi



Fig. 1.1: The Flag for the Republic of Benin

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1.0: General Country Profile for Benin.

1.1: Background

The Republic of Benin is a francophone country in the West African region, formerly called the Republic of Dahomey at independence on 1st August, 1960 (1). It is bounded in the South by the Bight of Benin, in the Gulf of Guinea, which is north of the Atlantic Ocean, with a coastal line of 121 km long, in the West by Togo, up North by Burkina Faso and Niger and in the East by Nigeria (World Bank Group, 2009, Turner, 2012). The Republic of Benin has an area of 114,763 km², with a population of 9 million people (est. 2012), with the majority of the population living in the coastal region, with Porto-Novo as the capital of the country and also the largest city, with Cotonou being the major port and the cultural and political center of the country (1,2,3).



Fig. 1.2: Political Map of the Republic of Benin

The map shows Benin and the surrounding countries with international borders, provinces boundaries, the national capital Porto-Novvo, Pendjari National Park, provinces capitals, major cities, main roads, railroads and airports.

1.2: Geography and Population.

The Republic of Benin is a West African country located in the inter-tropical zone between the Equator and the Tropic of Cancer. It is stretched in latitude and extends over a surface area of

114,763Km². The average altitude is 200m. Because of its location in the inter-tropical area, Benin has a hot and wet climate with average temperatures of 25°C, which is highest in March and lowest in August, with the mean annual rainfall ranging from 700 mm (North) to 1500 mm (South-East) (1,2,3). Benin has a low-lying, sandy, coastal plain, with many lakes in the south, while the north consists of high plateaus with altitudes ranging from 20m to 400m, with rivers running from the north to south draining into the Ocean.

The remaining topography is flat lands scattered with some hills, extending from the Togo Mountains, the highest elevation in Benin is Mount Sokbaro with 658m, located almost in the middle of the country. The Pendjari National Park is located in the northwest of the country adjoining the Arli National Park in Burkina Faso. The parks are known for their rich wildlife, the parks and game reserves are, together with adjoining Nigeria National Park, designated as Protected Areas of the International Union for Conservation of Nature (IUCN) (1,2).

1.3: Main Rivers in Benin include

Alibori river, Alpouro river, Kouffo (Couffo) river, Mékrou river, Mono river (border river), Niger river (border river), Okpara river, Oti river, Ouémé river, Pendjari river, Sota river, Tassiné river and Zou river (1,2).

1.4: History and Culture

The Republic of Benin has one of the oldest democracies in Africa, since its independence on 1st August, 1960 and named Dahomey, until 1975 when the name was changed to the Republic of Benin (République du Bénin in French). Dahomey was a well-organized and very powerful state

from the 17th century, trading extensively in slaves through the port of Whydah with the Portuguese, British and French (1).

In the late 80s, Benin faced a harsh political and economic crisis due to the collapse in the banking system and a drop in Government incomes. This crisis led to change in policies and administrative reforms characterized by the adoption of economic liberalism and a democratic structure. Since December 11, 1990, the country adopted a Constitution that made provisions for a presidential regime and assembly elected through universal suffrage that allowed the institution of human rights and gradual implementation of the rule of law. The administrative organization of the Republic of Benin has been decentralized into 12 regions since January 15, 1999, in accordance with Law No 97-028. These include: Alibori, Atacora, Atlantique, Borgou, Collines, Couffo, Donga, Littoral, Mono, Ouémé, Plateau, and Zou. These regions are also divided into 77 communes, among whom three have a particular status, including Cotonou, Porto-Novo and Parakou. The 77 communes are further subdivided into 546 arrondissements which are composed of around 3743 villages and neighborhoods, the villages are the smallest administrative units in a rural constituency (1,2).

1.5: Government and the Legal system

The state's monopoly on the use of force is well established nationwide and there are no rebel groups active inside or outside the national territory. Few cases of conflicts are reported between herders and farmers, especially in the rural areas, particularly in the lower Ouémé Valley and in the Niger Valley, which hosts trans-human migrants from Niger and Nigeria (4). Crime and

criminality are insufficiently addressed as armed robbers are occasionally reported by road users, despite government efforts to fight crime and criminality that lead to the merger in January 2018 of the police and gendarmerie to form a larger force called the Republican Police. Benin has also been involved in the regional security by joining forces with neighboring countries like Nigeria, Niger, Cameroon and Chad to fight against Boko Haram. The government recently established a National Commission to Combat Radicalization, Violent Extremism and Terrorism (CNLRET).

There is no discrimination based on ethnic, religious or cultural grounds, and the legitimacy of the republic is not questioned in principle. There is no dominant group that is identified as the core group of Benin's heterogeneous society. However, there is a strong historical divide between the northern part of the country (mainly the provinces of Atakora, Alibori, Borgou and Donga) and the southern provinces of Zou, Atlantique and Ouémé. This is because before colonialism, the latter used to belong to the kingdoms of Dahomey (Zou and Atlantique) and Porto-Novo (Ouémé). Both kingdoms were heavily involved in a slave trade and were politically favored in colonial times; they were at odds with each other. As a result, post-colonial Benin was politically divided into three parts representing internally heterogeneous communities (3,4,5)

Elections in Benin have been described as free and fair since 1990. The electoral administration is independent, however, not properly disorganized. The Autonomous National Electoral Commission (CENA), which was initially appointed temporarily, was turned into a permanent body in 2014. CENA successfully organized and conducted parliamentary elections in 2015 and presidential elections in 2016. Concerns have been raised regarding voter's registration since the introduction of a permanent and computerized electoral roll (LEPI) in 2013. A Council of Orientation and Supervision and a center for the treatment of biometric electoral data have been

created and were transformed in March 2017 into a National Processing Agency (ANT) which is administratively attached to the civil cabinet of the president. Limited financial resources have slowed the process of updating the list, often resulting to organizational problems and tensions between government and the oppositions (3,4,5).

Benin is known to have one of the most stable democratic systems in West Africa (4). The democratic institutions function well, at the national level, although progress has also been made at the regional and local level. The overall performance of the administrative and judicial systems is not always efficient due to general administrative weakness and the aforementioned lack of resources (3,4,5).

1.6: Socioeconomic Development

Benin has experienced some sustained economic growth over the past few years; however, it is still rated far from achieving sustainable poverty reduction. It is one of the least developed countries of the world with a per capita income of \$770 in 2016 (ranked 163th out of 188 countries with a value of 0.515 on the Human Development Index 2017). Benin exhibits social marginalization that is quantitatively and qualitatively extensive and structurally ingrained (inequality-adjusted HDI at 0.3). Some social indicators like; primary school enrollment; life expectancy at birth for both sexes between the period of 2000 to 2012 has improved significantly (1,3-5). Statistics still show that the majority of the population still live in abject poverty which has reportedly increased since 2011, with a proportion of the population living on \$1.90 per day in purchasing power parity (PPP) was estimated at 59.9% in 2015. This proportion with a threshold of \$1 per day in PPP was 53.9% in 2011 compared to 40.8% in 2009 and 51.6% in 2007. The Gini index rose from 47.2 in 2007 to 46.3 in 2009 and 47.8 in 2015.

It is also important to note that development is unequally distributed across the regions, with the urban and coastal areas benefiting more from development than rural areas. Leading to high internal migration and increased dissatisfaction among underprivileged people and unemployed young University graduates. The majority of the population are engaged in a subsistence economy with an estimate of 90.4% of the active population engaged in the informal sector. Gender inequality is also deficient, with the country scoring 0.611 in the 2017 Gender Inequality Index (ranked 146th out of 189 countries) (1-5).

Benin has strengthened its basic institutional framework for market competition over a few years ago, it has continually improved its ranking of the World Bank's Doing Business Report. Benin has been among the top 10 reformers since 2015 and improved its aggregated ranking further to 153 out of 190 countries in 2019. Starting a business takes eight days and five procedures with a cost of 3.5% of gross national income per capital. The Starting a Business score is 90.6 out of 100 (ranked 61st out of 190 countries). This recent improvement is due to a series of initiatives by the government in 2017 and 2018, which established a one-stop shop for starting or registering a business, resolving insolvency, transparency or dealing with construction permits and fair tax registration on property (4,5).

The informal sector dominates the business environment, there has been some remarkable expansion of the formal private sector in the last two decades, with persistent challenges such as access to finance, corruption and unfair tax rates and access to credit is hindered by the absence of an effective credit registry and problems in registering property titles, while a weak judiciary prevents effective contract enforcement (3-5)

Benin is a member of the West African Economic and Monetary Union (WAEMU); therefore, it cannot pursue an independent policy on currency and foreign exchange rates. The currency is pegged to the euro, and the Central Bank of West African States (Banque Centrale des États de l'Afrique de l'Ouest, BCEAO) is fully independent still heavily influenced by the European Central Bank's anti-inflation policy. According to the World Bank, inflation as measured by the CPI, was as low as 0.1% in 2017. The IMF projects a moderate increase in inflation between 2016 and 2020, which will however remain under the 3% WAEMU convergence criteria (1,3-5). Though a promising economy, Benin currently lacks the prerequisites for socioeconomic comprehensive freedom of choice.

1.7: Physical and Technological Infrastructure

1. 7.1: Transportation Infrastructure

Benin is a member of the Economic Community of West African States (ECOWAS) and the African Union (AU); the effective integration of which requires transport infrastructure. Its latitude and longitude are 9° 30' N and 2° 15' E respectively. The country has a total land area of 114,800 km² (44,310 sq miles) (6,7).

It is bordered on the North by Burkina Faso and the Republic of Niger, on the East by the Federal Republic of Nigeria, on the West by the Republic of Togo (Figure1.2). With 124 kilometers long coastline, it stretches north to South some 672 kilometers while its breath extends 324 kilometers at the evident point. This geographical location of Benin, among other factors, makes it a potential international trading partner. The natural resources of the country are unlimited and include limestone, deposits of gold and phosphates, which are yet to be explored, an offshore petroleum field located near Cotonou, iron ore, phosphates, chromium, rutile, marble and oil reserves (nearing exhaustion). The economic foundation of the country is very fragile

although it has superior location advantage compare to landlocked neighbor's countries (6,7). The economy of Benin remains underdeveloped and dependent on subsistence agriculture and cotton. Cotton accounts for 40% of GDP and roughly 80% of official export receipts. The contribution of the formal transport sector falls under services, which accounts for about 7% of the country's GDP. There is a lack of adjustment in the agricultural structure, restriction of the development of secondary industry and the tertiary industry which just started (6,8). All these lead to obstruction of the country economic development.

Currently, Benin's transport system consists of (i) a total length of the road network is about 15,700 km. Though the main roads (Interstate roads and national roads) comprise a total of 6,076 km of highway, 7,800 km of rural roads, and 1,800 km of urban roads (secondary and tertiary roads in urban areas); (ii) a railways network of 578 kilometers; (iii) air transport services consisting of five airports (Cadjehoun Airport located at Cotonou, the major airport at Parakou, the airfields of lesser importance at Natitingou, Kandi, and Abomey); in which the only one has a paved runway; (iv) a maritime service with two major seaports; and (v) a 150 km of navigable waterways, which consisted of its portion of the Niger River, which forms the country's northern border as of 2004 (7).

The need for transforming the country's transportation mode is essential for economic growth and poverty reduction at the national level and change in trade relationships which brings about globalization on the international scene. In the country's effort in doing business, the World Bank (2006) gave some benefits of an effective transport system such as costs and distance reduction between trading partners, an increase of trade effectiveness and maximization of existing industrial investments and production output. National development and poverty reduction target heavily based and related to the effectiveness of a country's transport system.

An efficient railway system gives easy access to the back and forth movement of goods and services and also the movement people from point A to point B (Job, School, Market, Hospital among others). It also lets farmers get their products to urban markets likewise for miners and manufacturers. It facilitates the haulage of their inputs and/or products to markets and ports. Conversely, lack of access to transport and/or at the instance of being too expensive are barriers to trade, industry, and denial of people the services amounting to social exclusion (7).

The underdevelopment of railway transport infrastructure is due to lack of the political will and leadership problems as it is the case of road sector. The development of railways transport and its direction growth is influenced by politicians. The huge financial commitment of the government in the transport sector leads to the overbearing influence of governments in infrastructure transport development projects in most developing countries. In Benin as elsewhere in most Africans countries, transportation infrastructure (roads or railways) projects have been used by politicians as bait to collect more votes since the advent of democratic rule in 1990 (7).

Additionally, Benin's national road railway (BNRR) requests are reflected in the national draft budget after which the Ministry of Finance approves. The BNRR had therefore relied on the influence of the ruling of the sitting government of every regime. The transport infrastructures along with reforms, rehabilitation and/or modernization have also undergone the same process since the advent of democratic rule (7). This abnormal control of transport infrastructure and especially railway has created a corruption environment between transport businesses and politicians. The poor policies of Benin's Government have favored the development of roads instead of railways while its poor administration has made the corporation of the latter run under capacity (7). The public ownership and management are identified as a problem to the railway sector and thus there were related operational inefficiencies and excessive fiscal's resources.

These aforementioned problems have blocked Benin to benefit from certain projects or sometimes the obstruction in their execution. As an example, the conflict between Bolloré and Dossou-Awouret about Benin-rail project has delayed the process of construction and rehabilitation of lines. In fact, the project consisted of building high railroad transportation way, bridges, train stations, multiple connections with the original railway (7).

The identified challenges above have led to the inactivity of Benin's railway. Unfair competition between the railways and the road haulers has gradually put an end the activities of the OCBN, thus creating a surge in the car fleet facilitated by the importation of used vehicles from the western countries. In 2001, the registration of the number of heavy truck vehicles for transport of goods reached 2,601 before starting to decrease to 692 in 2006. The 2001 explosion of heavy goods vehicles is explained by the improvement of the road network due to the complete construction of asphalt pavement of two main roads: port de Cotonou to Malanville (747km) and port de Cotonou-Porto-Novo (641km) through Bohicon- Dassa- Savalou- Djougou Natitingou (7). The 2001 explosion of heavy goods vehicles has also resulted in the early deterioration of road infrastructure, traffic accidents, causing property damage, loss of life: 3736 cases of road accidents in 2007, of which 595 were killed and 3,332 injured and increased of air pollution due to the use of adulterated fuel. It may be noticed that it is extremely difficult to breathe clean air in traffic in Cotonou (7,8). The little oxygen has been replaced by the presence of chemical elements harmful to the skin, lungs and all human organisms. The entire city aspires to polluted air, which comes from the smoke caused by the exhaust gases. For the moment; the impact of greenhouse emissions on nature at the level of the Beninese industries is not known. Cotonou being the city which shelters many industries, it results from the evidence that it is the most

polluted city in Benin. The consequences are unfortunate; skin diseases, cancers, and many other lung diseases decimate small urban populations (7,9).

1.7.2: Tele-communication Sector in Benin

There were five mobile telecommunication operators' and five main Internet Service Providers (ISPs) offering mobile and internet services. The roll-out of third generation (3G) services had just started in 2012 after MTN Benin was awarded the first universal license that is technology and service neutral. The government planned to award similar licenses to the other mobile operators, which had the potential to spur growth in the mobile broadband sector (10)

Benin Telecoms SA (BTSA), the owner and operator of national and international connectivity was wholly state-owned. The government had attempted to privatize BTSA at various intervals over several years but bids received were below expectations and the privatization was cancelled. They also considered repositioning BTSA as a wholesale capacity provider. Benin Telecom was also operating the only international submarine cable, the South Atlantic 3/Western Africa Submarine Cable (SAT-3/WASC), linking Benin to the international Backbone since 2002 (10)

National and international connectivity was leased to the mobile operators and ISP to provide internet and international communications services. Mobile operators also relied on their own microwave backhaul infrastructure for transmission capacity. At appraisal, the government was planning to give mobile operators the right to build their own fiber infrastructure where necessary. In addition, the new licenses issued to the ISPs in 2012 guaranteed their right to purchase international capacity from multiple sources and not exclusively through BTSA (10)

Benin was therefore dependent on a single submarine cable - SAT-3 for its international capacity requirements. Benin Telecom was using about 2Gbits of the total 10 Gbits capacity of SAT-3 for domestic use to its own Internet and voice customers, to the mobile operators and ISPs, as well as to Burkina Faso, Niger and Nigeria (300Mbps). However, this capacity use was relatively small, possibly because of the high prices of connectivity available through SAT-3 which were around US\$ 2500 per Mbps per month. Benin has the potential to become a regional hub for international connectivity when prices of international connectivity become more competitive and the backbone infrastructure more extensive and reliable (10)

Mobile service uptake increased in the years prior to project conception, reaching 79 percent penetration in 2010. At the same time, fixed line penetration was still limited at around 0.26 percent of households, and internet penetration was one of the lowest in the region at about 1.8 percent of the population. Growth in the Internet industry was therefore slow and constrained by cost, availability, and limited infrastructure. Mobile networks accounted for almost all internet connections. Fixed broadband was a service used by industry, government, and a privileged few at home and prevalent mostly in urban areas. This prevented Benin from reaping the benefits of the ICT revolution (10)

1.7.3: Electricity Availability and Access In Benin

Electricity in Benin is provided by the Beninese electrical power-company (SBEE) that is plagued by wide variations in voltage and frequent power cuts. The main Benin's energy resources can be classified into the following categories: biomass energy, fossil energy resources, mineral energy resources, hydro-power potential, solar energy and wind energy (11)

Access to modern fuels, especially electricity, is often considered a pre-requisite for development (12-13) . Currently, only 29% of the population in the country has access to electricity (14). About 40% of Beninese citizens have access to electricity, with a significant disparity between urban (70%) and rural areas (18%). Access to clean cooking solutions is extremely limited both in urban and rural areas (6% average) (15). In terms of electricity access, the objective is to achieve urban and rural electrification rates of 95% and 65% by 2025, and regarding renewable energy target the objective is to achieve 24.6 % renewable energy in the energy mix of Benin in 2025 (1,16).

Benin's power sector is closely tied to its neighbour Togo. The power system of both countries has been under the control of Communauté Electrique du Bénin (CEB). A large majority of the electricity consumed in the country is imported. Currently Benin is highly dependent on imports of electricity from Nigeria and Ghana from where they get approximately 90% of their electricity supply. The domestic power generation is also dependent on imports of Natural gas from neighbouring countries. Communauté Electrique du Bénin supplies the only power distribution utility, Société Béninoise d'Énergie Electrique (SBEE), in the country with electricity. The dependency on other countries has proven to be challenging. Fluctuations in the electricity supply from the supplying countries results in severe black outs and power shortages⁸. To mitigate the effects of these challenges, SBEE relied on inefficient thermal generators and expensive emergency power rentals to meet the demand. In addition, the transmission and distribution network is of poor quality with losses of approximately 24%. Finally, SBEE has set low electricity tariffs (on average US\$ 22.1 / KWh); this is not reflective of average cost of generation (US\$ 26 / KWh, thus damaging for the long term economic sustainability of the utility (17)

1.7.3.1: Access to Electricity.

Access to electricity is strongly linked to social and economic development (18). As at 2016 in Benin, residential access to electricity was limited to 29%. Targeting universal access to electricity by 2030 in Benin requires a combination of grid expansion and deployment of electricity infrastructure. In this study, the Open Source Spatial Electrification Tool (OnSSET) was used to examine 21 electrification pathways for Benin. The tool leverages on geo-spatial information and uses a least-cost approach to identify the most cost effective electrification solution in each settlement. The selected scenarios, study the effects and implication of targeting different levels of access to electricity as well as sensitivity to technology costs (11).

Results show that 58-92% of the population in 2030 is expected to receive electricity from the grid. The remaining 8-42% is expected to gain electricity access through mini grids or stand-alone systems. The total cost of investment required to achieve universal electrification in Benin by 2030, ranges from 1.2 to 5.9 billion USD, depending on the level of service provided and technology cost developments. Stand-alone technologies are favoured at lower electricity access targets and in remotely or sparsely located areas; mini grids and grid connections are observed at higher demand levels and in more densely populated areas (11). Table shows the urban and rural population access to electricity.

Table 2.1: Access to Electricity in Benin

Series	2010	2012	2014	2016
Access to electricity (% of population)	34.2%	38.4%	34.1%	41.4%
Urban (% of urban population)	65.4%	68.6%	57.6%	70.8%
Rural (% of rural population)	13.9%	14.5%	-	18%
Access to clean fuels and technologies for cooking (% of population)	5.3%	5.9%	6.6%	6.4%
Population, total	9.5 Million	10.0 Million	10.6 Million	10.9 Million
Renewable energy consumption (% of total final energy consumption)	51.5%	51.1%	48.6%	-
Renewable electricity output (% of total electricity output)	0.7%	0.6%	0.5%	-
Electric power consumption (kWh per capita)	92.3	90.2	97.3	-

Country statistics source: The World Bank (18,19)

1.7.4: WATER AND SANITATION SECTOR

The African continent currently has about 300 million people who do not have access to drinking water, and an even greater proportion of people do not have adequate sanitation systems. The rural population is worst hit, this make them prone to diseases vulnerability due to lack of drinking water and; the time and efforts required for water supply prevent women from engaging in other economic activities, and children from going to school (20)

Benin has an average annual rainfall which varies between 800 mm in the North and 1500 mm in the South. The potential of the waterways, excluding the Niger river, is estimated at 3,106 billion m³ per annum. The lakes and lagoons in the South of the country (Ahémé, Nokoué, Porto Novo) also constitute huge reservoirs of water. The annual refill rate of the groundwater reservoir is estimated at 1.87 billion m³, or 163 m³ per hectare (20). The coastal sedimentary basin, which represents 10% of the country's land surface, contains about 32% of the underground water potential. However, though abundant on the whole, water resources are unevenly distributed in the country. The geological situation, with about 80% of crystalline basement, favours water runoffs to the detriment of infiltration, which should supply the water (20)

The level of water mobilisation and utilisation is still low, barely 2% of the groundwater reservoir and a few dams (DWS Parakou, Djougou and Savalou, Save Sugar Company). However, mobilising underground water is a real problem in the bedrock area where borehole water pressure is low. There is considerable pressure on water resources in both the urban and rural areas, and there is pollution of all types, which can jeopardize the use of some sites. The measuring networks are functional only in certain areas, and there is no regular follow-up(20)

1.7.4.1: Drinking Water Supply in Urban and Rural Communities

Benin has an estimated urban population of 2.58 million people, representing about 38% of the total population as at 2002. The drinking water access rate in urban areas was estimated at 54%, calculated on the basis of one consumer (connection) serving 15 persons. An analysis of the current pattern of drinking water consumption shows demand as follows: (i) a concentration of demand in the country's four largest cities (Cotonou, Porto-Novo, Parakou, Abomey/Bohicon), which between them, consume about 80% of the drinking water produced by the company responsible for urban distribution; (ii) a low supply rate, even though this varies from one locality to another; (iii) the use of alternative sources of water supply (wells, rivers, marshes, tankers); and (iv) a low drinking water consumption level per inhabitant (20). The demand for water is greatly influenced by socio-economic conditions, marked by low and unstable household income and consumption patterns. Benin's rural population is estimated at 4.28 million people living in more than 3,148 villages. The drinking water access rate in rural areas is about 36 % with an average consumption estimated at 20 litres per inhabitant. Despite this, several localities still obtain water supply from polluted surface water (20).

1.7.4.2: Sanitation and Solid Waste Management

Very few statistics exist on sanitation in general. Despite the bad practice of burying and incinerating wastes at home, solid waste evacuation rates are very low in large built-up areas. Because the public water collection, evacuation and treatment system is not operational, household waste is dumped on secondary roads and empty spaces. The situation is hardly better in rural areas. The Population and Health Survey (ESDB), conducted in Benin in 2001, shows a refuse collection rate of 39% in urban centres and 3 % in rural areas(20).

1.7.4.3: Management of Domestic Wastewater and Excreta

Private on site wastewater treatment is the most common form of wastewater disposal in Benin. According to the ESDB, only two out of one thousand households dispose of wastewater correctly. Water emptied into nature pollutes the environment and water tables. Bodies of water also become breeding sites for mosquitoes and other disease carriers, constituting nuisance to people and contributing to the high incidence of malaria (34% of medical complaints). The situation calls for concern particularly in Cotonou because of: (i) the very hydromorphic nature of the soil; (ii) the water table (0.5 to 3.0 m from the surface); and (iii) the high population density. The wastewater disposal rate is estimated at 0.2 % for the whole country (20). Management of excreta is a very critical problem, particularly in the smaller towns. The coverage rate in the major towns is above 60%. A sewage network system is provided only in the major towns (Cotonou, Abomey-Calavi, Porto-Novo, Parakou, among others). According to the Population and Health Survey carried out in Benin in 2001, the rate of access to an adequate excreta disposal system is 32.1%. There is a wide disparity between the coverage rate in urban centres (61.6%) and that in rural areas (14%) (20).

1.7.4.4: Storm water Management

Since the 1990s, storm water management in big towns has been a major concern for the authorities, and considerable human and financial resources have been allocated to it, especially in Cotonou. As at July 2003, the total length of storm water drainage lines was estimated at 421,739 linear metres, comprising 305,059m for Cotonou, 85,000m for PortoNovo and 31,680m for Parakou (20). The coverage rate in these towns is 25%, 50% and 50% respectively. Despite these efforts, flooding remains a serious problem in Cotonou, which is very marshy, flat and with

a flush water table. In addition, normal drainage of water is impeded by the fact that people build their houses on the waterbeds. Apart from the multiple problems encountered in the maintenance of storm water drainage networks, the towns also have to cope with lack of civic responsibility among some members of the public who dump domestic solid wastes and wastewater in gutters (20).

1.7.4.5: Legal and Regulatory framework

Benin has a series of texts on the management of the water and sanitation sector but these, more often than not, have been overtaken by events. The Water Code, the main document that provides guidelines for sector, was enacted by Law No. 87-016 of 21 September 1987, but no implementing decrees have been issued. Consequently, the texts relating to the different committees have never been issued. Far-reaching reform of the texts relating to water is currently being undertaken, with the assistance of sector donors. It is expected that the Water Code will be reformulated, taking into account issues relating to decentralisation and deconcentration, integrated water resource management, procurement procedures, and strengthening of the role of women and the private sector. The document relating to the Water Code is being finalised, and should be submitted to the Assembly before the end of 2004 (20). As regards sanitation, Benin has a fairly impressive arsenal of legal and regulatory texts. Law No. 98-030 of 12 February 1999 relating to the outline law on the environment defines the bases for a national environmental policy and organizes its implementation, in accordance with the Constitution. The law is based on the application of the “polluter-pays” principle. Similarly, in 1987, the Government adopted and enacted the Public Hygiene Code. However, in view of the outline law on the environment, some of the provisions of this Code are obsolete and need to be updated. The regulations governing the management of biomedical waste were defined in Order 2002-484

of 15 November 2002; the Order specifies the various categories of biomedical waste, and reiterates the conditions and manner in which such waste should be treated. Finally, two Inter-Ministerial Orders regulate the collection, drainage, treatment and elimination of used oil, as well as the collection, disposal, treatment and elimination of solid waste. These have often proved difficult to apply strictly because of the lack of human, material and financial resources (20).

2.0: National Health Care Profile

2.1: Introduction.

The Republic of Benin has enjoyed political stability and democracy for some decades now, from 1996 till date. The country changed from a Marxist-Leninist system of governance to pluralist democracy in 1990, and several elections and peaceful transition of government have taken place regularly. The assumption of power by President Talon in April 2016, following a peaceful election, has reaffirmed the stability of democracy in Benin. The new president committed himself to a series of institutional, political and economic reforms outlined in the Government's Action Program (PAG), developed for 2016 to 2021. This ambitious program is embraced by civil society, political actors and the international community who have supported from the start (21, 22)

2.2: The Healthcare System Structure in Benin

The health care system is organized based on the administrative division of the country into 12 departments and 77 local councils. It is pyramidal with three levels: the central, intermediary, and peripheral levels. The central level is also referred to as the national level is responsible for providing strategic guidelines and policies, and also making decisions on health sector development, and initiating the health action plans. The Ministry of health and the central departments coordinate and control the implementation of health projects and programs. The National Public Health Directorate (Direction Nationale de la Santé Publique) is responsible for the National Community Health Support Program. The apex of the health care pyramid is the National University Teaching Hospital (23,24). The intermediary level has 18 Regional Health

Delegations (RHDs) that are responsible for supporting the implementation and monitoring of government-defined health policies, and coordination of all peripheral health services activities. The health infrastructure at the intermediate level is the departmental general hospital (DGH), which is the referral structure for zonal hospitals within the department, where national strategic guidelines which control standards and provide technical assistance to zonal health management teams, are adapted to regional specificities (23,24). The peripheral level is the health zone. It is at this level that national health development programs and projects are implemented along with the basic level of health care providers for the people. There are 34 health zones in the country, each covering an average population of 100,000 to 200,000 inhabitants. Each health zone has a network of first-contact health services and a referral hospital. The first contact services comprise village health units (VHUs), district health centres (DHCs), municipal health centres (MHCs), and private health units. The first level management organs are the village committee for VHUs, the district management committee (DMC) for DHCs, and the municipal health constituency management committee (MHCMC) for MHCs. There is also the private health sector, as well as the pharmaceutical sector (23,24).

As one of the stable democracies in West Africa, Benin has not been without socioeconomic and health challenges. The fertility rate remains high at 4.8 births per woman, with poor usage of family planning methods. Life expectancy at birth of the average Beninese is 59.6 years (25,26). The maternal mortality rate in Benin was high. The Demographic and Health Survey of 2006 found a maternal mortality ratio of 397 for 100,000 births, which was a drastic reduction from what was obtained in 1996, 498. There is also a significant improvement in the declining rate of child mortality from 185 deaths per 1,000 births in 1990 to 125 in 2006. These high rates were strongly related to major deficiencies in the health system (26).

Table 2.1: The situation of health indicators in Benin relative to countries in the sub-region

Country	Poorest with at least 4 ANC visits	Institutional delivery, 2006	Full vaccine coverage rate, card	Care seeking for fever—malaria	Maternal mortality rate, 2010	Median U-5 mortality, 2010	Median infant mortality rate, 2010
Benin	38.5 (2006)	78	54.3 (2011)	42.9 (2011)	446	111.1	70.8
Burkina Faso	22.3 (2010)	50.5	83.1 (2010)	54.4 (2010)	417	116.4	66.2
Ghana	60.1 (2006)	48.7	88.6 (2011)	49.4 (2011)	325	74.7	50.2
Niger	9 (2006)	17.2	65 (2012)	51 (2012)	657	123.3	62.4
Nigeria	15.9 (2008)	35 (2008)	24.4 (2010)	31.5 (2013)	867	129.6	81.1
Togo	36.9 (2010)	62.9	73.4 (2010)	57.8 (2013)	393	90.3	59

Source: Statistics by Topics and Country, <https://data.unicef.org/>

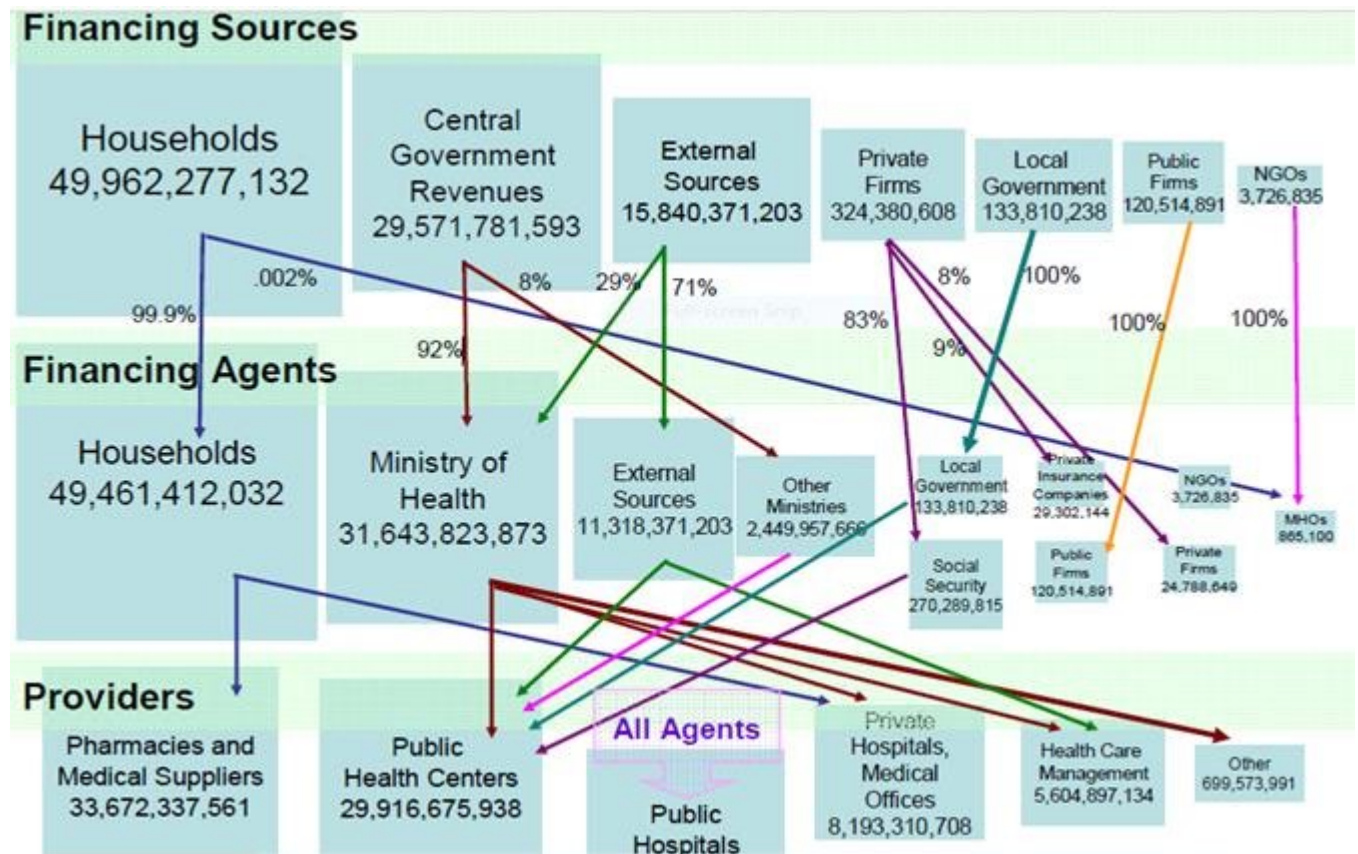
2.3: Health Financing in Benin

Benin spends slightly less than the average Sub-Saharan African country on health with 4.6 percent of GDP, against 5.24 percent. The total per capita health spending is USD 26 at current exchange rates and USD 43 at purchasing-power parity. Households are by far the largest source of health spending in Benin. Private out-of-pocket spending makes up 51.2 percent of total spending and nearly 99 percent of all private spending. The government (at 31 percent) and donors (at 16.5 percent) follow households as a source of funding for health in Benin. The two largest providers of health services are pharmacies and public health centres. External sources of funds retain direct spending control of a large share of their contributions. Public hospitals have very diverse funding streams, receiving funds from all financing agents. Benin is far above regional averages for out-of-pocket spending (26).

There are several contributors to the health sector in Benin in addition to traditional international partners (WHO, United Nations Population Fund, United Nations Children’s Fund [UNICEF], and the World Bank); the Global Fund to Fight AIDS, Tuberculosis and Malaria; Global Alliance on Vaccines and Immunizations (GAVI); and the African Development Bank are contributors. Bilateral donors include Belgium, Canada, China, France, Germany, Japan,

Switzerland, and the United States. The World Bank and the European Union provide budgetary support. The donor community and the Government of Benin have established a coordination mechanism. Within this mechanism, there is a group for the health sector, chaired by the Minister of Health. It meets routinely twice yearly, or additionally as needed. The partners select a representative among them (currently the Swiss Cooperation) serves as the spokesperson for the partners and the point of communication for the ministry (25,27,28)

Table 2.2: Benin Health Financing (2003 FCFA based on 3/2006 Provisional NHA Report)



2.4: Health Indicators for Benin (Service Delivery)

Health care delivery systems include both public and private sector providers, who are influenced by levels of decentralization, and payment relationships among others. Service delivery can be defined as the way that inputs are combined to allow the delivery of a series of interventions or health actions and service delivery is the chief function that the health system needs to perform (23). It is the point at which all the resources and norms come together to be transformed into curative, preventive, promotive, and rehabilitative services (26).

Benin's epidemiological profile is marked by a high rate of infectious diseases, followed by nutritional issues. The prevalence of HIV/AIDS in 2004 was 2.0 percent (2.4 percent in urban areas and 1.6 percent in rural areas). Benin has also seen a rise in non-communicable diseases, such as heart disease and cancer. Table 2.3, shows the 2002 WHO data on death rates and disability-adjusted life years (DALYs) for Benin. The age-adjusted rates allow for comparison with other countries with other age structures. However, the unadjusted rates, which reflect absolute numbers, more accurately reflect Benin's morbidity and mortality profile and show that acute respiratory infections (ARIs) and malaria are the major causes of death and disability. They also show the effect of non-communicable diseases, injuries, and other health issues (perinatal causes) (26).

Table 2.3: Causes of DALYs and Death, 2002

Major Causes of DALYs (Age Adjusted)	Major Causes of Death (Age Adjusted)	Major Causes of DALYs (Not Age Adjusted)	Major Causes of Death (Not Age Adjusted)
ARIs	Cardiovascular diseases	ARIs	ARIs
Malaria	ARIs	Malaria	Malaria
Injuries	Cancer	Injuries	Cardiovascular diseases
HIV/AIDS	Malaria	Diarrhea	Diarrhea
Cardiovascular diseases	Injuries	Perinatal causes	Injuries
Neuropsychiatric diseases	HIV/AIDS	HIV/AIDS	HIV/AIDS
Diarrhea	Diarrhea	Neuropsychiatric diseases	Cancer

Source: WHO, 2002. Global Burden of Disease Estimates. <http://www.who.int/healthinfo/bodestimates/en/>.
 Note: ARI = acute respiratory infection.

Tuberculosis, HIV/AIDS and malaria have received significant attention in Benin due to the available funding to combat them. The tuberculosis detection rate was reported as 82 percent. The treatment success (cure) rate was 81 percent in 2004 and has been fairly stable at that rate since 1999. In 2004, 3,304 persons were identified as having tuberculosis, with an incidence rate (new cases) of 4.6/10,000 inhabitants. The prevalence of HIV/AIDS is currently measured at 2 percent nationally. A system of treatment, prevention of maternal-to-child transmission, testing and counselling, and prevention have been established within 40 sites throughout the country. As of 2005, 4,298 patients are under treatment with antiretrovirals (of an estimated 13,190 people needing antiretroviral treatment). Malaria is the major cause of consultation and hospitalizations in Benin. A 2003 Roll Back Malaria midterm evaluation found that 35 percent of pregnant women slept under an insecticide-treated net, 37 percent of children under five slept under an insecticide-treated net, and 52 percent of pregnant women received prophylaxis against malaria during their pregnancy according to national policy (26).

2.5: Health Care Workforce and Infrastructure

An analysis of overall hospital bed capacity for Benin both in the public and private sector reveals an average of 0.55 hospital beds per 1,000 populations. This is, however; lower than the recommended 1 bed per 1,000 populations by WHO. Bed occupancy rates at the Commune Health Center (Centre de Santé de Commune) range from 30 percent, 39 percent at Departmental Hospital (Centre Hospitalier Départemental), 53 percent at public Zonal Hospital (Hôpital de Zone), 65 percent at the National and University Hospital (Centre National Hospitalier et Universitaire), and 81 percent at the private and faith-based hospitals. The National and University Hospital (Centre National Hospitalier et Universitaire) represents 15 percent of national hospital capacity, 29 percent is at Departmental Hospital (Centre Hospitalier Départemental), and the states and the faith-based zonal hospitals share 28 percent each. It is worthy of note that the faith-based hospitals have a higher occupancy rate with 36 percent hospitalizations compared to 21 percent in state zonal hospitals. In terms of functionality, the zonal hospitals serve as the first referral level. About 67 percent of health zones have a designated zonal hospital, and only 47 percent have an obstetrician-gynaecologist, 52 percent have surgeons, and 23 percent have paediatricians, with a perceived adequate distribution of healthcare personnel (28,29). However, the distribution between the public and private sectors and between urban and rural areas indicates that human resources are often not available where they are needed. Overall, 56 percent of physicians work in the private sector. The number reported in the *Annuaire des Statistiques sanitaires* for nurses, midwives, and laboratory technicians working in the private sector appears much lower (15 percent, 17 percent, and 12 percent respectively) (29,30).

Table 2.4: Range of Health Personnel per Capita

Personnel Category	Lowest	Highest
Physicians	2,325 Atlantique/Littoral	22,160 Borgou/Alibori
Nurses	1,700 Ouème/Plateau	4,000 Atacora/Donga
Midwives	1,125 Atlantique/Littoral	2,700 Atacora/Donga
Laboratory technicians	8,800 Atlantique/Littoral	34,000 Atacora/Donga

Source: Benin MOH. 2005. Annuaire des statistiques sanitaires 2004.

2.6: Health Service Coverage in Benin

The *Annuaire Statistique data* for 2004 indicates a continuing low use of outpatient services, number of visits per year averaged 0.39 among the facilities reporting (ranging from 0.27 in Couffo to 0.62 in the Littoral) (31). Prenatal consultation by pregnant women was 92 percent, ranging from 66 percent in Atacora to 179 percent in the Littoral (32). The percentage of women having an assisted delivery was 76 percent, with a range from 47 percent in the Atacora to 91 percent in the Littoral. The DHS data indicates that 87 percent of women had at least one prenatal visit, with little difference between urban and rural women, but 71 percent of women in urban areas made four prenatal visits compared to 57 percent in rural areas. Although the overall percentage of women delivering in a modern facility was 72 percent, this figure ranged from 98 percent in Cotonou to 54 percent in the Atacora (33). Contraceptive prevalence in 2004 was 16.4 percent, ranging from 1 percent in Plateau to 23 percent in the Zou. Coverage with diphtheria,

pertussis, and tetanus vaccine (DPT3) was 87 percent, ranging from 68 percent in Plateau to 103 percent in Couffo. Data from the DHS health facility survey showed DPT3 coverage ranging from 56 percent to 88 percent. Table 2.5 summarizes coverage rates from various sources (32).

Table 2.5: Service Coverage Rates from Various Sources

Type of Care	DHS 2001	<i>Annuaire des Statistiques Sanitaires 2004</i>	Evaluation of 34 Health Zones (1st trimester 2005)
Use of curative services (number of visits)	No data available	0.39	0.09–0.93
Childhood vaccinations	73% DPT3 (range: 56–88%) 59% all vaccines (range: 49–68%)	DPT3 87% (range: 68–103%)	Effect coverage 26–85%
Prenatal care	87% at least 1 visit 4+ visits: 57% (rural); 71% (urban)	92% at least 1 visit (range: 66–179% at least 1 visit)	4+ visits: 4–69%
Assisted deliveries	72% (range: 54–98%)	76% (range: 47–75%)	15–75%
Contraceptive prevalence	18.6% (range: 5–28%)	16.4% (range: 1–23%)	0.25–25%

2.7: Human Resource for Health

Human resources constitute a critical element for a well-functioning and well-performing health system. Improvement of the quality of services and achievement of health outcomes depend on available, competent, and motivated workers. “Human resources/human resources management” refers to the people who work in an organization and the organizational function that effectively manages and uses the people who work in the organization. The human resources function in a health system is important because it addresses an organization’s or health system’s need for a competent, stable workforce that meets its needs: that is, having the right number of skilled service providers in the right location at the right time. Human resources actions, if well managed and implemented, lead to workforce objectives that include coverage, motivation, and

competence. Good coverage of health personnel influences equitable access; motivation influences efficiency and effectiveness; competence influences quality and responsiveness. Equity, efficiency, and quality, which are all determinants of health system performance, lead in turn to positive health outcomes for the population (26).

The Benin health system has four main categories of healthcare personnel, which are;

- (1) The permanent government employees (Agents Permanents de l'État, or APE);
- (2) The contractual government employees (Agents Contractuels de l'État, or ACE) who hold short- or long-term contracts with the government but who can become permanent government employees after four years of service;
- (3) The contractual employees recruited under a special government program called "Social Measures" and
- (4) The contractual employees were recruited through community financing funds.

Benin health professionals work in both the public and private sectors. Doctors (generalists and specialists) get their education at the University of Abome-Calavi Faculty of Health Sciences. As at the time of writing this report in 2004, the faculty has trained 1,003 doctors since its creation in 1971. The Dr. Alfred Comlan Quenum Regional Institute of Public Health trains doctors specializing in public health and epidemiology. The institute is part of the Abome-Calavi Faculty of Health Sciences and has trained 380 doctors since 1991 (32). Nurses, midwives, social workers, and laboratory and other health technicians are trained at the National Medico-Social Institute (INMES). The INMES is made up of five schools that train these different categories of

medical professionals. It is under the authority of the Ministry of Technical Education and Professional Training. From 1992 to 2004, the institute had trained 3,063 nurses. In 2002, a specialized school was created to train nurses and midwives in anesthesiology and cardiopulmonary resuscitation (CPR). The National Nursing School of Benin (ENIAB) and the National School of Sanitation and Hygiene (ENAAH) are three-year professional and technical institutes based in Parakou train assistant nurses, and hygiene and sanitation health workers respectively (31,32).

More than 2,355 assistant nurses have been trained at ENIAB since its creation in 1973, and 29 hygiene workers have completed their training in 2004 at ENAAH, which was created in 2001 (32) Salaries of medical health professionals in the public sector are comparable to those of other categories of professionals working in the public sector, but they are lower than those of health professionals working in the private sector.

With efforts to increase availability and access to health care, many health centres have been created that require a sufficient number of well-trained professional health workers. Unfortunately, a critical shortage of health personnel exists, especially specialized doctors at all levels of the health pyramid (central, intermediate, and peripheral). The number of professional health personnel in the main personnel categories currently available in the public sector and their ratios to the population is presented in table 2.6.

Table 2.6: Number of Professional Health Personnel in Different Categories Available in the Public Sector and their Ratios to the Population

Category/Specialty	APE	ACE	CMS	CFC	Others	Total
Generalists	87	56	32	14	12	201
Anesthesiologists and CPR specialists	1					1
Biologists	3					3
Cardiologists	1					1
Dentists		2				2
Development health specialists					1	1
Epidemiologists	6	2				8
Gynecologist-obstetricians	30	1	3	1		35
Health administrators	2					2
Hematologists	1					1
Internists	1					1
Kinesiologists	1					1
Malaria specialists	1					1
Microbiologists	1					1
Nephrologists					1	
Nutritionists	2					2
Occupational health specialists	2					2
Ophthalmologists	9			1		10
Pediatricians	21		1	3		25
Planning specialists	1					1
Psychiatrists	1					1
Public health specialists	50	6		1	3	60
Radiologists	2					2
Surgeons	21	1	1	1	1	25
Trauma specialists	1					1
Total specialists	158	14	4	7	6	189

Source: DRH database 2004.

APE = permanent civil servant; ACE = contractual government employee; CMS = contractual employee through "Social Measures" fund; CFC = contractual employee paid through community financing funds.

2.8: Health Trends in Benin

The Republic of Benin is characterized by a high population growth rate of 3.25%. There is good decentralisation of the healthcare system and distribution of health infrastructure across the country. As a matter of fact, 77% of the population lives at less than 5 km from a health establishment, with a low frequenting rate of 44 % (33). Health financing is mostly provided by households up to 52%. The country is currently in epidemiological transition, with the existence of communicable diseases, the emergence of noncommunicable diseases and the growing relevance of health problems related to the environment (33).

Maternal, newborn and child health situation is characterized by a slow drop and a permanently high level of mortality and morbidity indicators, notwithstanding a satisfactory provision of maternal, child and adolescent health care. Maternal mortality ratio is estimated at 397 cases of maternal deaths for 100 000 live births in 2006. Nonetheless 9 women out of 10 use antenatal consultation services. About 22 % of childbirths still occur at home, especially in the north of the country, in rural areas (26 %) and in the poorest households (43%) (33). Most Beninese women have at least 5 children and the rate of use of modern contraception method among married women is 8 percent, with male condoms and injectables being the most popular methods. The maternal mortality ratio is 350 per 100,000 live births, and 74 percent of live births have a skilled attendant at delivery (34).

Needs for satisfactory emergency obstetrical care is still low; that is to say 22.9%. Contraceptive prevalence remains low, that is to say 6.2 per cent in 2006. Such Practices as female genital mutilations which prove to be harmful to women's and young girls' health are still current. Child

and adolescent mortality dropped from 166.5 to 125 for 1000 live births during the same period (33).

A significant majority 70% of morbidity are attributable to communicable diseases. Malaria remains the first cause of medical consultation in health establishments (39,7%), followed by acute respiratory infections (13,8%), gastro-intestinal complaints (6,6%) and traumas (5,6%). The mean incidence of serious malaria was 28.6 for 1000 inhabitants in 2006. Mean mortality nationwide is 6.2 for 1000 cases, as regards serious malaria against 14 for 1000 in 2005. About 56.3% of children under 5 years of age and 54.8% of pregnant women slept under insecticide-treated mosquito nets in 2008. Even though epidemic cases of measles are sometimes recorded, the overall trend did show a reduction in the number of cases by more than 60% in 2006-2008, compared with the year 2001. Human immune deficiency virus (HIV/AIDS) has a prevalence rate of around 2% from 2002 to 2005 before going down to 1.2% in 2006. The number of people suffering from AIDS and who are under anti-retroviral (ARV) therapy went up from 500 in 2003 to 9765 in 2007. Tuberculosis incidence is 44 cases for 100 000 inhabitants. The rate of successful therapies is 87 per cent (33,34).

The number of Buruli ulcer cases went up from 291 in 2000 to 1203 in 2007 (NPC Benin, 2006). Noncommunicable diseases constitute a major concern due to their frequent occurrence and morbidity and mortality rates. For example, the hospital prevalence of cerebrovascular accidents is 13.86%; that of hypertension is 27.5% in adults; those of obesity and excess weight are respectively 9.4% and 20.5%. Tobacco consumption prevalence is 16%, that of alcoholism is 2.9% and that of physical inactivity is 8.3% (33).

More than 66 % of households have access to running water. Only 38% of households are equipped with sanitary facilities. Air pollution is high with a daily emission of 83 tons of carbon monoxide in the major towns of the country. The health system in Benin is composed of 34 health zones, half of which is functional. The development of health services is adequate: 77% of the population live at less than 5 km from a health establishment. However, only 44% of these populations resort to these health services. The share of the general State budget allocated to the health sector was 11% in 2009. The health sector financing is mainly based upon households up to 52%. There is a shortage of specialists, especially in health zones and an unequal breakdown of the staff. The health system decentralisation which started some years ago is still not in fully functional (33).

The private health sector in Benin consists mainly of profit oriented private and pharmaceutical sector based mainly in the south and faith-based and nongovernmental organizations (NGOs) found mostly in the interior of the country (Andrew et al., 2014). Private for-profit facilities include individual medical *cabinets or clinics*, midwife-led *maternités*, nurse-run *cabinets de soins*, and other general and specialized medical practices, while the faith-based and nongovernmental sector consists primarily of hospitals. The private sector has the potential to play a larger role in improving the health indicators of Benin (Andrew et al., 2014). Private expenditures on health currently make up 51 percent of total health expenditures, the vast majority of which are through out-of-pocket payments (93 percent). The private health sector is a significant source of treatment for illnesses among children under five years of age, including diarrhea (approximately 46 percent of cases that sought treatment) and fever (38 percent of cases that sought treatment) (34). The private medical and non-medical sector is also an important

source for male condoms and oral contraceptives, with 75 percent of women buying condoms and 54 percent buying oral contraceptives from for-profit pharmacies and informal shops (34).

The true magnitude and distribution of the private health sector has been largely unknown, with a common perception among stakeholders surveyed from the SHOPS Private Health Sector Assessment in 2012 that unregistered private facilities and providers are vastly underrepresented. In October 2012, the United States Agency for International Development Benin Mission (USAID/Benin) commissioned the global Strengthening Health Outcomes through the Private Sector (SHOPS) project to conduct a Private Health Sector Assessment that would identify opportunities for increased involvement of this sector. Building on the assessment findings, USAID/Benin requested that SHOPS conduct a census of all private provider facilities in the country to document the size, scope, and characteristics of Benin's private health sector. This information gave the government of Benin, other health sector stakeholders, and development partners a clearer understanding of the private sector's ability to contribute effectively to efforts to improve health outcomes in Benin (34).

Section 3: National Radiology Profile.

3.1: Radiology workforce.

Workforce development is important in to develop a sustainable health system over time by developing and maintaining a highly qualified health workforce with appropriate technical training, scientific skills and subject-matter expertise (35)

Over half of patients seen in the rural and semi-urban health facilities in most sub-Saharan African countries may require imaging, the majority of which are usually ultrasound and plain X-ray, though requiring less of other imaging investigations like computed tomography (CT), magnetic resonance imaging (MRI), among others, because they may not be readily available in most rural and semi-urban healthcare centres in sub-Saharan African countries (36,37). A majority (50%) of imaging needs of urban dwellers are made compared to only (10-13%) in rural and semi-urban communities. In some sub-Saharan African countries, over 90% of patients who would benefit from ultrasonography do not have the privilege to be scanned, and over 90% of plain X-ray films are not reported in rural health centres (36-42). Generally, healthcare financing in sub-Saharan Africa countries is characterized by low government investment in health, inadequate health financing policies and strategic plans, extensive out-of-pocket payments, lack of social safety nets to protect the poor, very weak financial management, inefficient resource use, and very poor mechanisms for coordinating partner support in many sub-Saharan Africa countries (43).

As of 2012, available data shows that there were approximately only 12 radiologists in Benin, 24 radiographers, 42 sonographers and 4 medical physicists and no radiation oncologist, serving a

population of over eight million people (table 3.1) (36). Also, a study on the current state of affairs on continuing medical education for technicians in radiology in Francophone West African countries found that about 15% of the radiologic technicians in Francophone West African countries were in Benin (fig 3.1) (44).

3.2: Equipment inventory and distribution.

Most African countries are faced with the challenge of; poor infrastructure, inadequate healthcare workforce, lack of capacity in the existing workforce and substandard facilities (42,43). These challenges, coupled with inadequate public sector spending on health, have paved the way for the private sector to be on the frontline of healthcare development in the region. Also, the lack of stable electricity infrastructure remains a huge challenge and therefore poses daunting impediments to acquiring and maintaining modern imaging equipment in most African countries.

Ogbole et al., (42), in a Survey of magnetic resonance imaging availability in West Africa, found that Benin with a population of over eleven million people do not have magnetic resonance imaging (MRI) equipment as at the time of the study in 2018 (table 3.2) (42). They found a total of 83 MRI units across the West Africa sub-region with 58 (69.8%) of these MRI units were found in Nigeria, with the private sector leading with over 37 (73.7%) units (42,43). A study conducted in Benin on clinical and imaging concordance of joint damages in rheumatoid arthritis presented both ultrasound radiographic findings in rheumatoid arthritis. Also, a study on clinical and computed Tomodensitometric aspects in Cotonou in Benin, found that about 225 of the patients scanned on computed tomography had pathological findings (44-46). Similarly, a study on the anatomic variants of sphenoid sinuses and adjacent structures found several anatomical

variations on the head CT-scan findings among Beninese (45). These studies confirm the availability of these imaging equipment in Benin, however, there was a dearth of data on radiologic equipment inventory from Benin at the time of compiling these report.

3.3: Regulation and policy

Benin does not have a strategy or national plan for detecting, assessing and/or responding to radiation emergencies. Radiation safety has not been assessed. A radiological and nuclear authority has not been established. There is no mechanism for coordination and communication among the national authorities responsible for radiological or nuclear emergencies. It should however be noted that there is strong political commitment and a favourable political climate, and an interministerial focal point for radiological emergencies has been identified. A bill on radiation security and nuclear safety, drafted with assistance from the International Atomic Energy Agency (IAEA), has been submitted to the National Assembly, which has unfortunately been slow to approve it. In addition, persons skilled in radioprotection have been appointed to radiology units in hospitals (46,47)

A bill on radiation security and nuclear safety, drafted with assistance from the International Atomic Energy Agency (IAEA), has been submitted by the Government to the National Assembly for review and approval. Persons skilled in radioprotection have been designated in hospitals. Develop a continuing education programme and measuring instruments to build radioprotection capacity (47)

Table 3.1: Imaging personnel for some African countries

Country	Population	Radiologists	Radiographers	Sonographers	Medical Physicists	Radiation Oncologists
Algeria	35,101,720	788	-	-	-	-
Benin	8,532,547	12	24	42	4	0
Burkinafaso	14,902,785	26	85	4	1	0
Djibouty	900,000	1	-	-	-	-
Egypt	81,713,517	1,250	-	-	-	-
Ethiopia	80,000,000	100	-	-	-	-
Kenya	36,000,000	105	650	90	6	8
Libya	6,173,517	1250	-	-	-	-
Mauritania	3,364,940	11	-	-	-	-
Morocco	34,343,219	450	-	-	-	-
Nigeria	130,000,000	300	100	120	7	25
Rwanda	10,473,282	7	99	1	0	0
Sudan	40,218,455	200	-	-	-	-
Sychelles	85,000	3	8	0	0	0
Tanzania	41,048,532	30	500	30	0	5
Tunisia	10,383,577	450	2,500	0	10	20
Uganda	32,369,558	38	150	300	3	5
Zambia	11,862,740	2	-	12	-	-

Courtesy: (Kawooya, 2012). For the empty spaces, there is no data available

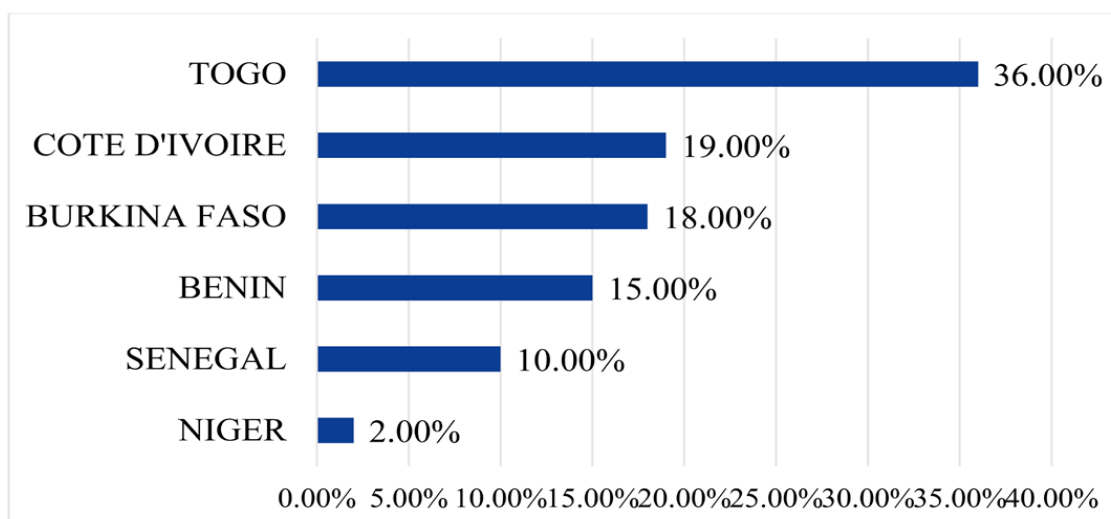


Fig 3.1: Distribution of technicians by country of practice (Amadou et al., 2021)

Table 3.2: Distribution of MRI Units in the West African Sub-Region (per million)

Country	Population (2017)	MRI Units	(Approx. Per Million Population)	GDP	Human Development Index
Nigeria	191,835,936	58	0.30	2,929.525	0.514
Ghana	28,656,723	14	0.48	1,384.354	0.579
Mauritania	4,266,448	3	0.77	1,197.121	0.506
Ivory Coast	23,815,886	2	0.08	425.056	0.462
Senegal	16,054,275	2	0.14	945.863	0.466
Guinea	13,290,659	1	0.07	519.173	0.411
Burkina Faso	19,173,322	1	0.06	644.502	0.402
Togo	7,691,915	1	0.15	586.301	0.484
Gambia	2,120,418	1	0.54	435.452	0.441
Cape Verde	533,468	1	2.00	3,057.916	0.646
Benin Republic	11,458,611	0	0.00	814.360	0.480
Mali	18,689,966	0	0.00	844.274	0.419
Liberia	4,730,437	0	0.00	478.681	0.430
Niger	21,563,607	0	0.00	412.797	0.348
Sierra Leone	6,732,899	0	0.00	635.892	0.413
Guinea Bissau	1,932,871	NA	NA	624.671	0.420

(Ogbole et al., 2018)

3.4: CONCLUSION

The future of medical imaging in Benin is looking bright as moves by both government and private entities have yielded significant investment in the health sector. Although there is a scarcity of data on the quality, quantity, and geographical distribution of radiodiagnostic and radiotherapy equipment and human resources, a few published literature shows the availability of some of these equipment in Benin. Benin's epidemiological profile is marked by a high rate of infectious diseases, followed by nutritional issues. The prevalence of HIV/AIDS in 2004 was 2.0 percent (2.4 percent in urban areas and 1.6 percent in rural areas), with a rise in non-communicable diseases. Benin spends slightly less than the average Sub-Saharan African country on health with 4.6 percent of GDP, against 5.24 percent. The total per capita health spending is USD 26 at current exchange rates and USD 43 at purchasing-power parity. Households are by far the largest source of health spending in Benin. Private out-of-pocket spending makes up 51.2 percent of total spending and nearly 99 percent of all private spending. The government (at 31 percent) and donors (at 16.5 percent) follow households as a funding source for health in Benin. Like most countries in the global south, the progress of medical imaging has been stalled by limited financial resources and political will. The sector still lags behind other medical specialties, both in terms of training and retaining the trained radiology, radiotherapy and oncology specialists. The country could benefit more from donations from international organizations and donor agencies to help in training and retraining the healthcare workforce, particularly the radiology workforce by offering scholarships and straightening local institutional capacities in the training, retraining and retention of the healthcare workforce in Benin.

References

1. Republic of Benin Health, Nutrition and Population Health & Poverty Analytical Report. (2009). The World Bank Group Africa Region, Human Development & Ministry of Health, Republic of Benin Public.
2. Turner B. (2012). *The Statesman's yearbook*. Palgrave Macmillan, London. https://doi.org/10.1007/978-1-349-59541-9_178
3. Republic of Benin ministry of environment, habitation & urbanism department of environment. First national communication of the Republic of Benin to the framework convention on climate change. Coordination of studies edition: Projet BEN/98/G31 «Changements Climatiques»/MEHU 09 BP : 432 Cotonou St-Michel.2001
4. Stiftung B, (2020). *BTI Country Report-Benin*. Gütersloh: Bertelsmann Stiftung.
5. The World Bank Group (Report No. 123031-BJ) International Bank for Reconstruction and Development. International Development Association. International Finance Corporation. Multilateral Investment Guarantee Agency. *Country Partnership Framework for Benin for the Period FY19–FY23*. June 6, 2018.
6. Bierschenk T. (2009). *International journal of politics, culture, and society, 1989 and beyond: The Future of Democracy*. 22(3): 337-357
7. Bouraima M.B and Qiu Y. (2018) *Towards Innovative Solutions for Revitalizing Benin Republic Railway Transportation System*. International Conference on Transportation and Development. 238-246.
8. *Human Development Report (PDF)*. (2015). United Nations Development Program. Retrieved 13 September, 2021.
9. World Bank, *Benin Country Brief (2016)*. Retrieved 12 November, 2021
10. *The World Bank Implementation Completion and Results Report P130184 ON A Credit in the Amount of SDR 23.2 Million To The Republic Of Benin For A WARCIP APL 1C - BENIN (P130184)* January 12, 2018.

11. Electrification pathways for Benin A spatial electrification analysis based on the Open Source Spatial Electrification Tool (OnSSET) Prepared by the division of Energy Analysis at KTH Systems in collaboration with SNV 2018
12. Stern I.D, “The Impact of Electricity on Economic Development: A Macroeconomic Perspective,” p. 44.
13. Niu S, Jia Y, Wang W, He R, Hu L, and Liu Y, “Electricity consumption and human development level: A comparative analysis based on panel data for 50 countries,” *Int. J. Electr. Power Energy Syst.*, vol. 53, pp. 338–347, Dec. 2013.
14. Mentis D et al., “Lighting the World: the first application of an open source, spatial electrification tool (OnSSET) on Sub-Saharan Africa,” *Environ. Res. Lett.*, vol. 12, no. 8, p. 085003, 2017.
15. USAID, “Power Africa - Benin,” 2018.
16. African Development Fund, “Benin Energy Sector Budget Support Programme - Phase I (PASEBE I),” Mar. 2017.
17. Benin ECOWAS SE4ALL NETWORK.” [Online]. Available: <http://www.se4all.ecreee.org/node/15>. Accessed: 16/12/2021.
18. The World Bank, “International Development Association Project Appraisal Document on A Proposed Scale Up Facility Credit,” PAD2162. 2017.
19. The World Bank, “Combined Project Information Documents /Integrated Safeguards Datasheet (PID/ISDS),” PIDISDSA20198. 2017.
20. African Development Fund. Republic of Benin Rural Drinking Water Supply and Sanitation Programme Appraisal Report. Department of Infrastructure Central and West Regions. 2004
21. Fuso F. N et al., (2018) “Mapping synergies and trade-offs between energy and the Sustainable Development Goals,” *Nat. Energy*, vol. 3, p. 10.

22. World Health Organization. (2000). World Health report: Improving performance. Geneva: WHO.
23. Devlin K, Egan E.F, & Pandit-Rajani T. (2017). Community health systems catalog. country profile: Benin. Arlington, VA: Advancing partners & communities.
24. World Bank. (2000). Effectiveness of public spending in the Benin health sector.
25. Adeya, G., A. Bigirimana, K. Cavanaugh, L. & Franco M. (2007). Rapid assessment of the health system in Benin, April 2006. Submitted to the U.S. Agency for International Development.
26. Coopération Benino-Belge. (2005). Étude d'identification d'une nouvelle intervention dans la zone sanitaire de Comé (Département du Mono).
27. USAID. (2006). Health systems assessment approach, draft manual for pilot test in Benin
28. The World Bank (2013). World Development Indicators.
29. Benin ministry of health. (2005). Annuaire des statistiques sanitaires.
30. World Health Organization. (2006). Global Tuberculosis control: Surveillance, planning, financing. Geneva: WHO.
31. Ministry of Health (2006). Directorate of human resources, Republic of Benin. Effectifs du personnel de medecins specialistes.
32. World Health Organization (2017). Joint external evaluation of IHR core capacities of the Republic of Benin mission report.
33. Population survey and health, Benin 2006. Third general population census and housing. <http://www.who.int/nha/country>
34. Andrew C, Callahan S, and Banke K. 2014. *Benin Private Health Sector Census*. Bethesda, MD: Strengthening Health Outcomes through the Private Sector Project, Abt Associates Inc.

35. Kawooya MG. (2012). Training for rural Radiology and Imaging in Sub-Saharan Africa: Addressing the mismatch between services and population. *J Clin Imaging Sci.* 2:37.
36. Kawooya MG, Pariyo G, Malwadde EK, Byanyima R, Kisembo H. (2011). Assessing the diagnostic imaging needs for five selected hospitals in Uganda. *J Clin Imaging Sci.*1:53
37. Tshibwabwa ET, Kawooya MG, Muyinda Z. (2009). Trends in Radiology and Imaging services in the Tropics. In: Cook G, Zumla A, editors. London: Saunders Ltd.
38. Mindel S. (1991). Role of imager in developing world. *Lancet.* 350:426-9.
39. Bussmann H, Koen E, Arhin-Tenkorang D, Munyadzwe G, Troeger J. (2001). Feasibility of an ultrasound service on district health care in Botswana. *Trop Med Int Health.* 6:1023-31.
40. Steinmetz JP, Berger JP. (1999). Ultrasonography as an aid to diagnosis and treatment in a rural African hospital: A prospective study of 1,119 cases. *Am J Trop Med Hyg.* 60:119-23.
41. Spenser JK, Adler RS. (2008). Utility of portable ultrasound in a community in Ghana. *J Ultrasound Med.* 27:1735-43.
42. Ogbole G.I, Adeyomoye A.O, Badu-Peprah A, Mensah Y, Nzeh D.A. (2018). Survey of magnetic resonance imaging availability in West Africa. *Pan African Medical journal.* 30:240. doi:10.11604/pamj.2018.30.240.14000
43. Amadou A, Dagbe M, Adjadohoun S.B.M.G, Gbande P, Sonhaye L, Agoda-Koussema L.K, Adjenou K.E. (2021). Current state of affairs with regard to continuing medical education for technicians in Radiology in Francophone West Africa *Open journal of Radiology.* 11: 91-100
44. Ahouansou A.Y, Akanni D, Santos A.D, Adjadohoun S, Gbaguidi B, Tovè K.M.S, Biao O, Boco V. (2020). Non-Traumatic chronic nasosinusitis disorders: Clinical and Computed Tomodensitometric aspects in Cotonou in Benin, West Africa. *Open journal of Radiology.* 10:159-172
45. Yèkpè P, Akanni D, Souza C.O, Adjadohoun S, Kiki M, Tovè K.M.S, Biao O, Boco V. (2018). Anatomic variants of sphenoid sinuses and adjacent structures: A study of 225 Skull CT Scans at CNHU-HKM in Benin, West Africa *Open journal of Radiology.* 8: 181-190

46. Sonia B. M. G. A, Miralda K, Maurice M. W. D. A, Boris V, Perpétue B, Kofi-Mensa S. S T, Patricia Y. A, Zavier C. Z, Olivier B, Vicentia B. (2021). Clinical and Ultrasound concordance of joint damages in Rheumatoid Arthritis in a resource-limited country. *Open journal of Radiology*. 11: 126-137
47. Joint External Evaluation of IHR Core Capacities of the Republic of Benin. Geneva: World Health Organization; 2018. Licence: CC BY-NC-SA 3.0 IGO.