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nexus

RES4AFRICA FOUNDATION

Stakeholders Survey on the Water Energy and Food Nexus in the Niger Basin region

A survey to public and private stakeholders to assess Technical Assistance gaps in WEF Nexus knowledge

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH



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About

Nexus Regional Dialogues Programme Phase II

Building on the results of Phase I, the Nexus Regional Dialogues Programme Phase II aims to institutionalise the WEF Nexus approach in national and regional governance structures and investment decisions and to engage the public and private investors for WEF Nexus projects.

Vision: Inclusive water, energy and food security on the path to a climate resilient and resource efficient future for all.
Implementing organisation: Regional Environmental Centre for Central Asia (CAREC); Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (GIZ); Global Water Partnership Southern Africa (GWP-SA)
Collaborating partners: National Partners in Central Asia; League of Arab States (LAS); Niger Basin Authority (NBA); Southern African Development Community (SADC)
Implementation period: July 2020 – June 2023
Beneficiary countries: Central Asia; Latin America and the Caribbean (LAC); Middle East and North Africa (MENA); Niger Basin; Southern Africa
Funding by: European Union (EU), German Federal Ministry for Economic Cooperation and Development (BMZ)

GIZ

As a service provider in the field of international cooperation for sustainable development and international education work, we are dedicated to shaping a future worth living around the world. We have over 50 years of experience in a wide variety of areas, including economic development and employment promotion, energy and the environment, and peace and security. The diverse expertise of our federal enterprise is in demand around the globe – from the German Government, European Union institutions, the United Nations, the private sector, and governments of other countries. We work with businesses, civil society actors and research institutions, fostering successful interaction between development policy and other policy fields and areas of activity. The guiding principle is sustainability. Our main commissioning party is the German Federal Ministry for Economic Cooperation and Development (BMZ).

The commissioning parties and cooperation partners all place their trust in GIZ, and we work with them to generate ideas for political, social and economic change, to develop these into concrete plans and to implement them. As a public-benefit federal enterprise in international cooperation with a focus on sustainability, we represent German and European values. Together with our partners in national governments worldwide and cooperation partners from the worlds of business, research and civil society, we work flexibly to deliver effective solutions that offer people better prospects and sustainably improve their living conditions.

RES4Africa Foundation

Born in 2012, RES4Africa (Renewable Energy Solutions for Africa) is a Foundation that works in support of Africa's just energy transition in order to achieve the SDG7, ensuring access to affordable, reliable, sustainable and modern energy for all. It functions as a bridge between Europe and Africa: gathering a network of members from all over the clean energy sector from both continents and high-level international partnerships, we ensure constant dialogue between the most relevant energy stakeholders willing to mobilise investments in clean energy technologies.

We envision the sustainable transformation of Africa's electricity systems to ensure reliable and affordable electricity access for all, enabling the continent to achieve its full, resilient, inclusive and sustainable development.

We work towards creating favourable conditions for scaling up investments in clean energy technologies to accelerate Africa's just energy transition and transformation.

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Acronyms

BMI	Body Mass Index
BMZ	German Federal Ministry for Economic Cooperation and Development (Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung)
CFA	Franc of the Financial Community of Africa
CSO	Civil Society Organization
EU	European Union
GDP	Gross Domestic Product
GHG	Green House Gas
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GW	Gigawatt
IPP	Independent Power Producer
kW	Kilowatt
kWh	Kilowatt/hour
MW	Megawatt
MWh	Megawatt/hour
NBA	Niger Basin Authority
NGO	Non-Governmental Organization
NPV	Net Present Value
NRDP	Nexus Regional Dialogues Programme
PHD	Doctor of Philosophy
PUE	Productive use of energy
PPA	Power Purchase Agreement
PV	Photovoltaic
RES4Africa	Renewable Energy Solutions for Africa
SADC	Southern African Development Community
SDG	Sustainable Development Goal
SPIS	Solar-Powered Irrigation Systems
TW	Terawatt
TWh	Terawatt/hour
WB	World Bank
WEF	Water-Energy-Food

Executive Summary

In West Africa, 160 million people's livelihood depends on the Niger River which is the foundation of many everyday activities of nine countries: Benin, Burkina Faso, Cameroon, Chad, Ivory Coast, Guinea, Mali, Niger and Nigeria. With growing climate change effects on natural resources, the Niger Basin could suffer from severe consequences in the near future, affecting millions of lives. More than 80% of freshwater is withdrawn for agricultural purposes, and the 7 of the Basin's countries are among the 20 poorest nations in the world. It is then evident how fundamental is the role played by natural resources management in the region and the relevance of the water, energy and food nexus.

In this framework, the Nexus Regional Dialogue Programme (NRDP) in the Niger Basin proposes to i) mainstream the Nexus approach through policy and investment dialogue, ii) implement tailored training for the nine countries, iii) demonstrate the benefits of the Nexus approach through demonstration projects and iv) establish accelerator programmes for SMEs. Under the umbrella of the NRD Programme, nine national dialogues were conducted (one per country) and these workshops were a unique opportunity to carry on institutional high-level conversation on the WEF approach that provided an unvaluable contribution in achieving the objective of the WEF institutionalization. Ministries, governmental agencies and other institutions took part to the dialogue. Not limited to high-level discussions, the conversations among the participants and the implementing parties of the NRD programme brought to a deep understanding of the knowledge and competences of the institutions in the WEF space.

Taking stock from the experience of the national dialogues' participants, the analysis outlined in this report provides interesting elements to assess the level of knowledge of public institutions on the water, energy and food nexus concept and it does so with the support of a structured survey. The survey collects information on the participants' academic background, experience with the WEF nexus, sector of employment, etc. The survey tool is especially useful to address challenges and collect recommendations directly from stakeholders involved in the water, energy and food sectors. The aim of the report is to shed light on the public sector perspective on the WEF space in terms of challenges and opportunities, to formulate relevant suggestions to move forward for a full-fledged nexus institutionalization.

The surveys have seen the involvement of 203 people coming from the public sector of the nine countries and 8 young innovators of the private sectors. The youngest participant was 26 years old and the oldest 75, while the average years of professional experience among the interviewees was 16 years.

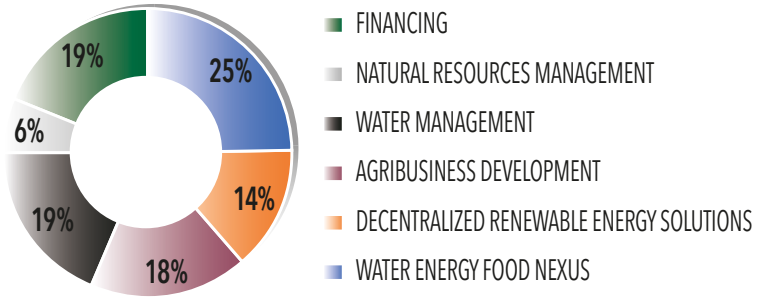
The level of education of people surveyed ranged from "licence" to "PHDs", with 59% of people holding a Master degree, 25% of people obtained a licence, 9% of people with secondary education level and finally only 8% of participants holding a PHD. When it comes to the type of education of the respondents, the vast majority has scientific background: indeed 71% of people has pursued scientific studies, 14% in humanities, 10% technical schools and 5% other type of studies.

In particular, for the public sector, the survey respondents' background show that there is a strong expertise at least in one of the nexus-related fields with a similar percentage in the water, energy, food and environment sectors with a slight majority of people working in the water sector (30%), followed by environment and agriculture (25% each) and energy (20%). Despite the expertise just mentioned, only half of the total number of interviewees has actively participated to WEF projects.

One of the main objectives of the survey was to estimate the perception of the attendants on their "lack of knowledge" on certain topics and their interest in capacity building in the following areas:

- Water, Energy, Food Nexus
- Decentralized Renewable Energy (DRE) solutions
- Agribusiness development
- Water management
- Natural resources management
- Financing

The outcomes of the survey showed that there is interest in all of the subjects, with a general preference for the WEF concept, as shown in the following graph, probably also as a consequence of the national dialogues ability to generate interest in the nexus approach.



The survey included a section for open answers related to challenges and recommendations for the implementation of the nexus and the improvement of natural resources management.

Among public sector's actors one of the biggest concerns is the management of water resources and, consequently, the ability to achieve food security. In this sense rainwater control appears to be of uttermost importance to guarantee resilience of crop production (which is already put in danger from soil degradation) during dry seasons. Furthermore, a general lack of competences about groundwater use and storage technologies contribute to an overall management issue of this precious resource. The preoccupation around the water resources is further aggravated as some countries of the region are also burdened with difficulties in access to safe drinking water.

The agri-food sector is reported to be underperforming in most of the cases due to a weak enabling environment, lack of investments, incentives and adequate finance. In the meantime, desertification of certain rural areas is posing serious threats to population that still highly rely on wood for cooking purposes. Many countries in the region have to import food as their production is not able to keep up with the growing population. The high cost of new technologies and the capacity to operate them contribute to the overall insecurity of the food and agriculture sector.

According to the interviewees, energy plays a key role in the development of the water and agriculture sectors, but prohibitive cost of clean technologies and lack of funding make it hard for farmers to adopt renewable solutions. Public energy networks struggle to provide reliable electricity and bridging the energy gap in rural communities would be a catalyser for their development; the unreliability of current power supply is furthermore responsible for the breakdown of the food supply chain as its conservation becomes nearly impossible to achieve in certain climate areas.

Overall, the lack of coordination among the three sectors is the most common issue reported by the public sector stakeholders, as insufficient resource management planning and silo approach do not allow communities to benefit from the implementation of a full-fledged water, energy and food integrated approach.

The survey was complemented by the private sector perspective working in the water energy and food sectors, to assess the business environment for young entrepreneurs to start and manage a company in the Niger Basin. A general agreement has been found about the overall issues identified by

the public sector; however, it is particularly interesting to understand the difficulties faced by entrepreneurs as they provide an extra perspective on the regional situation.

Most of the entrepreneurs find that bureaucracy is one of the main barriers when starting a new business, especially in relation to paperwork and consistent fees to face for documents' approval, permits, licenses etc. and requested from financial bodies. Another obstacle for young entrepreneurs is the absence of incentives and/or special tax regulations for youth, start-ups and innovators; the absence of such incentives makes it difficult for young entrepreneurs to compete on a levelled playing field with experienced companies already on the market with more traditional solutions.

In terms of recommendations, it is possible to highlight common views from most of the interviewees, notably:

- the need for a coordinated structure among the water, energy and food sectors, with cross ministerial meetings and task forces and dedicated body
- efforts to manage better water resources in order to expand agricultural productivity beyond the rainy season
- increased investments at regional level to stimulate a regional integrated market in the three sectors
- comprehensive training and capacity building to raise awareness about the importance of resource management and integrated solutions, as well as specific training on issues such as financing and technology
- the need to encourage local entrepreneurship especially among youth with specific programmes and financing schemes
- harmonize national policies of the three sectors to work in a more synergic manner, also foreseeing the inclusion of farmers associations and other stakeholders in the consultations
- adopt sustainable solutions and technologies to ensure reliable power supply
- promoting the design of integrated and innovative business models upholding environmental preservation

Methodology

Res4Africa, in collaboration with the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), participated in the Nexus Regional Dialogues (NRD) program, an initiative that has the ambition to stimulate the Water Energy Food Nexus institutionalization in the nine Niger Basin countries.

To this end, GIZ collaborated with the Niger basin Authority (NBA), an intergovernmental organisation responsible for the joint management of the river and sustainable development of the basin. The nine riparian nations are all members of the NBA, whose aim is to encourage coordinated development in various areas, including water, energy, agriculture, livestock, fisheries, forestry, and society.

First Phase – Public Sector

Face-to-face national workshops have been implemented over two months in the nine basin countries, each executed over one week addressing public sector stakeholders. The workshops consisted of a training week on the WEF nexus concept. R4A conducted surveys at the end of each week's workshop to gather data regarding i) the profile of respondents and their familiarity with the concept of WEF Nexus, ii) their expertise, and most importantly, iii) the gaps in terms of knowledge that they would address to better integrate the WEF approach in their competencies. Depending on the country, the number of participants ranged from a minimum of 14 (Benin and Côte d'Ivoire) to a maximum of 52 (Nigeria).

These public stakeholders mainly came from public institutions, public agencies, and international organizations, including: the Ministry of Water, Planning Ministries, Ministry of Foreign Affairs, Ministry of the Economy/ Budget, Ministry of Commerce, Ministry of the Environment, Ministry of Mines/Energy, Ministry of Agriculture/Livestock, Dam agencies, ABN MPs' Network, NGOs, civil society organizations including national user coordination, representatives of the traditional chiefs and religious denominations and scientific representatives.

Second Phase – Private Sector

The collaboration for reaching out to private sector stakeholders was done with the university Institut International d'Ingénierie de l'Eau et de l'Environnement (2iE). The university issued a call for applications on behalf of the Nexus Regional Dialogues Programme (NRDP) to identify 12 young entrepreneurs to be included in a one-week workshop in Ouagadougou. The workshop served to select 5 companies for the acceleration programme held by the 2iE University. The most promising start-ups were selected using the WEF Nexus selection criteria toolbox, which identifies projects that create positive synergies between the three sectors (water, energy, and food) without negatively impacting each other.

The objective of this accelerator program was to provide training and individual coaching for the participants to develop their businesses further and link them with potential investors. During and after this workshop and the acceleration phase, RES4Africa conducted interviews and surveys to understand the entrepreneurs' perception of barriers and challenges in implementing energy business models within the WEF Nexus realm.

Composition of Country Profiles

Each Country Profile is comprised of several sections, namely i) Introduction, ii) Survey, iii) WEF nexus analysis, and iv) The way forward.

Introduction

The section commences with an "About" subsection, which furnishes general details concerning the country's geography and economic significance. Following this, there are sections titled "Rankings on Doing Business Topics" and "Ease of Doing Business Rank," both formulated by the World Bank. These indices evaluate economies based on their adherence to regulatory excellence, signifying their proximity to optimal regulatory performance for each metric within the World Bank's Doing Business framework.

The "Economic Overview" provides insight into the nation's present economic state, highlighting whether its socio-economic circumstances have advanced or declined over time, while underscoring potential factors influencing these shifts. This segment culminates with a chart that compares the annual GDP (%) growth rates between the evaluated country and Sub-Saharan Africa.

Survey

This section unveils the outcomes of the public institution's survey, elucidated earlier in the "Methodology" section. The initial subsection, labelled "Respondents Background Profile," delves into the analysis of the sample size from the evaluated country. Information such as the number of participants, average years of professional experience, job titles, and originating institutions are presented.

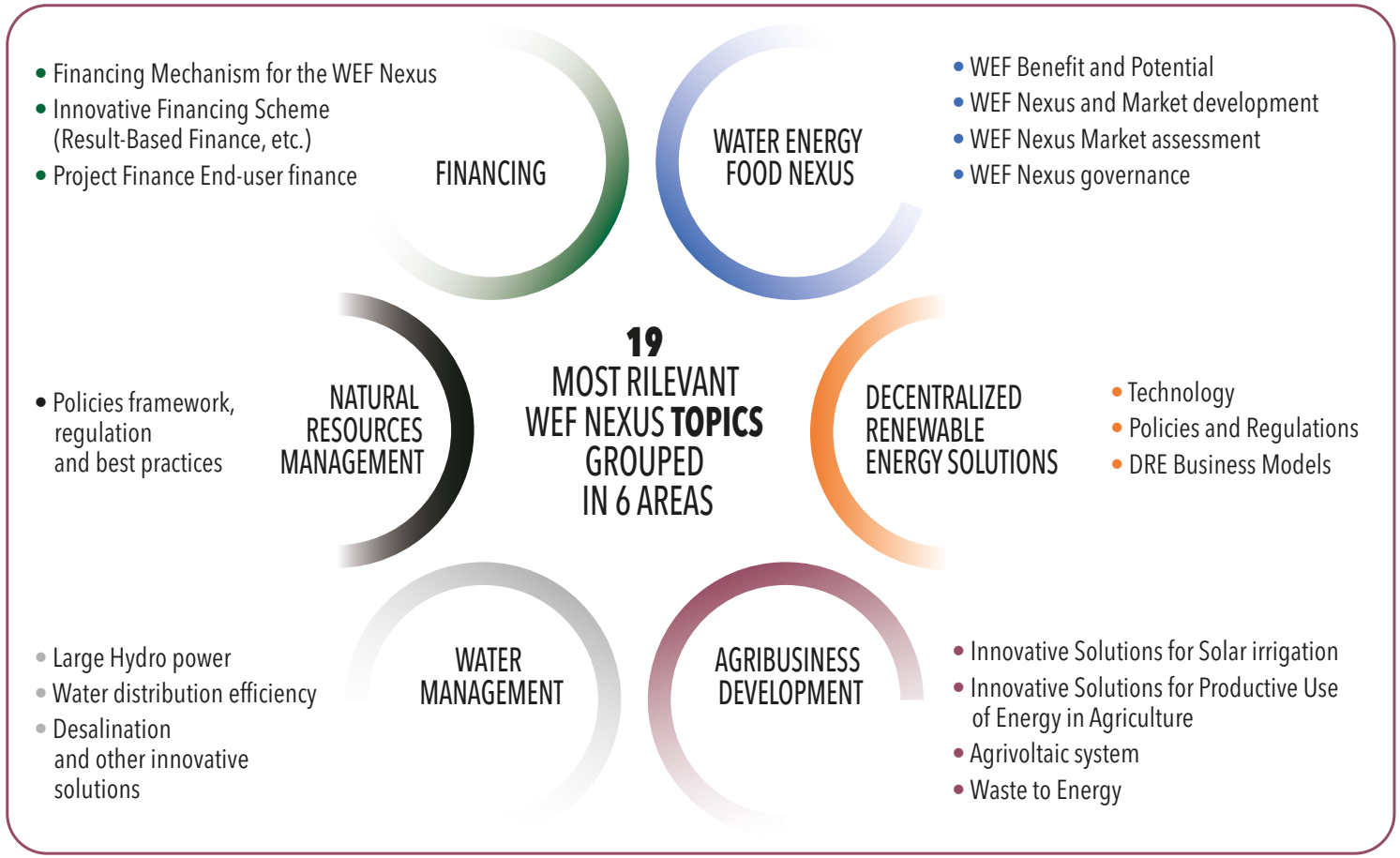
The section concludes with six graphs:

- "Selected Technical Assistance" scrutinizes the most notable focal points chosen by participants from the comprehensive array of technical assistance offerings presented in the survey.
- "Educational Profile" showcases the academic and schooling backgrounds of the participants.
- "Professional Nexus Expertise" outlines the specific WEF nexus area in which the participants hold professional engagement.
- "Domains of Education" illustrates whether participants have a technical, scientific, or humanities-oriented educational background.
- "Nexus Concept Familiarity" gauges participants' familiarity levels with the WEF nexus concept as a whole.
- "Participation in WEF-related Activities" indicates whether participants have previously been involved in activities related to the WEF approach.

WEF Nexus Analysis

This section thoroughly examines the current state of each component within the WEF nexus - Water, Energy, and Food. The analysis begins with an initial graph displaying the pertinent Sustainable Development Goal (SDG) indicator, which sheds light on the country's progress toward achieving that specific SDG. For clarity reasons, access to energy is intended as "a household having reliable and affordable access to both clean cooking facilities and to electricity, which is enough to supply a basic bundle of energy services initially, and then an increasing level of electricity over time to reach the regional average" (IEA). Following the graph, the "Challenge" subsection outlines the critical issues faced by each sector and offers potential recommendations. The subsequent "In Numbers" part presents essential statistical figures related to each component.

The section culminates with the "Water-Energy-Food Nexus INDEX," a composite indicator at the national level, which is built upon 21 relevant indicators aimed at gauging the extent to which the country has adopted the WEF Nexus approach. Lastly, key figures pertaining to the WEF Nexus are provided, encapsulating important insights and data.



With the final goal of finding out the most relevant topics related to a WEF Nexus implementation, R4A has asked the participants to tick three to five most relevant ones.

The way forward

Drawing on the insights gathered from surveys and interviews conducted with public institutions and private companies, this section presents valuable recommendations aimed at promoting and strengthening the WEF Nexus approach in the countries assessed. These suggestions are geared towards enhancing coordination and collaboration among the water, energy, and food sectors, and fostering sustainable practices that optimize resource utilization and address potential challenges effectively. By implementing these recommendations, the countries can foster a more integrated and harmonious approach to addressing their water, energy, and food needs, contributing to greater socio-economic and environmental resilience.

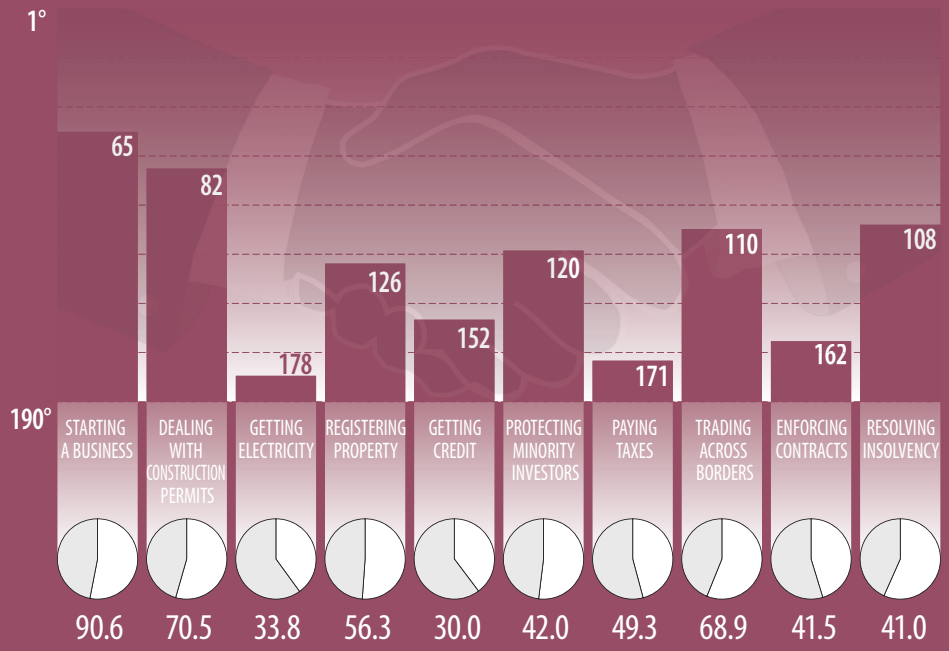
Benin

25.2 million population

About

Benin's strategic location at the juncture of major regional corridors and its 121km coastline on the Gulf of Guinea contribute to its commercial and tourism significance. The economy relies on agriculture and reexport trade with Nigeria.

Rankings on doing business topics

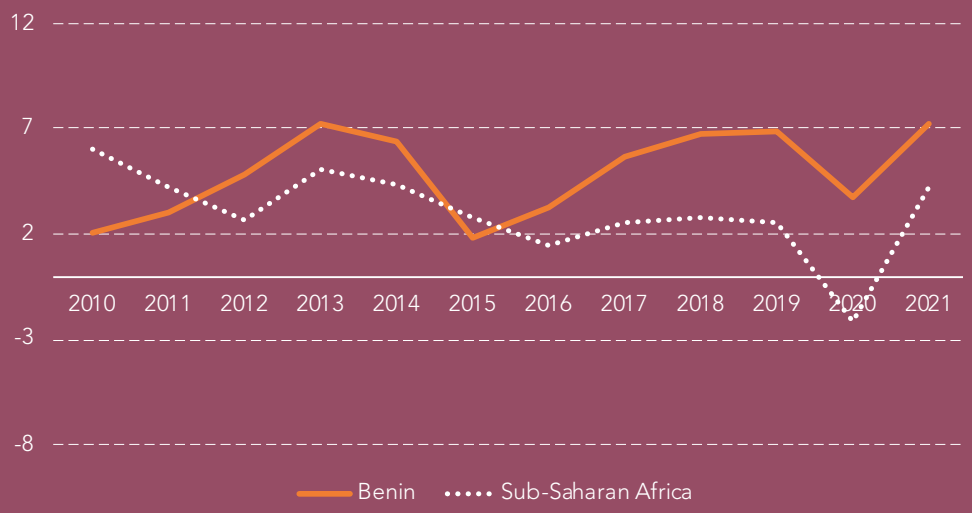


Ease of doing Business
Niger World Rank **132**

Economic Overview

In the year 2022, there was a moderate deceleration in economic growth, reaching 6%, following a robust rebound in 2021 with a growth rate of 7.2%. This growth was primarily stimulated by the agricultural sector, particularly through cotton production, and the services sector. The economy's reliance is evident in the export of unprocessed agricultural products, such as cotton and cashew nuts, and the reexport of imported goods and commodities, including secondhand cars and rice, to Nigeria. A significant proportion of the labor force, approximately 85%, operates within the informal economy.

GDP growth (annual %) - Sub-Saharan Africa, Benin



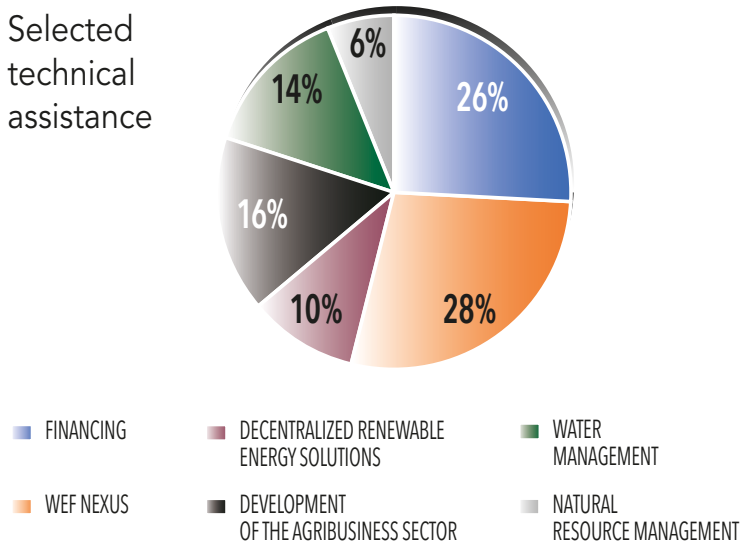
Survey

Respondents Background profile

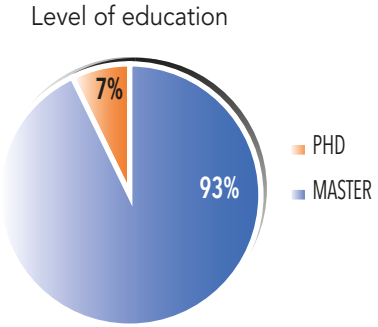
The analysis of surveys in Benin involved 14 participants, mainly from public institutions. Average age was around 40 years, with about 10 years of professional experience. Participants held various roles like managers, technicians, researchers, teachers, and engineers. Institutions included DGRE, Direction Générale de l'eau, Wascal - LACEEDE, Ministry of Foreign Affairs and Cooperation, Laboratoire d'Ecologie et de Management des Écosystèmes Aquatiques, Direction Générale des Eaux, Forêt et Chasse, Ministry of Water and Mines in Benin, and Laboratoire Pierre Pagney Climat Eau Écosystèmes et Développement (LACEEDE/Université d'Abomey Calavi).

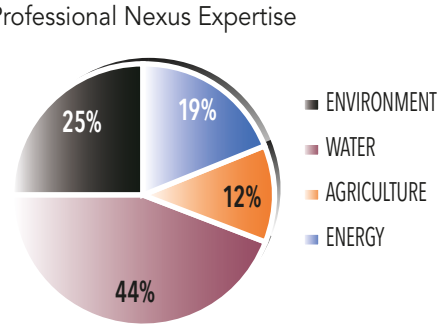
Mostly selected technical assistance packages by participants

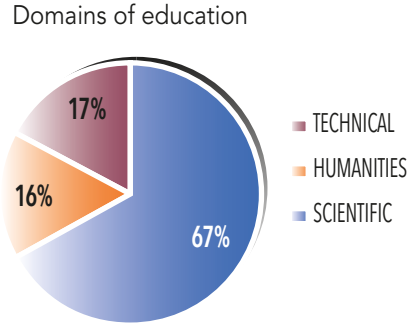
A list of different technical assistance packages have been proposed to the participants during the survey. Here under are the most interesting focus points as selected by participants from the exhaustive list of the survey.



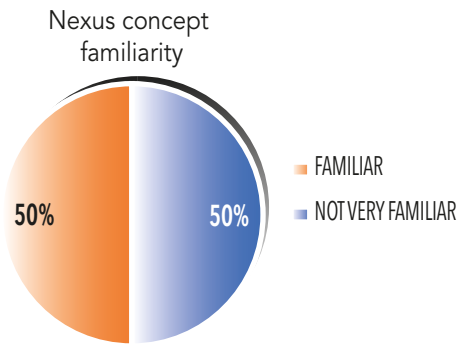
Educational profile

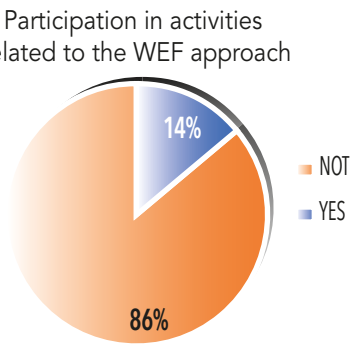






Familiarity to Nexus Concept





Energy

SDG7 - Affordable and Clean Energy			Overtime trend	
Population with access to electricity (%)	18.8	2019		
Population with access to clean fuels and technology for cooking (%)	2.4	2019		
CO2 emissions from fuel combustion per total electricity output (MtCO2/TWh)	4.2	2019		
Share of renewable energy in total primary energy supply (%)	75.9	2019		

Challenge

The Glo-Djigbé Industrial Zone's expected investments will raise Benin's peak electricity demand from 250 MW to 500 MW by 2025. Despite dependence on Nigeria and Ghana for half of its electricity, new domestic generation capacity and the WAPP regional power market activation will provide additional capacity by 2024.

in numbers

304 MW installed electricity-generating capacity

18 % access to electricity in rural population

Major challenges remain
Significant challenges remain
Challenges remain
SDG achieved
Trend information unavailable

Decreasing
Stagnating
Moderately improving
On track or maintaining SDG achievement

Food security

SDG2 - Zero Hunger			Overtime trend	
Prevalence of undernourishment (%)	NA	NA		
Prevalence of stunting in children under 5 years of age (%)	47.1	2019		
Prevalence of wasting in children under 5 years of age (%)	9.8	2019		
Prevalence of obesity, BMI ≥ 30 (% of adult population)	5.5	2016		
Human Trophic Level (best 2-3 worst)	2.1	2017		
Cereal yield (tonnes per hectare of harvested land)	0.6	2018		
Sustainable Nitrogen Management Index (best 0-1.41 worst)	0.9	2015		
Exports of hazardous pesticides (tonnes per million population)	14.2	2019		

Challenge

Agriculture holds a pivotal position within the national economy of Benin, constituting 32 percent of the Gross Domestic Product (GDP) and employing a substantial portion of the workforce. Despite possessing considerable productive potential and maintaining a diversified agricultural sector encompassing crop production, livestock, non-timber forest products, and fisheries, the country heavily depends on food product imports, which account for 25 percent of the overall value of imports.

in numbers

7.4 % of prevalence of undernourishment

28 % of employment in agriculture

Water

SDG 6 - Clean Water and Sanitation			Overtime trend	
Population using at least basic drinking water services (%)	46.9	2020		
Population using at least basic sanitation services (%)	14.8	2020		
Freshwater withdrawal (% of available freshwater resources)	7.5	2018		
Anthropogenic wastewater that receives treatment (%)	0.0	2018		
Scarce water consumption embodied in imports (m3 H2O eq/capita)	163.2	2018		

Challenge

The northern regions of the country have endured prolonged periods of drought, while the southern regions have been severely impacted by floods. Climate change, urbanization, deforestation, mangrove depletion, and heightened demand for water and agricultural land are the primary factors responsible for these challenges.

The expansion of cities and urban areas has resulted in a threefold increase in water consumption over the past few decades. Furthermore, the once dense forest cover has experienced a decline of more than 50% since 2013.

▼ in numbers

2177 total renewable water resources per capita (m3/inhab/year)

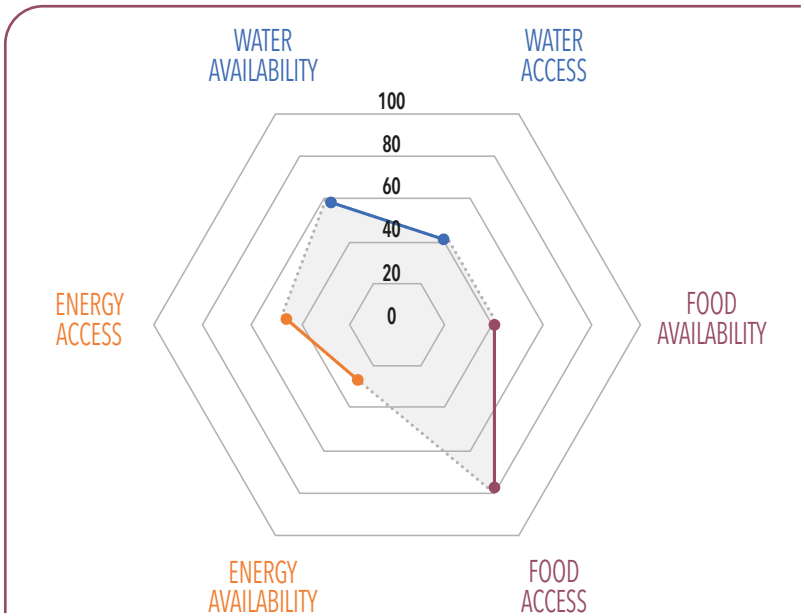
959,5 National Rainfall Index (2020)[1]

25,21 % agricultural water withdrawal as % of total (2020)

[1] NRI is defined as the national average of the total annual precipitation weighted by its long-term average.

Water-Energy-Food Nexus INDEX

The WEF Nexus Index is an inclusive metric that amalgamates 21 indicators from worldwide data repositories. In Benin, the WEF Nexus Index value is 44.5, placing the nation in the 160th position globally. Benin has a value of 45.3 for the Water pillar, 34.6 for the Energy pillar and 53.5 for the Food pillar.



▼ in numbers

44.5 WEF index score

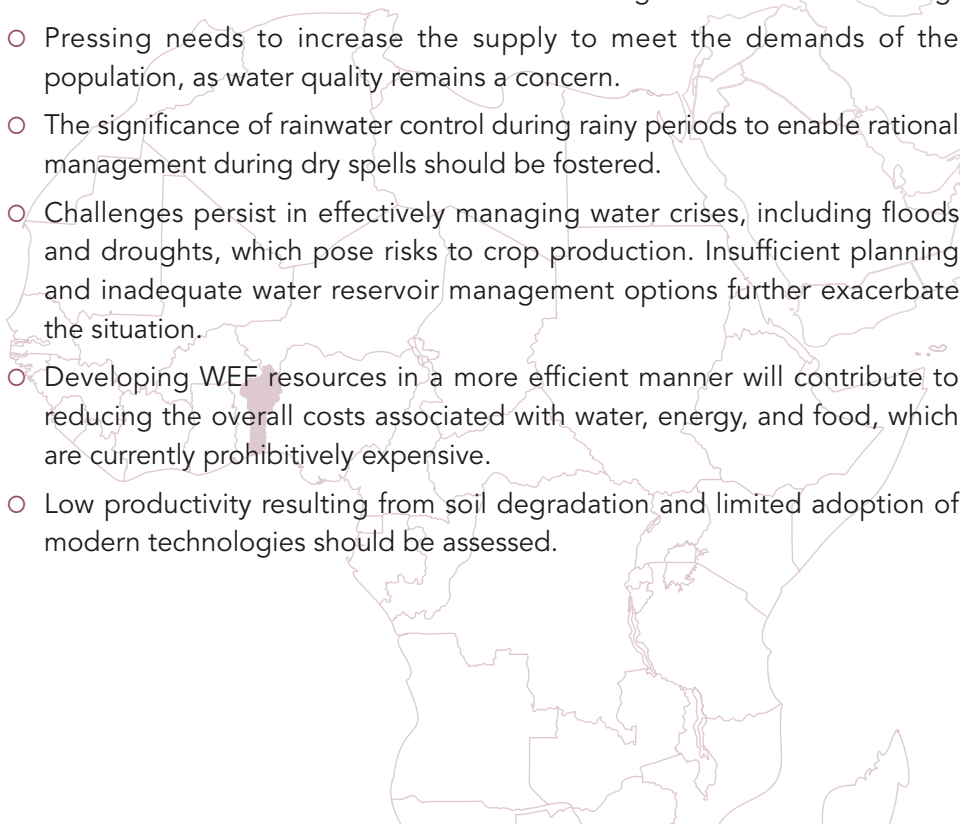
160th global rank

The way forward

Focus on public sector: understanding the local Benin context

Challenges in implementing the Water Energy Food Nexus in Benin

- The primary barriers encountered in off-grid areas of Benin revolve around the challenges of accessing energy and water. These obstacles have had a direct impact on the declining production of food.
- Achieving self-sufficiency in food production and consumption remains a critical objective in order to attain food security.
- Benin heavily relies on food imports.
- Growing need to mobilize water for aquaculture while implementing better control measures for various water uses such as agriculture and fish farming.
- Pressing needs to increase the supply to meet the demands of the population, as water quality remains a concern.
- The significance of rainwater control during rainy periods to enable rational management during dry spells should be fostered.
- Challenges persist in effectively managing water crises, including floods and droughts, which pose risks to crop production. Insufficient planning and inadequate water reservoir management options further exacerbate the situation.
- Developing WEF resources in a more efficient manner will contribute to reducing the overall costs associated with water, energy, and food, which are currently prohibitively expensive.
- Low productivity resulting from soil degradation and limited adoption of modern technologies should be assessed.



Recommendations for a more efficient implementation of the Water Energy Food Nexus in Benin

- It is crucial to focus on the restoration, protection, and preservation of biodiversity, as well as safeguarding river banks and bodies of water.
- Efforts should be made to ensure a more balanced distribution of water resources.
- Knowledge and understanding of water availability during times of low water levels should be spurred, in order to facilitate more accurate irrigation predictions while maximizing land utilization for crops.
- The promotion of off-season crops and organic fertilizer-based agriculture should be given due consideration.
- WEF Nexus should not be seen as separate entities with conflicting resource allocations, but rather as a collaborative commitment driven by shared interests.
- High transaction costs pose a challenge, requiring mobilization of local stakeholders and resulting in performance risks due to a lack of technical expertise or continuity plans.

Focus on private sector: Agro Eco Service

It specializes in producing organic fertilizers using Black Soldier Flies and reducing the composting time to 12 days. This innovation answers the problem of declining agricultural yields and soil fertility in Africa thanks to a clever combination of biochar/fertilizer and urban organic waste management. Marketed under the "Maggot-Compost" label, the fertilizer produced retains water and the minerals necessary for the plant, sustainably fertilizes the soil, and increases the yield of producers.

Barriers

Farmers are confronted with the problem of water retention in the soil. Severe droughts are occurring, impeding the water to stay in the ground for a long time. Other key challenges lie around pest management and yield for producers in the region.

Entrepreneurs are also confronted with time intensive and expensive paperwork and documentation. For example, projects connected to agricultural regulations take at least 6 to 7 months to be approved. On top of that, the costs of paperwork are high; for any entrepreneur, it is needed to spend 6 -7 million CFA francs (10,000 USD) to have the papers to produce on a large scale. The government also facilitates only the marketing of chemical fertilizers, while companies dealing in non-chemical are not safeguarded. Exemptions for organic producers at different levels - such as taxes, paperwork, subsidies – are highly encouraged.

Prerogatives

To overcome the issue of water retention, the local government could subsidize biochar to foster the deployment of biochar-related kits to farmers. To achieve a meaningful impact, capacity building should be implemented, because, as of now, there is an overarching lack of technical and financial support for entrepreneurs. Access to technical equipment is encouraged, especially to foster production on a large scale. Financially-wise, the picture has been depicted as "impossible" for small producers and startups because interests are too high.

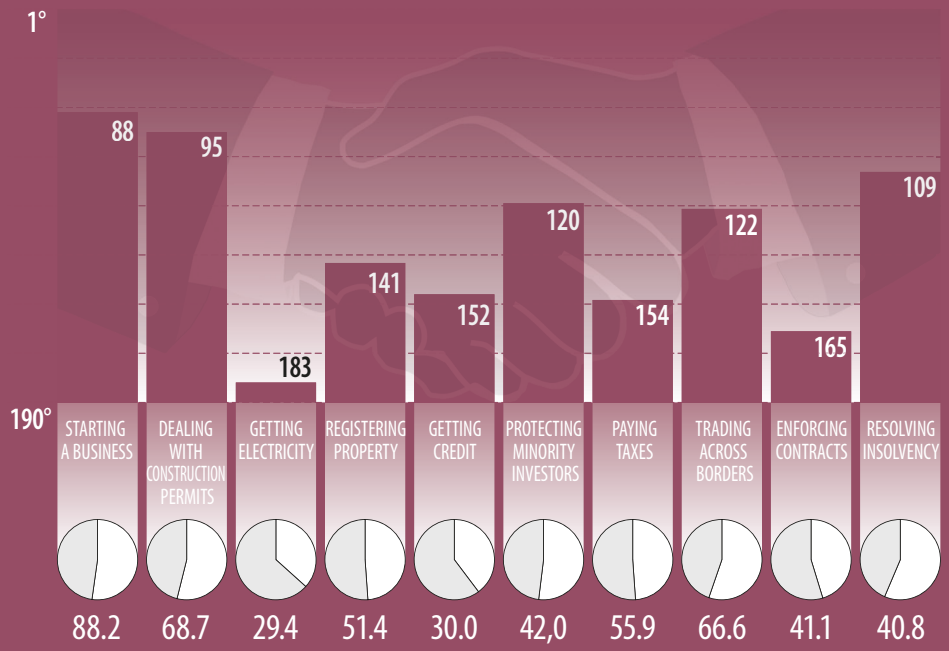
Burkina Faso

22.1 million population

About

Burkina Faso is a landlocked country between Ghana to the south and Mali to the north, with limited natural resources. Its economy is predominantly based on agriculture activities and gold export. More than 40% of the population lives below the poverty line. In the World Bank's Human Capital Index, Burkina Faso ranks 144 out of 157 countries.

Rankings on doing business topics

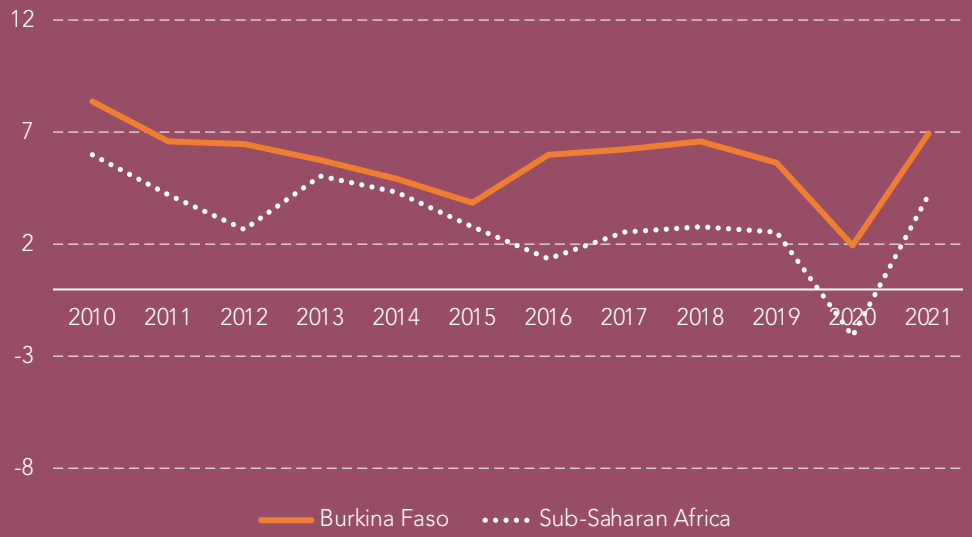


Ease of doing Business
Burkina Faso World Rank **151**

Economic Overview

After a strong recovery in 2021 with estimated growth of 6.9% (4.3% per capita), growth slowed to 2.5% (-0.1% per capita) in 2022. Exports fell by 0.6% in 2022, while imports rose by 1.7%, mainly due to the purchase of hydrocarbons. The agricultural sector accounted for an estimated 18.4% of Burkina Faso's GDP in 2020. About 26% of the population engages in subsistence agriculture. Cotton is the main cash crop.

GDP growth (annual %) - Sub-Saharan Africa, Burkina Faso



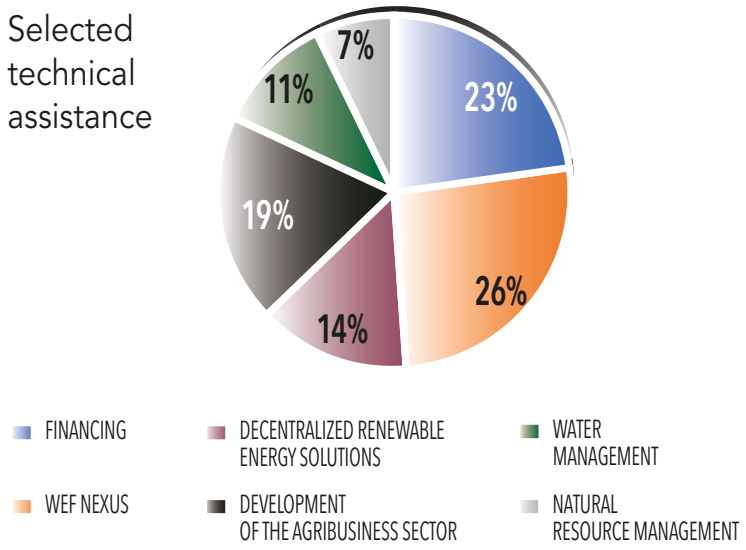
Survey

Respondents Background profile

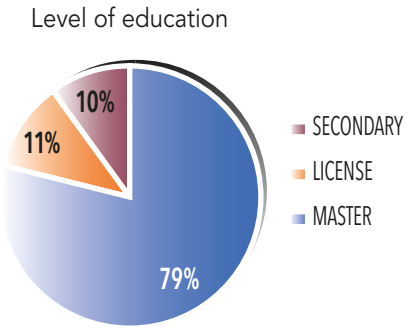
The analysis of surveys in Burkina Faso involved 20 participants, mainly from public institutions. Average age of the participants was approximately 43 years, with an average professional experience of around 13 years. They held various profiles, including engineer, agronomist, hydrogeologist, electrician, and project manager. The institutions involved were: Minister of Foreign Affairs, Pidacc/ BN, Direction Régionale de l'Eau et de l' Assainissement du Sahel, direction generale espace et aménagement pastoraux, direction générale des énergie renouvelable et de l'efficacité énergétique, direction régionale des ressources animales et halieutique.

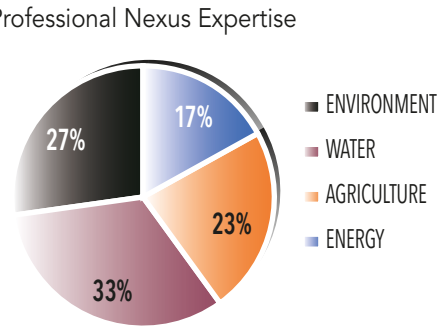
Mostly selected technical assistance packages by participants

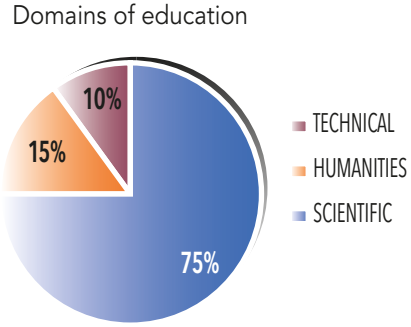
A list of different technical assistance packages have been proposed to the participants during the survey. Here under are the most interesting focus points as selected by participants from the exhaustive list of the survey.



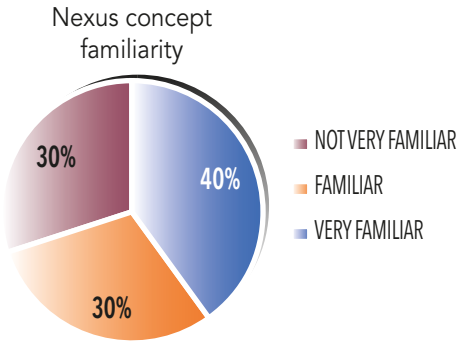
Educational profile

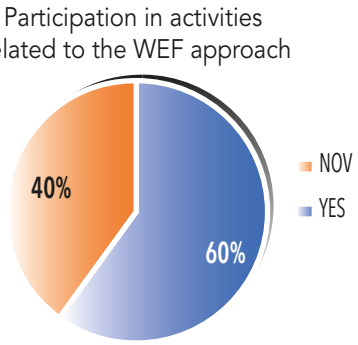






Familiarity to Nexus Concept





Energy

SDG7 - Affordable and Clean Energy			Overtime trend	
Population with access to electricity (%)	18.4	2019	■	→
Population with access to clean fuels and technology for cooking (%)	10.2	2019	■	→
CO2 emissions from fuel combustion per total electricity output (MtCO2/TWh)	2.1	2019	■	→
Share of renewable energy in total primary energy supply (%)	NA	NA	■	■

Challenge

The cost of electricity production is currently among the highest in the region, ranging from $0.22 to $0.25 USD per kilowatt-hour (kWh). In response to this, the Government of Burkina Faso (GOBF) has devised an ambitious national plan and has initiated legislative measures to promote private-sector investment and to liberalize the generation and distribution of electricity.

▼ in numbers

437 MW installed electricity-generating capacity

4.7 % access to electricity in rural population

■ Major challenges remain
■ Significant challenges remain
■ Challenges remain
■ SDG achieved
■ Trend information unavailable

↓ Decreasing
→ Stagnating
↗ Moderately improving
↑ On track or maintaining SDG achievement

Food security

SDG2 - Zero Hunger			Overtime trend	
Prevalence of undernourishment (%)	14.4	2019	■	↓
Prevalence of stunting in children under 5 years of age (%)	23.8	2019	■	→
Prevalence of wasting in children under 5 years of age (%)	8.1	2019	■	→
Prevalence of obesity, BMI ≥ 30 (% of adult population)	5.6	2016	■	↑
Human Trophic Level (best 2-3 worst)	2.1	2017	■	↑
Cereal yield (tonnes per hectare of harvested land)	1.1	2018	■	↓
Sustainable Nitrogen Management Index (best 0-1.41 worst)	0.8	2015	■	→
Exports of hazardous pesticides (tonnes per million population)	0.0	2019	■	■

Challenge

Since 2018, Burkina Faso's security has deteriorated due to non-state armed groups, leading to increased forced displacement and exacerbating food insecurity. In 2019, the country witnessed one of the world's most rapidly growing displacement crises. Approximately 3.3 million individuals currently face acute food insecurity. The provinces of Oudalan and Soum in the Sahel region have reached the emergency phase of food insecurity. Within these areas, an alarming 3 percent of the population is enduring catastrophic levels of acute food insecurity.

▼ in numbers

18 % of prevalence of undernourishment

73 % of employment in agriculture

Water

SDG 6 - Clean Water and Sanitation			Overtime trend	
Population using at least basic drinking water services (%)	47.2	2020		
Population using at least basic sanitation services (%)	21.7	2020		
Freshwater withdrawal (% of available freshwater resources)	7.8	2018		
Anthropogenic wastewater that receives treatment (%)	0.0	2018		
Scarce water consumption embodied in imports (m3 H2O eq/capita)	218.2	2018		

Challenge

The desert region of Sahel in the north of Burkina Faso is the driest and hottest part of the country. Due to extreme conditions and political instability, many communities in this region are in need of humanitarian assistance. Violence and climate change have left people without water and at high risk of disease. The water crisis in Burkina Faso has impacted six out of the country's 13 regions. These regions include Sahel, Centre-Nord, Nord, Est, Boucle du Mouhoun, and Centre-Est.

▼ in numbers

645 total renewable water resources per capita (m3/inhab/year)

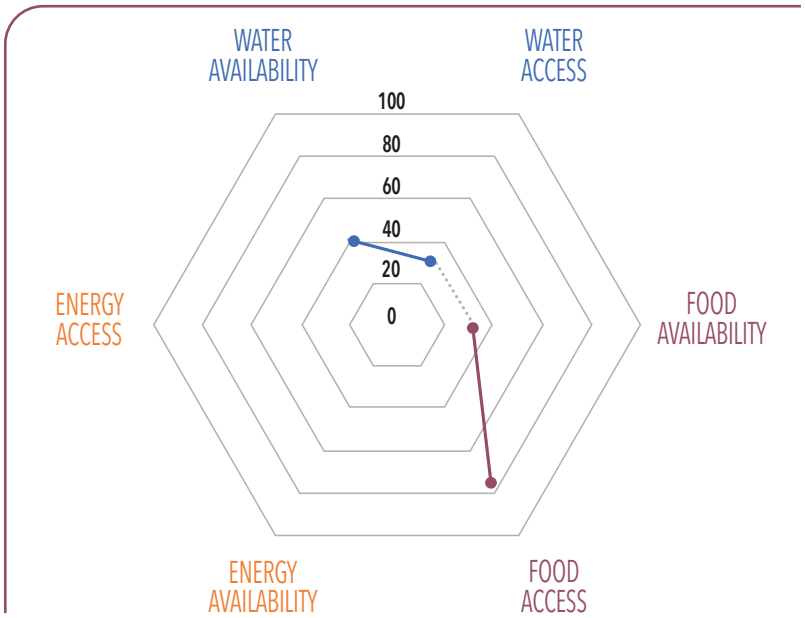
759 National Rainfall Index (2020)[1]

51.43 % agricultural water withdrawal as % of total (2020)

[1] NRI is defined as the national average of the total annual precipitation weighted by its long-term average.

Water-Energy-Food Nexus INDEX

The WEF Nexus Index is an inclusive metric that amalgamates 21 indicators from worldwide data repositories. The WEF Nexus Index value for Burkina Faso is 41.4, placing the nation in the 169th position for the countries assessed. Burkina Faso has a value of 35.9 for the Water pillar, 35.9 for the Energy pillar and 52.5 for the Food pillar.



▼ in numbers

41.4 WEF index score

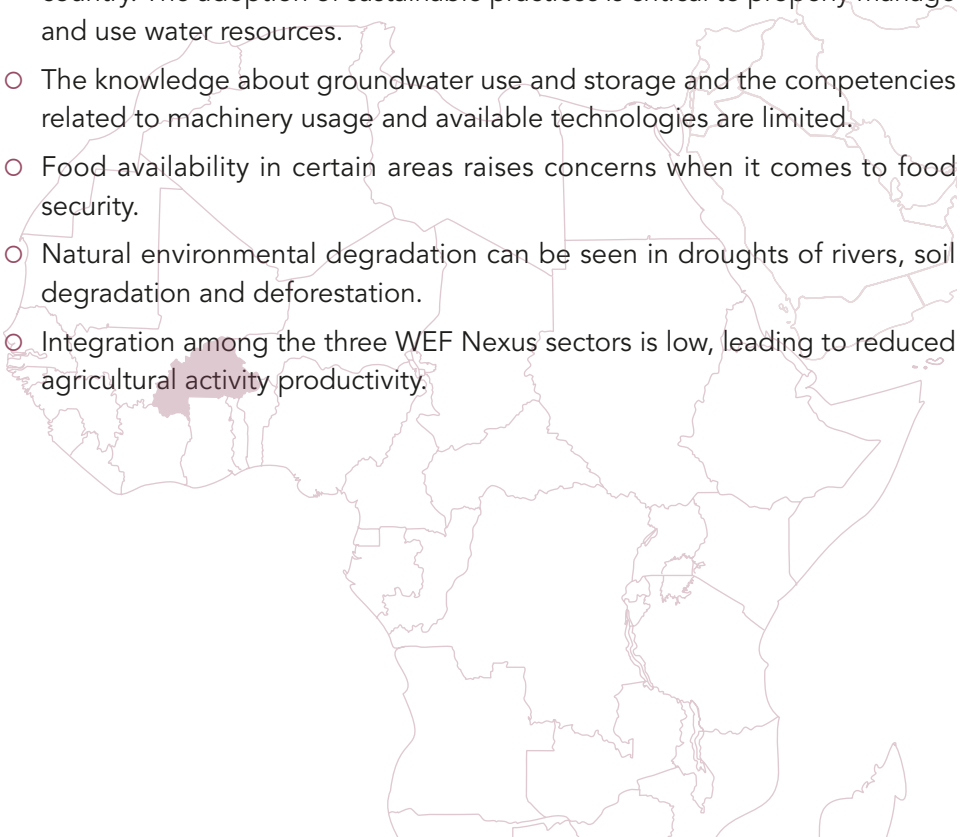
169th global rank

The way forward

Focus on public sector: understanding the local Burkina Faso context

Challenges in implementing the Water Energy Food Nexus in Burkina Faso

- The mobilisation of water resources and the low use of solar energy, especially to promote clean energy for agriculture and water mobilisation. This is an urgent need in a country with a very high potential for sustainable access to energy and needs to expand the availability of energy.
- Security of land tenure to promote land development.
- Water resources are not exploited sustainably: the Dari Pond Basin and other water bodies are deteriorating, threatening water availability in the country. The adoption of sustainable practices is critical to properly manage and use water resources.
- The knowledge about groundwater use and storage and the competencies related to machinery usage and available technologies are limited.
- Food availability in certain areas raises concerns when it comes to food security.
- Natural environmental degradation can be seen in droughts of rivers, soil degradation and deforestation.
- Integration among the three WEF Nexus sectors is low, leading to reduced agricultural activity productivity.



Recommendations for a more efficient implementation of the Water Energy Food Nexus in Burkina Faso

- Fostering knowledge about water resources and aquifers to mobilise them better. A shared vision could bring lower costs and higher value to activities that foresee water usage as a primary input.
- Improving security could lead to a more stable business environment. Conflicts linked to agriculture still take place, undermining the market.
- Upgrading and popularising organic fertilisers while limiting the use of chemicals.
- Stimulate a more potent synergy of actions among WEF stakeholders, with the final objective of developing projects that include the three components.
- To increase knowledge of groundwater resources to ensure the long-term sustainability of resources.
- To implement capacity-building initiatives to foster the adoption of efficient techniques among producers.
- Restore the aquatic ecosystem for better management of water resources, desilting rivers, restoring banks, creating irrigation perimeters by pumping groundwater, etc.
- The construction of dams and high-capacity boreholes with solar pumping systems to stimulate alternative agricultural activities other than rainwater-dependent subsistence agriculture.
- To educate the population about the relevance of the WEF Nexus and how its three components can synergize their actions.
- Pond development projects need to be funded on a larger scale and made more accessible.
- Training of IDPs/guests in sustainable management (organic charcoal, improved herding, IWRM, improving agricultural productivity, security).

Focus on private sector: Farafina agry funding

Farafina Agri-Funding is an agricultural financing alternative that connects agricultural promoters and potential investors thanks to its crowdfunding and agrimarket platforms.

Barriers

Financially-wise, in Burkina Faso is complex for a startup to access credit lines or any other kind of financial support. The main issues range from high interest rates, guarantees, to repayment times that do not take into consideration fixed costs such as prototype development. Furthermore, financial bureaucracy represents an additional barrier for entrepreneurs. Financing bodies, during the application stage, require several documents which are unknown to the entrepreneur and extremely expensive to prepare.

New financing mechanisms are needed because most of the banks have the same rates and the same conditions. More flexible structures exist, but you often have a year of waiting before disbursement.

Another key barrier is the lack of proper regulations in Burkina Faso regarding crowdfunding. The interviewee talks about a legal void that does not prevent them from operating but does not allow them to use international crowdfunding platforms. Central bank regulations are much needed as it would facilitate business for devolved crowdfunding platforms. There are a lot of local entrepreneurs who suddenly go through international platforms because there is no platform at the moment in-country.

Lastly, it is important to have functional business network to promote your business with potential partners. Many young people have embarked on entrepreneurship, but they lost time on projects that secured financing but could not advance due to lack of expertise, know-how, or partners.

Prerogatives

Farafina Agry Funding remarks the relevance of advocating for alternative financial models to foster investments, forcing traditional institutions to change/review their modus operandi. As a business, they are into crowdfunding which is labelled as a simpler mean with many advantages, such as mobilizing a whole community. An alternative like this could push institutions to be more flexible, have lower rates, and have less stringent conditions. The future of crowdfunding in Africa is positive as more and more financing banks are using this form, while NGOs are integrating it. Still, they still constitute only a tiny group; it takes an extensive awareness campaign to spread this method. A functioning financing mechanism would allow entrepreneur to also access reliable equipment; the interviewee states that instalment payments, for example, would highly beneficiate the sector.

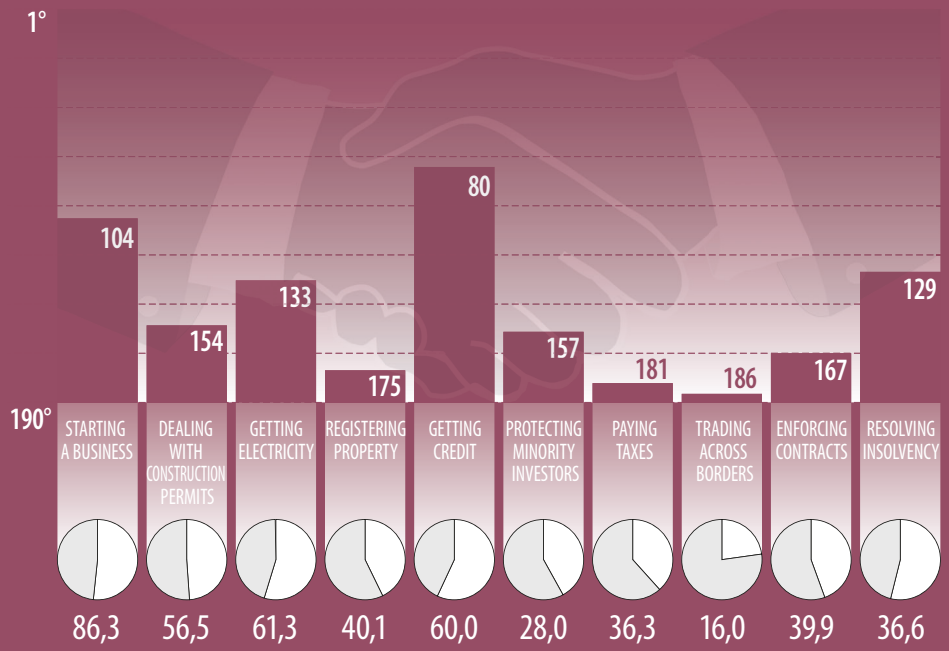
Cameroon

27.1 million population

About

Cameroon shares its territorial boundaries with the Central African Republic, Chad, Equatorial Guinea, Gabon, and Nigeria. Cameroon possesses lucrative reserves of oil, gas, mineral ores, prized timber species, as well as a diverse array of agricultural products, including coffee, cotton, cocoa, maize, and cassava. An estimated 40% of the population lives below the poverty line.

Rankings on doing business topics

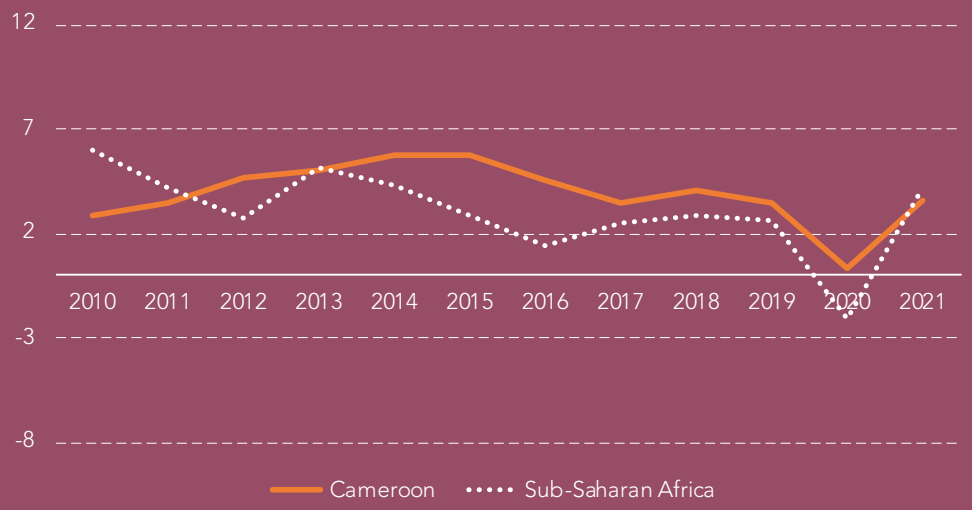


Ease of doing Business
Cameroon World Rank **167**

Economic Overview

Cameroon relies heavily on oil as its primary export commodity, contributing to approximately 40% of its total exports. Cameroon's economy faces various challenges, including stagnant per capita income, an unequal distribution of wealth, a top-heavy civil service, pervasive corruption, persisting inefficiencies within key sectors governed by large parastatal systems, and an overall unfavorable business environment.

GDP growth (annual %) - Sub-Saharan Africa, Cameroon



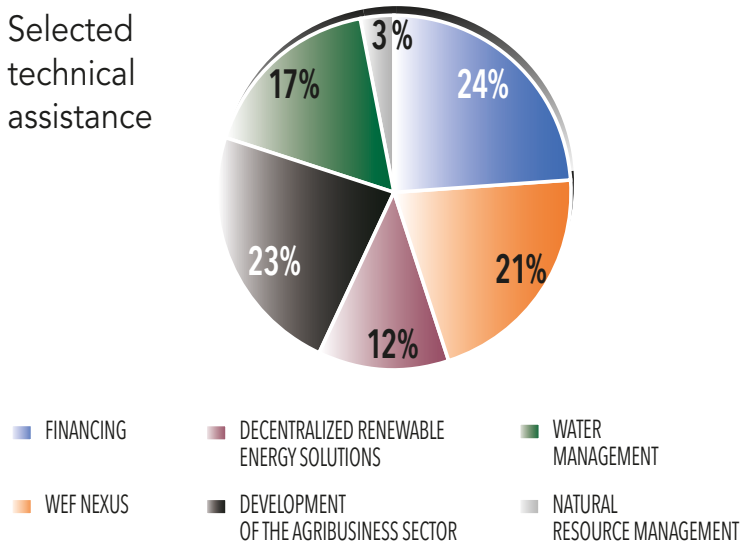
Survey

Respondents Background profile

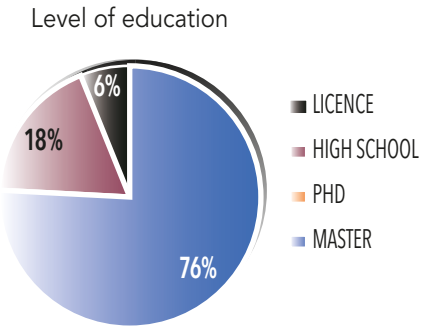
The analysis of surveys in Cameroon involved 17 participants, mainly from public institutions. Average age was around 37 years, with about 7/8 years of professional experience. Participants held various roles like managers, technicians, researcher, teacher & engineers. Institutions included, among others, the Ministry of Forest and Wildlife, MINEPAT (Ministry of Economy Planning and Regional Development), Ministry of External Relations, Ministry of Economy, Planning and Layout of the Territory (MINEPAT), Ministry of Finance, Ministry of Agriculture and Rural Development, Ministry of Environment for the Protection of Nature and Sustainable Development, and Ministry of Commerce.

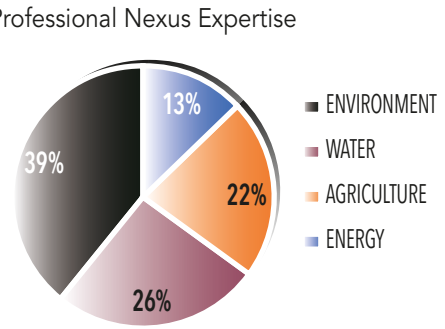
Mostly selected technical assistance packages by participants

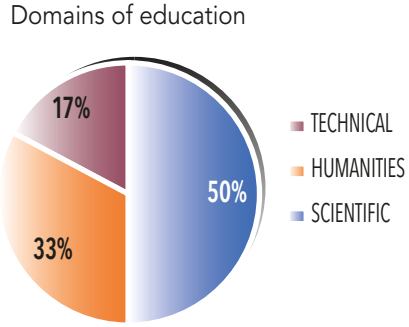
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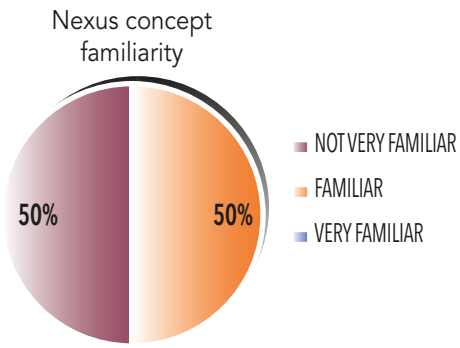
Educational profile

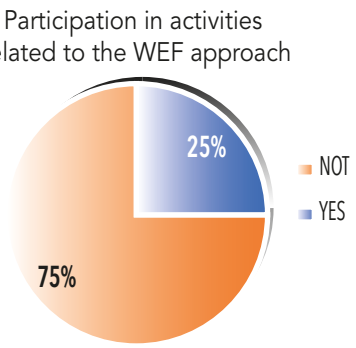






Familiarity to Nexus Concept





Energy

SDG7 - Affordable and Clean Energy			Overtime trend	
Population with access to electricity (%)	63.5	2019		
Population with access to clean fuels and technology for cooking (%)	21.9	2019		
CO2 emissions from fuel combustion per total electricity output (MtCO2/TWh)	1.0	2019		
Share of renewable energy in total primary energy supply (%)	75.7	2019		

Challenge

Insufficient generation capacity poses a significant challenge to the electricity sector in Cameroon. This deficit in the electricity supply has had severe repercussions on the country's aspirations for industrialization, socio-economic progress, and the attainment of its developmental goals outlined in Vision 2035. In response to this pressing issue, the government has placed a high priority on the development of hydropower and natural gas plants as the primary solution to bridge the gap between electricity demand and supply. Cameroon's Nationally Determined Contributions (NDCs) outline specific measures to reduce emissions in the power sector, which include enhancing energy efficiency and aiming for a 25% share of renewable energy in the overall generation mix by 2035.

in numbers

1497 MW installed electricity-generating capacity

24.8 % access to electricity in rural population

Major challenges remain
Significant challenges remain
Challenges remain
SDG achieved
Trend information unavailable

Decreasing
Stagnating
Moderately improving
On track or maintaining SDG achievement

Food security

SDG2 - Zero Hunger			Overtime trend	
Prevalence of undernourishment (%)	5.3	2019		
Prevalence of stunting in children under 5 years of age (%)	28.9	2018		
Prevalence of wasting in children under 5 years of age (%)	4.3	2018		
Prevalence of obesity, BMI ≥ 30 (% of adult population)	11.4	2016		
Human Trophic Level (best 2-3 worst)	2.1	2017		
Cereal yield (tonnes per hectare of harvested land)	1.6	2018		
Sustainable Nitrogen Management Index (best 0-1.41 worst)	0.8	2015		
Exports of hazardous pesticides (tonnes per million population)	NA	NA		

Challenge

Before the advent of oil trading, which currently constitutes more than 8 percent of GDP, agriculture played a central role as Cameroon's primary economic catalyst. In regard to poverty, official data indicates that approximately 10% of rural households in Cameroon face food insecurity, primarily resulting from insufficient food production in impoverished regions, with a staggering 97% of households experiencing challenges in food production. Prominent factors contributing to this situation include limited financial resources, volatile market prices, inadequate farm-to-market transportation infrastructure, insufficient storage facilities, pests and crop diseases, and the adverse impacts of climate change. Moreover, the absence of robust transportation infrastructure significantly hampers the efficient distribution of food resources.

in numbers

6.7 % prevalence of undermourishment

43 % of employment in agriculture

Water

SDG 6 - Clean Water and Sanitation			Overtime trend	
Population using at least basic drinking water services (%)	65.7	2020		
Population using at least basic sanitation services (%)	44.6	2020		
Freshwater withdrawal (% of available freshwater resources)	1.6	2018		
Anthropogenic wastewater that receives treatment (%)	0.0	2018		
Scarce water consumption embodied in imports (m3 H2O eq/capita)	285.9	2018		

Challenge

Cameroon is not on track to achieve the Sustainable Development Goal (SDG) 6.1, which aims for universal access to drinking water by 2030. In rural areas, water supply primarily relies on wells, boreholes with hand pumps, and rural distribution networks. The situation is compounded by a significant number of non-functional rural drinking water supply systems. An estimated 32% of hand pumps are consistently inoperable, with 10-60% of rural water supply systems experiencing issues or functioning below optimal levels in certain Cameroonian councils. Moreover, a third of schools in the country lack a reliable source of drinking water, with a school drinking water coverage rate of only 39%.

▼ in numbers

10.666 total renewable water resources per capita (m3/inhab/year)

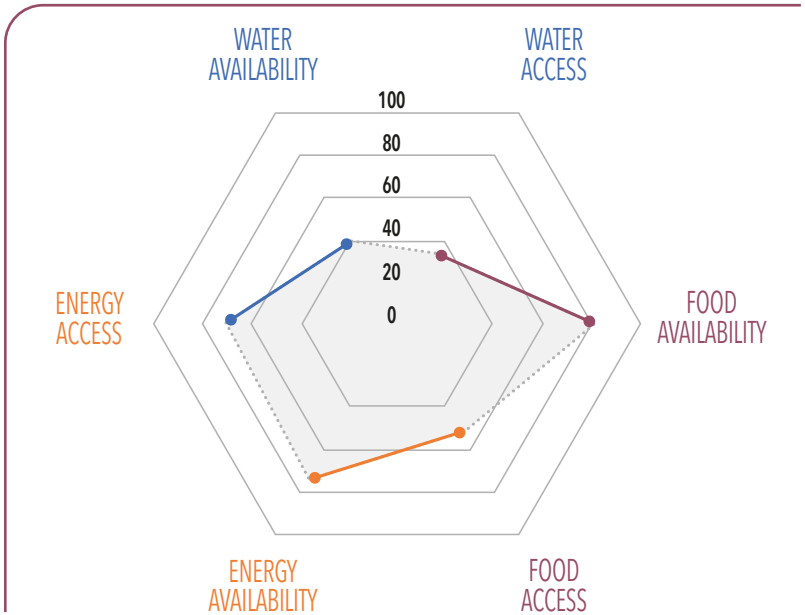
1694 National Rainfall Index (2020)[1]

67,71 % agricultural water withdrawal as % of total (2020)

[1] NRI is defined as the national average of the total annual precipitation weighted by its long-term average.

Water-Energy-Food Nexus INDEX

The WEF Nexus Index is an inclusive metric that amalgamates 21 indicators from worldwide data repositories. The WEF Nexus Index value for Cameroon is 57.6, placing the nation in the 96th position for the countries assessed. Cameroon has a value of 54.5 for the Water pillar, 62.1 for the Energy pillar and 56 for the Food pillar.



▼ in numbers

57.6 WEF index score

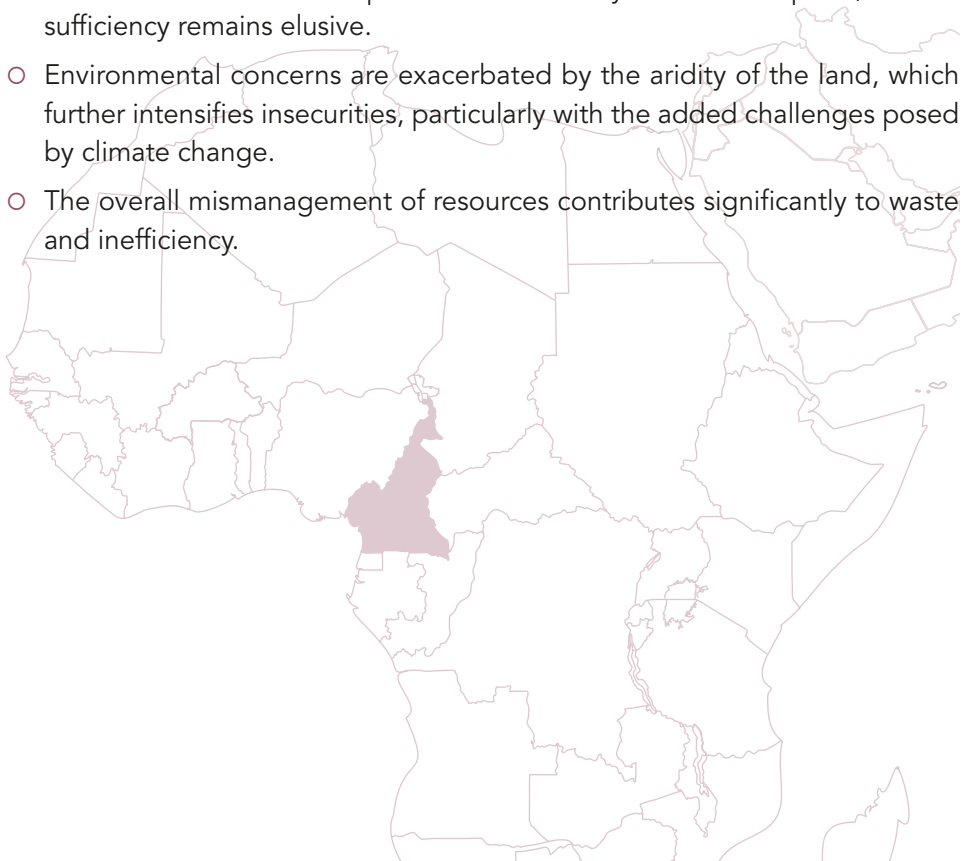
97th global rank

The way forward

Focus on public sector: understanding the local Cameroon context

Challenges in implementing the Water Energy Food Nexus in Cameroon

- Many in the region lack access to safe drinking water, primarily due to challenges in clean water accessibility and sanitation in urban areas.
- Efficient water resource management remains a significant challenge.
- Electricity connections remain severely limited, resulting in frequent load shedding incidents that perpetuate ongoing issues and unmet demands across various sectors.
- The current state of food production is heavily reliant on imports, as self-sufficiency remains elusive.
- Environmental concerns are exacerbated by the aridity of the land, which further intensifies insecurities, particularly with the added challenges posed by climate change.
- The overall mismanagement of resources contributes significantly to waste and inefficiency.



Recommendations for a more efficient implementation of the Water Energy Food Nexus in Cameroon

- To combat the escalating inflation, there is a pressing need to enhance vegetable cultivation and agricultural practices.
- Mobilize finances, gain local support, and improve professional practices for water, energy, and food security.
- Tackle dam challenges, reduce imports, and achieve energy self-sufficiency.
- Harmonize sectoral priorities, provide financing and support, ensure water and energy access, and implement specific nexus projects.
- Construct water reservoirs, develop hydro-agricultural areas, manage resources sustainably.
- Expanding state credits, enhancing people's credit funds, and streamlining loan procedures for farmers, particularly providing subsidized credit to the poor, are effective strategies for improving food crop production.
- To facilitate access to credit, it is crucial to strengthen both semi-formal and formal rural-based saving and credit societies.
- Promoting and encouraging the establishment of food crop processing industries can help stabilize output prices.
- Policies should be devised to involve crop farmers in the planning and implementation processes of food crop production.
- Increasing the availability of extension services and trained personnel for food crop farmers is essential.
- Both central and local government authorities should ensure the availability of sufficient and high-quality agricultural inputs, such as pesticides, insecticides, and fertilizers.

Focus on private sector: Clean Energy services

Clean Energy Services is a Cameroonian company specializing in the R&D of innovative energy solutions. Their main product is a 100% solar refrigerator capable of operating 24 hours a day without electricity. They aim to build a production unit to reach a clientele of more than 20,000 households.

Barriers

There are too many barriers in terms of regulations in Cameroon. For example, there is no special status for companies working in the renewable or innovative solution; the tax system is the same as a company that has been in business for a long time. Thus, green energy companies are subjected to the same rule as other companies that have a lot more financing under the same conditions, which does not incentivize sustainable solutions.

Regulations are not clear and as a result, enterprises do not know which state department regulates their own sector. Furthermore, the quality of imported materials is not checked and often not compliant with local quality standards, which does not foster an equal playing field.

Prerogatives

The government is called to deliver special status to companies operating in the renewable sector in terms of tax incentives. Green companies should also have access to better equipment to scale up their businesses. Another barrier is the lack of widespread information regarding new tenders; only few entrepreneurs are aware of green tenders which leads to the growth of only a few number of businesses in the country.

The government is predominantly focusing on training digital skill, disregarding young enterprises acting in the renewable energy sphere. There are only few green initiatives n the country and majorly international such as GiZ or the United Nations.

Cameroon needs a sound regulatory framework aimed at accelerating the implementations of green solutions. Local startups do have attractive solutions but they are not financially attractive to mainstream institutions due to a lack of interest in financing pilot projects. For example, young enterprises, which still need to reach a break-even point, have issues in get funds because local banks focus exclusively on the economic part without testing the solution proposed.

“In Cameroon, the best guarantees are land titles, without them you do not get access to loans”.

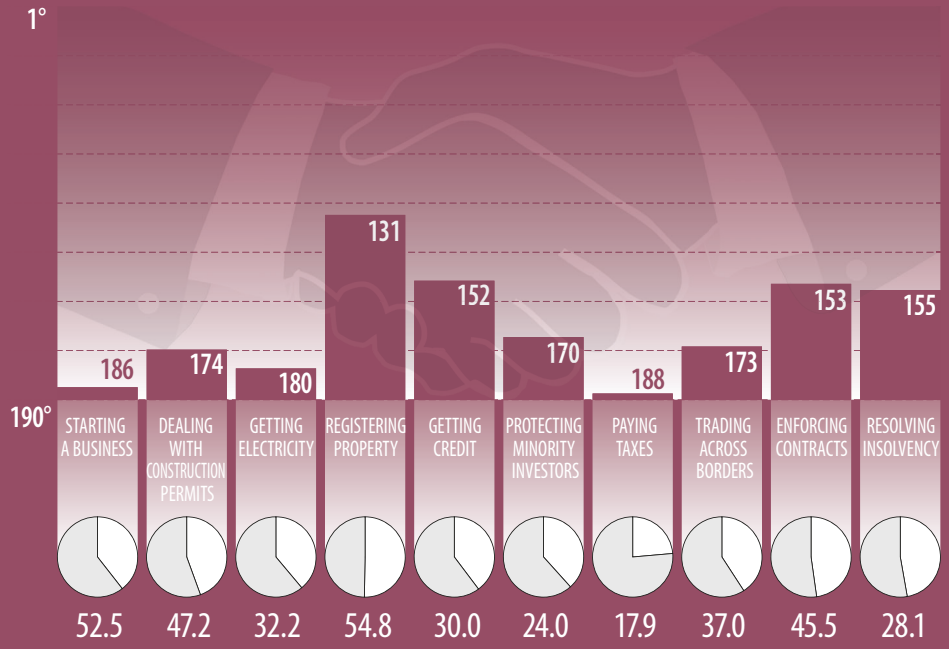
Chad

17.1 million population

About

Chad, located in central Africa and surrounded by land, faces significant security challenges due to conflicts in neighboring countries. Additionally, the country is severely affected by climate change, leading to accelerated desertification and the depletion of Lake Chad.

Rankings on doing business topics

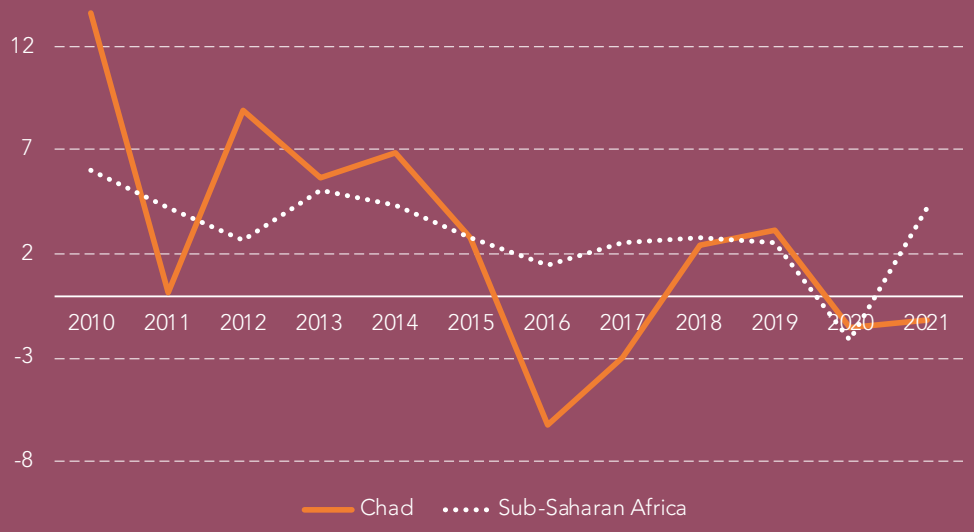


Ease of doing Business
Chad World Rank **182**

Economic Overview

Chad's economy, once reliant on agriculture, shifted to oil production in 2003. After a contraction in 2021, it is projected to recover in 2023 driven by high oil prices. Inflation is expected to rise due to global food and energy prices. Chad declared a "food and nutrition emergency" in June 2022. The economy is expected to gradually recover in 2023-24, driven by favorable oil prices and increased government investment, with inflation projected to slightly decline.

GDP growth (annual %) - Sub-Saharan Africa, Chad



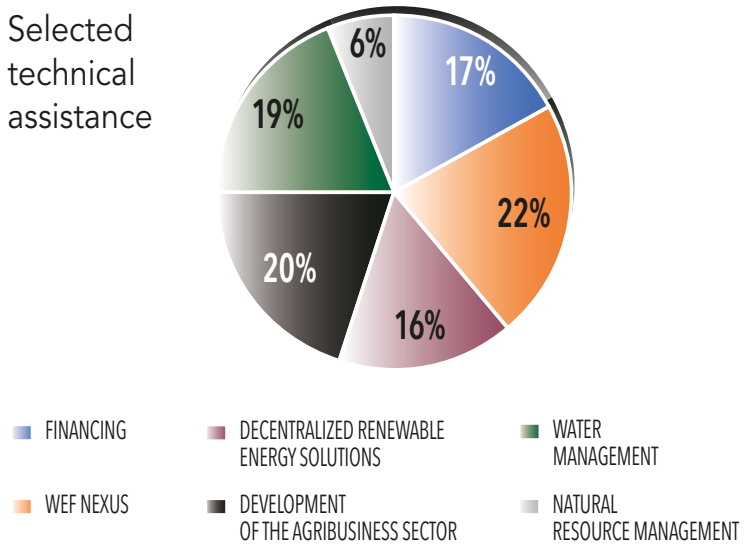
Survey

Respondents Background profile

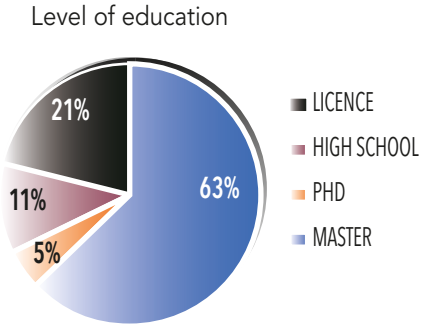
The analysis of surveys in Chad involved 19 participants, mainly from public institutions and international organizations. Average age was around 40 years, with about 13 years of professional experience. Participants held various roles like managers, technicians, researchers, teachers, and engineers. Institutions included, among many others, the Ministry of Finance and the Ministry of Environment, Water, and Fisheries.

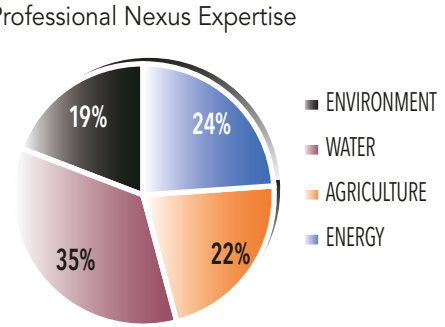
Mostly selected technical assistance packages by participants

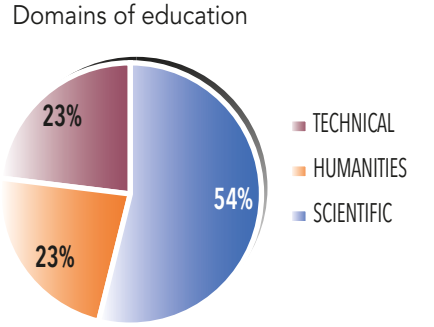
A list of different technical assistance packages have been proposed to the participants during the survey. Here under are the most interesting focus points as selected by participants from the exhaustive list of the survey.



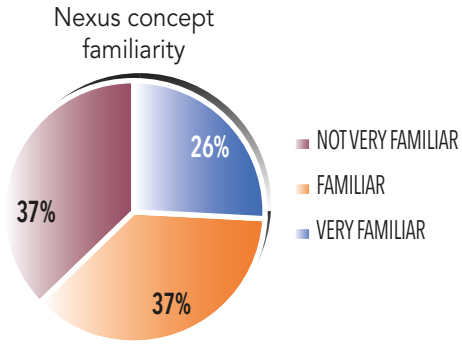
Educational profile

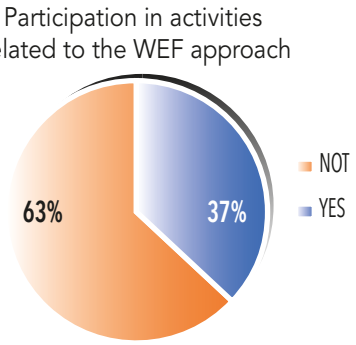






Familiarity to Nexus Concept





Energy

SDG7 - Affordable and Clean Energy			Overtime trend	
Population with access to electricity (%)	8.4	2019	■	→
Population with access to clean fuels and technology for cooking (%)	3.8	2019	■	→
CO2 emissions from fuel combustion per total electricity output (MtCO2/TWh)	4.4	2019	■	→
Share of renewable energy in total primary energy supply (%)	NA	NA	■	■

Challenge

Chad's electricity sector faces significant challenges, hindering energy access and poverty reduction efforts. Despite abundant energy resources and the government's aim to expand supply and attract investments, the country's installed power capacity is insufficient for its population. Heavy reliance on hydrocarbons limits energy access, despite having substantial oil reserves.

▼ in numbers

285 MW installed electricity-generating capacity

1.3 % access to electricity in rural population

■ Major challenges remain
■ Significant challenges remain
■ Challenges remain
■ SDG achieved
■ Trend information unavailable

↓ Decreasing
→ Stagnating
↗ Moderately improving
↑ On track or maintaining SDG achievement

Food security

SDG2 - Zero Hunger			Overtime trend	
Prevalence of undernourishment (%)	31.7	2019	■	↓
Prevalence of stunting in children under 5 years of age (%)	37.8	2019	■	→
Prevalence of wasting in children under 5 years of age (%)	13.9	2019	■	→
Prevalence of obesity, BMI ≥ 30 (% of adult population)	6.1	2016	■	↑
Human Trophic Level (best 2-3 worst)	2.3	2017	■	↓
Cereal yield (tonnes per hectare of harvested land)	0.9	2018	■	→
Sustainable Nitrogen Management Index (best 0-1.41 worst)	0.8	2015	■	→
Exports of hazardous pesticides (tonnes per million population)	NA	NA	■	■

Challenge

Agriculture contributes 40% to GDP and 80% to exports, employing 80% of the workforce. However, farmers lack access to essential services, knowledge, and technology needed for productivity improvement. Insufficient access to rural financial services also hampers the ability of farmers to pursue alternative income sources and enhance productivity. The growing strain on natural resources in marginal areas leads to ecological damage and conflicts between settled farmers and nomadic herders, posing threats to development and livelihoods. This situation drives farming households to migrate, perpetuating the cycle elsewhere.

▼ in numbers

32.7 % prevalence of undermourishment

69 % of employment in agriculture

Water

SDG 6 - Clean Water and Sanitation			Overtime trend	
Population using at least basic drinking water services (%)	46.2	2020		
Population using at least basic sanitation services (%)	12.1	2020		
Freshwater withdrawal (% of available freshwater resources)	4.3	2018		
Anthropogenic wastewater that receives treatment (%)	0.0	2018		
Scarce water consumption embodied in imports (m3 H2O eq/capita)	199.6	2018		

Challenge

Less than half of the children have access to safe drinking water, and only one in ten have access to improved sanitation facilities. 6% of children use soap and water. Inadequate provision of water, sanitation, and hygiene services contributes to the occurrence of recurrent diarrheal diseases and malabsorption issues, leading to malnutrition among young children. Recognizing the urgency of addressing this issue, the government embraced the National Strategy for Sanitation in 2017, signifying its commitment to achieving the targets set forth by the SDGs.

▼ in numbers

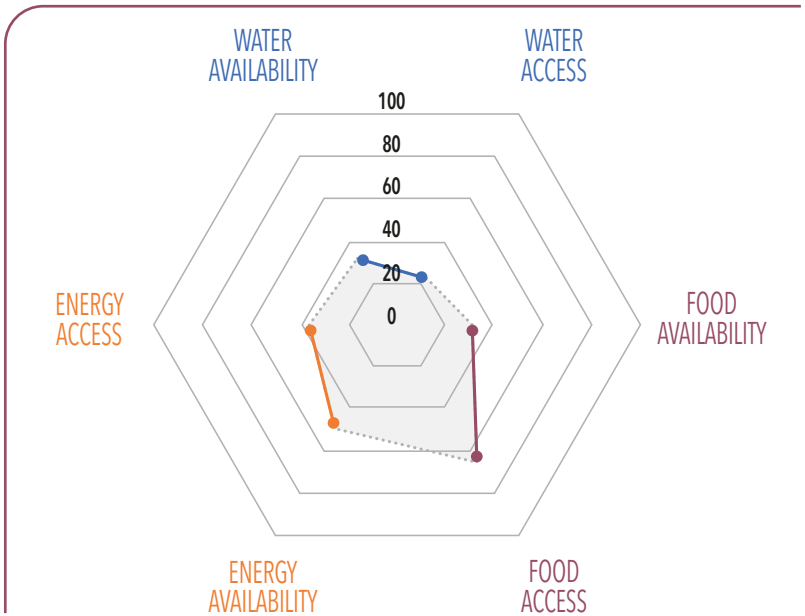
2782 total renewable water resources per capita (m3/inhab/year)

648,2 of the population has access to sanitation

76 % agricultural water withdrawal as % of total water withdrawal

Water-Energy-Food Nexus INDEX

The WEF Nexus Index is an inclusive metric that amalgamates 21 indicators from worldwide data repositories. In the case of Chad, the WEF Nexus Index value is 35.5, positioning the country at the 176th rank worldwide. Specifically, Chad obtains a score of 30.1 for the Water pillar, 38.7 for the Energy pillar, and 37.6 for the Food pillar.



▼ in numbers

35.5 WEF index score

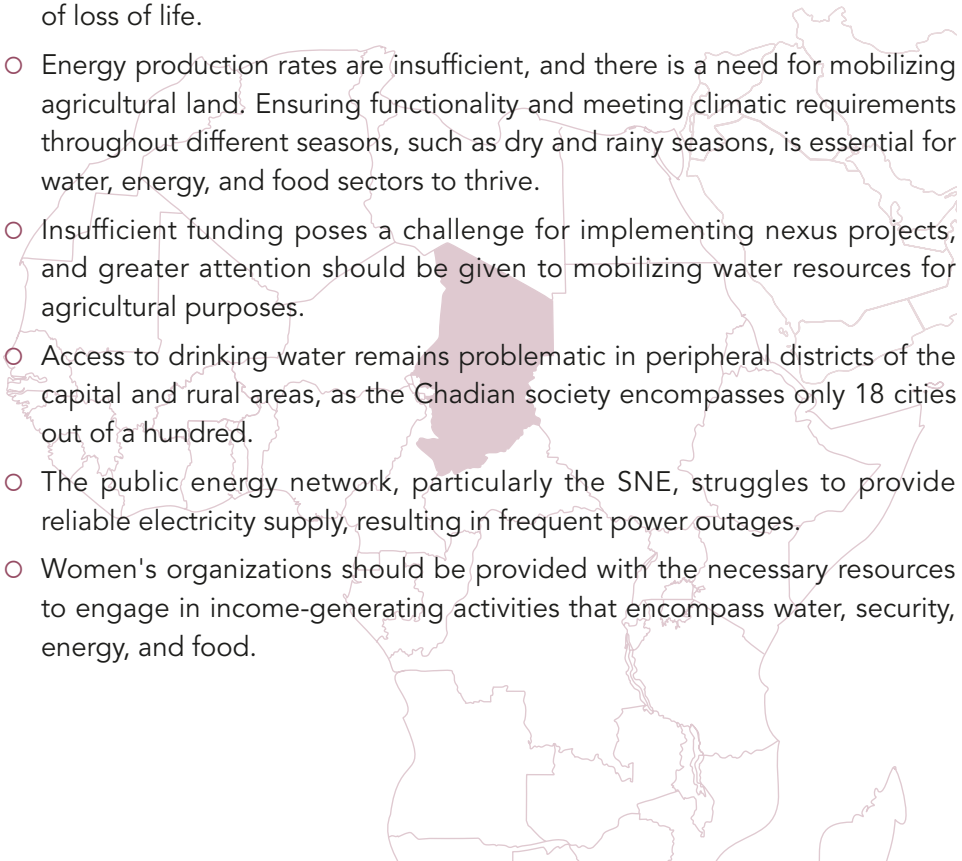
176th global rank

The way forward

Focus on public sector: understanding the local Chad context

Challenges in implementing the Water Energy Food Nexus in Chad

- Access to clean drinking water and sanitation remains a persistent issue, as does the scarcity of water for both the population and agricultural purposes.
- Cultural unfamiliarity with the WEF approach is a key challenge. Adequate studies and reliable data are required to effectively mobilize water resources for initiating projects.
- Currently, project leaders lack sufficient support, resulting in ongoing famine and hardships for farmers and breeders, leading to extreme cases of loss of life.
- Energy production rates are insufficient, and there is a need for mobilizing agricultural land. Ensuring functionality and meeting climatic requirements throughout different seasons, such as dry and rainy seasons, is essential for water, energy, and food sectors to thrive.
- Insufficient funding poses a challenge for implementing nexus projects, and greater attention should be given to mobilizing water resources for agricultural purposes.
- Access to drinking water remains problematic in peripheral districts of the capital and rural areas, as the Chadian society encompasses only 18 cities out of a hundred.
- The public energy network, particularly the SNE, struggles to provide reliable electricity supply, resulting in frequent power outages.
- Women's organizations should be provided with the necessary resources to engage in income-generating activities that encompass water, security, energy, and food.



Recommendations for a more efficient implementation of the Water Energy Food Nexus in Chad

- Chad needs to implement a hydropostal landscaping project, install solar pumping stations and power plants that can support processing units for agro-sylvo-pastoral products to provide electricity distribution in rural areas (solar-powered).
- Embracing the nexus concept can address drinking water challenges for livestock and agriculture, enhance energy generation, and boost productivity, ensuring food security and addressing climate-related issues.
- Establishing drinking water points in each village of the region and conducting comprehensive studies on water resources, both in terms of quantity and quality, are essential.
- Agricultural activities should extend beyond the rainy season, and access to energy must be prioritized for rural populations. Conducting field studies to identify key challenges and exploring natural resources in a sustainable manner are crucial.
- International collaboration is needed to attract donors, leverage land resources, generate energy, and ensure food security.
- Sensitizing states, NGOs, and CSOs to embrace this integrated approach and facilitating fundraising efforts are vital.
- The implementation of nexus projects will contribute to increased production, improved food security, and the availability of water, energy, and food in sufficient quantity and quality, despite the climatic and technical challenges.

Focus on private sector: Savip

Faced with the absence of an integrated waste management system in Chadian municipalities, the AJEVODE initiative will soon be replaced by the Service d'Assainissement et de Ville Propre (SAVIP). Through the collection, transport, and recovery of waste (plastic and organic), SAVIP proposes to support town halls in their sanitation policy, raise public awareness, and offer people alternative products - such as composts, feeds, cooking coals, and paving stones. These solutions make it possible to clean up the living environments of the populations, stop the progression of waterborne diseases, reduce the ecological footprint of human activities, and contribute to reducing poverty.

Barriers

Waste management in Chad has not been a priority for the Government, which lead to a stagnating environment for local entrepreneurs. Access to material, work equipment, and permits represents an issue. For example, to get the official approval from the Ministry of the Environment costs 100,000 CFA francs; the one from the Ministry of Health also requires 1,000,000 CFA francs. On top of these expenses, companies are obliged to pay a patent, which serves as a tax for enterprises, of 250,000 CFA francs every quarter. The banking sector also does not foster investments. Financing institutions demand financial guarantees which are hard to meet for young entrepreneurs, therefore access to finance is an obstacle. Thus, for a young startup, that is still challenged to get a fixed revenue, is extremely difficult to last overtime.
In terms of capacity building and know-how generation, there is a lack of participation and support from the local municipalities. Entrepreneurs do not have access to training/coaching centers or networking systems, which undermines their growth path.

Prerogatives

Entrepreneurs need more support in terms of growth financing and capital to allow them to develop and expand their businesses, even geographically. Sector focused training is needed, both practical and theoretical. Long-term personalized coaching would be a beneficial way forward: especially if it is aimed at fostering business networks that would generate partnerships. The local government is called to facilitate access to investments for young entrepreneurs who are trying to innovate their business sectors. Furthermore, the banking sector needs more institutions with entrepreneurs-focused economic supports, which understand the financial needs of a young enterprise. Even access to international funding should be more encouraged in-country.

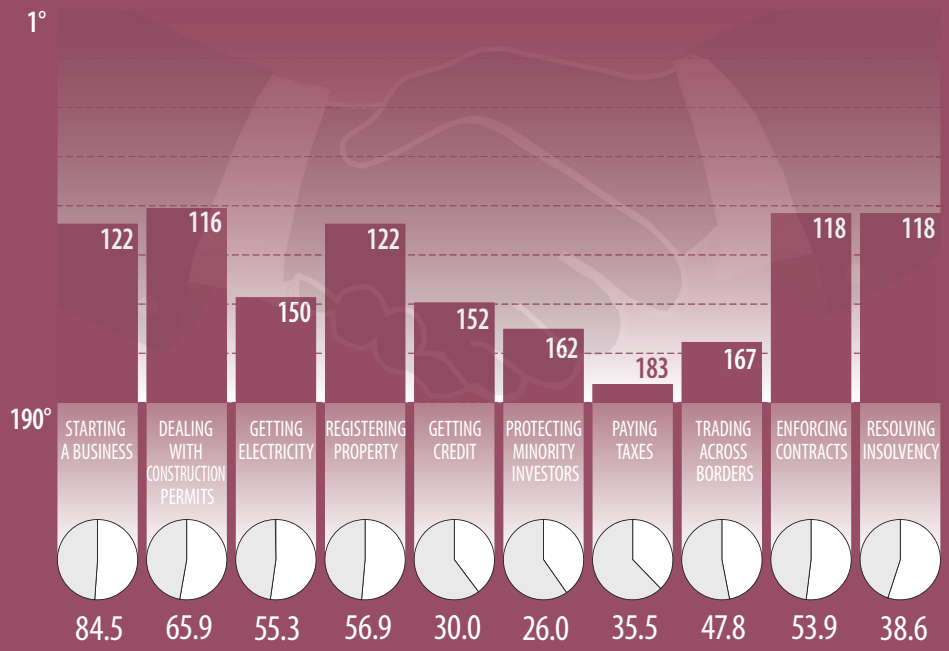
Guinea

13.5 million population

About

Guinea shares borders with Guinea Bissau, Senegal, Mali, Sierra Leone, Liberia, and Côte d'Ivoire. It is endowed with abundant natural resources, and fertile land. The agriculture sector serves as the largest employer, contributing to poverty reduction and rural development. It provides income for 57% of rural households and employment for 52% of the overall labour force.

Rankings on doing business topics

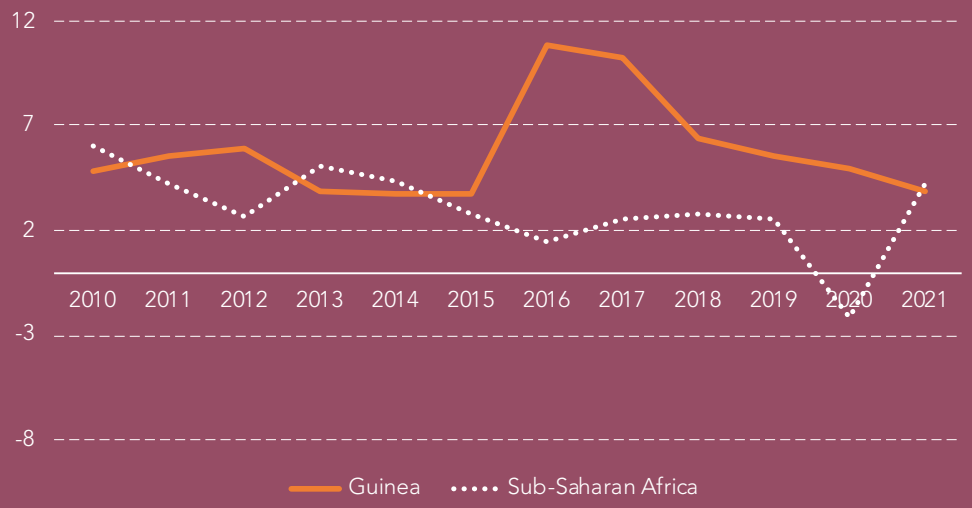


Ease of doing Business
Guinea World Rank **156**

Economic Overview

In 2022, Guinea experienced an economic growth acceleration of 4.7%, primarily driven by increased mining activities. The inflation rate decreased slightly to 12.1% compared to 12.6% in 2021, attributed to tight monetary policy and a strengthened exchange rate. The overall fiscal deficit, including grants, improved from 1.8% of GDP in 2021 to 0.9% in 2022. However, tax revenues remained low at 10.6% of GDP, while mining tax revenues remained stable at 2.1% of GDP. Subsidies to the electricity sector decreased to 1.9% of GDP from 2.8% in 2021. The country also increased its capital expenditure, reaching 1.4% of GDP, surpassing the previous year's achievement.

GDP growth (annual %) - Sub-Saharan Africa, Guinea



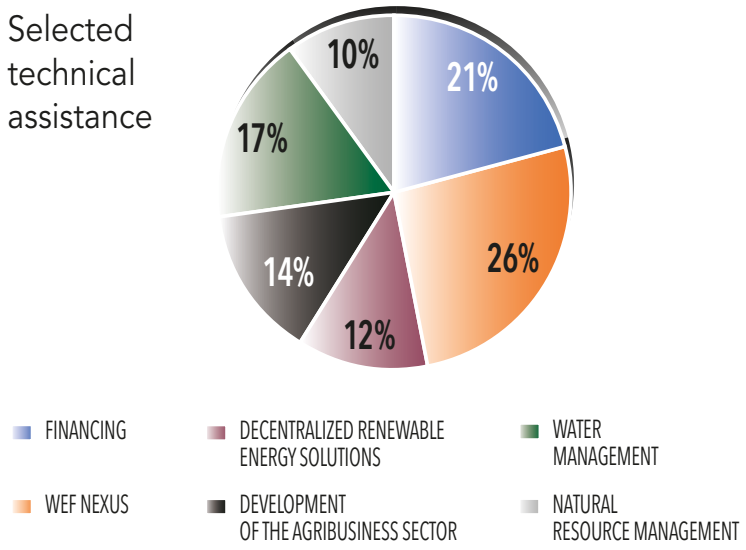
Survey

Respondents Background profile

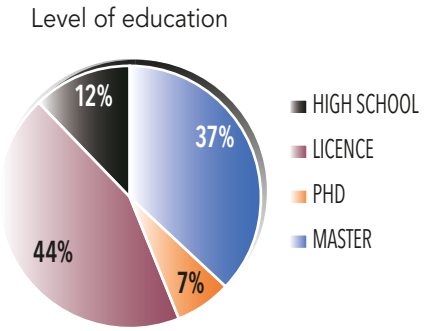
The analysis of surveys in Guinea involved 28 participants, mainly from public institutions. Average age was around 47 years, with about 14 years of professional experience. Participants held various roles like managers, technicians, engineers, consultants, directors, hydrologists, environmentalists, researchers, teachers, and hydro-agricultural specialists. Institutions included, among many others, the agence d'évaluation environnementale, and the Ministère des Affaires Étrangères.

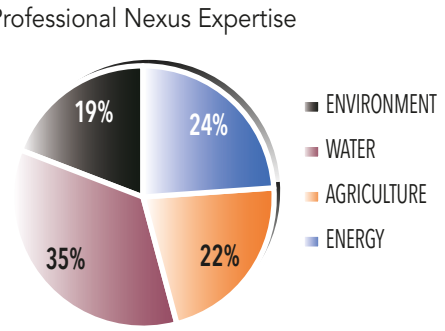
Mostly selected technical assistance packages by participants

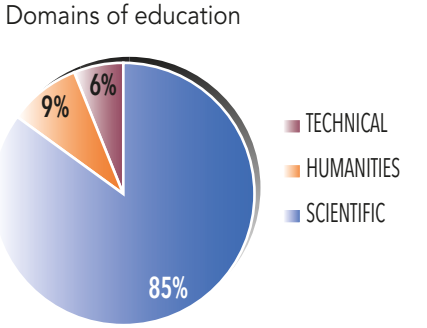
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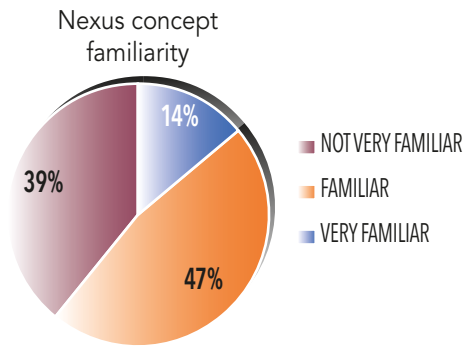
Educational profile

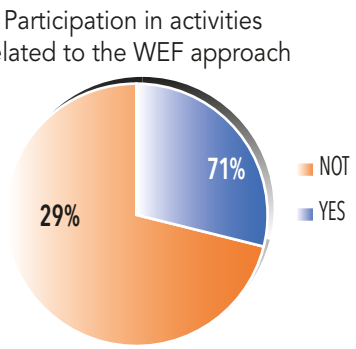






Familiarity to Nexus Concept





Energy

SDG7 - Affordable and Clean Energy			Overtime trend	
Population with access to electricity (%)	42.4	2019	■	→
Population with access to clean fuels and technology for cooking (%)	1.6	2019	■	→
CO2 emissions from fuel combustion per total electricity output (MtCO2/TWh)	1.7	2019	■	↑
Share of renewable energy in total primary energy supply (%)	NA	NA	■	■

Challenge

Access to liquid fuel is severely constrained throughout the country. However, Guinea possesses substantial renewable energy resources, particularly in the form of hydroelectricity, with an estimated potential capacity of around 4,740 MW. To meet the projected surge in energy consumption, the state foresees a need for an additional capacity ranging from 535 MW to 1,838 MW by 2025.

▼ in numbers

636 MW installed electricity-generating capacity

21.3 % access to electricity in rural population

■ Major challenges remain
■ Significant challenges remain
■ Challenges remain
■ SDG achieved
■ Trend information unavailable

↓ Decreasing
→ Stagnating
↗ Moderately improving
↑ On track or maintaining SDG achievement

Food security

SDG2 - Zero Hunger			Overtime trend	
Prevalence of undernourishment (%)	NA	NA	■	■
Prevalence of stunting in children under 5 years of age (%)	30.3	2018	■	→
Prevalence of wasting in children under 5 years of age (%)	9.2	2018	■	→
Prevalence of obesity, BMI ≥ 30 (% of adult population)	7.7	2016	■	↑
Human Trophic Level (best 2-3 worst)	2.1	2017	■	↑
Cereal yield (tonnes per hectare of harvested land)	1.2	2018	■	→
Sustainable Nitrogen Management Index (best 0-1.41 worst)	0.9	2015	■	↓
Exports of hazardous pesticides (tonnes per million population)	NA	NA	■	■

Challenge

Rural populations face a high risk of food insecurity, with 71.1% of subsistence farmers experiencing severe food insecurity. Poverty and food insecurity are intertwined, impacting smallholder farmers who are the majority of the impoverished population. Limited access to crucial resources, including seeds, fertilizers, equipment, storage facilities, infrastructure, and financial services, further compound their challenges. Women, who play a vital role in agriculture and food production, encounter additional barriers such as land access, productive resources, education, formal employment, and income opportunities.

▼ in numbers

12.9 % of prevalence of undernourishment

59 % of employment in agriculture

Water

SDG 6 - Clean Water and Sanitation			Overtime trend	
Population using at least basic drinking water services (%)	64.0	2020		
Population using at least basic sanitation services (%)	29.8	2020		
Freshwater withdrawal (% of available freshwater resources)	1.4	2018		
Anthropogenic wastewater that receives treatment (%)	0.0	2018		
Scarce water consumption embodied in imports (m3 H2O eq/capita)	500.6	2018		

Challenge

Guinea-Bissau has made significant progress in water and sanitation, with 75% of the population having access to improved drinking water sources. Around 50% of hand pumps are non-functional due to the lack of technicians and spare parts. Furthermore, 65% of protected open wells are contaminated, rendering the water unsafe for human consumption.

▼ in numbers

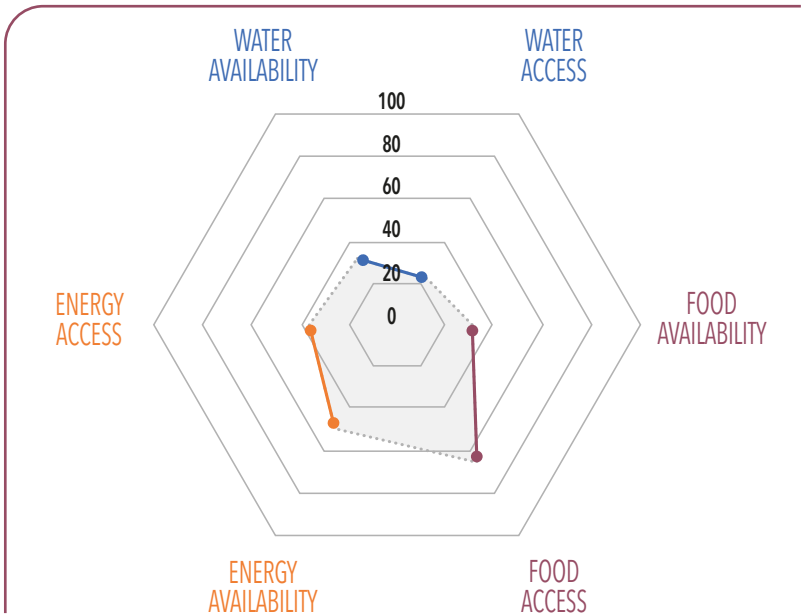
17.209 total renewable water resources per capita (m3/inhab/year)

1638 people don't have a decent toilet

67 % children under 5 die each year from diarrhoea

Water-Energy-Food Nexus INDEX

The WEF Nexus Index is an inclusive metric that amalgamates 21 indicators from worldwide data repositories. The WEF Nexus Index value for Guinea is 53.1, placing the nation in the 124th position worldwide. Guinea has a value of 48.9 for the Water pillar, 60.8 for the Energy pillar and 49.5 for the Food pillar.



▼ in numbers

53.1 WEF index score

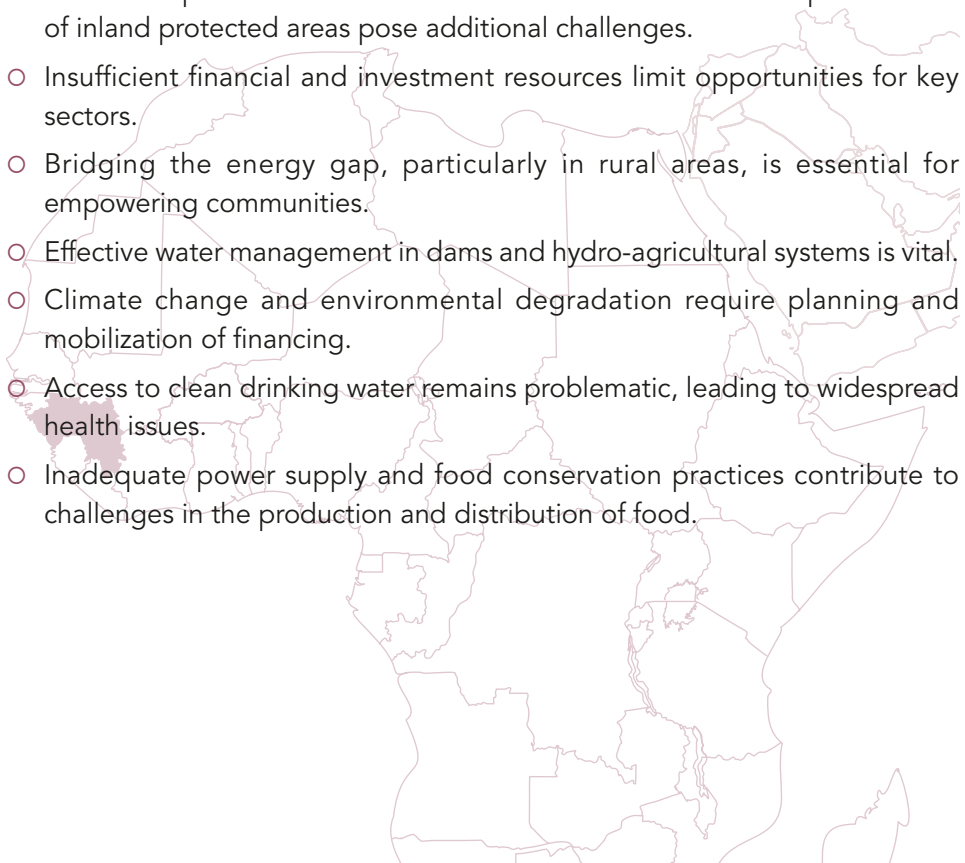
124th global rank

The way forward

Focus on public sector: understanding the local Guinea context

Challenges in implementing the Water Energy Food Nexus in Guinea

- There are significant challenges related to poverty and food security, necessitating the promotion of agriculture to achieve self-sufficiency.
- Integrated sanitation approaches are crucial to address water pollution resulting from climate change and human activities.
- Water management is inadequate, lacking energy-generating dams and facing issues such as the destruction of river bays, tides, and plant covers.
- The development of infrastructure for inland fisheries and the preservation of inland protected areas pose additional challenges.
- Insufficient financial and investment resources limit opportunities for key sectors.
- Bridging the energy gap, particularly in rural areas, is essential for empowering communities.
- Effective water management in dams and hydro-agricultural systems is vital.
- Climate change and environmental degradation require planning and mobilization of financing.
- Access to clean drinking water remains problematic, leading to widespread health issues.
- Inadequate power supply and food conservation practices contribute to challenges in the production and distribution of food.



Recommendations for a more efficient implementation of the Water Energy Food Nexus in Guinea

- Efforts should be focused on improving living standards and enhancing access to clean water and energy.
- Integrated waste management strategies should be encouraged for densely populated areas, including reforestation of river bays and protection of water sources.
- Collaboration across projects within sectors should be emphasised, with technical players involved in decision-making and capacity-building initiatives.
- Funding opportunities are sought to support Nexus projects and raise awareness among beneficiaries and planners.
- Pollution control, food security, and clean energy installation are key priorities.
- Coordinated information exchange among actors and public engagement are crucial for successful implementation.
- Engagement with local decision-makers and support for hydroelectric and hydro-agricultural infrastructure development are essential.
- Focus areas encompass energy production, food security, drinking water supply, watercourse protection, improved electricity provision, and promotion of local product production and consumption.

Focus on private sector: Moon Soft Bio

This startup uses recycled materials (plastics and scrap metal) to design and manufacture intelligent bio-digesters. Through this project, Moon Soft Bio offers households and collective catering establishments a system for managing their biodegradable waste, replacing charcoal with methane for clean and sustainable cooking, while promoting aquaponics and urban agriculture thanks to the production of liquid and solid fertilizers.

Barriers

Young companies in Guinea are not protected due to a lack of laws that guarantee an equal business playing field. For example, young businesses are obliged to pay early taxes even if they are still struggling to reach their break-even point. Guinea scores high when it comes to how easy it is to establish a new business; in 72 hours, entrepreneurs can process each document and the government is fast in accepting them. On the other hand, the monitoring and protection sides are lacking, as helping a new business with its initial logistics – renting warehouses in Guinea is a complicate venture.
Moreover, certifications are an important obstacle. Local certifications do not validate their products for international exports, undermining their business reach.

Prerogatives

The government is called to establish a development/investment bank that guarantees loans for small entrepreneurs. As of now, commercial banks only provide reimbursable loans, to be repaid after a month with high interest rates, which are also chained to lengthy and expensive paperwork. The entrepreneurial dimension should be developed and taught in schools to spur innovative solutions. On top of that, Guinea needs incubators which follow you also after the program by supporting you for a longer period. These kinds of follow-ups would also foster a higher level of confidence in potential investors.
There should be an adequate training staff to support young ventures, the know-how is critically important. Lastly, investors should fund machineries which would guarantee the scale-up of several businesses.

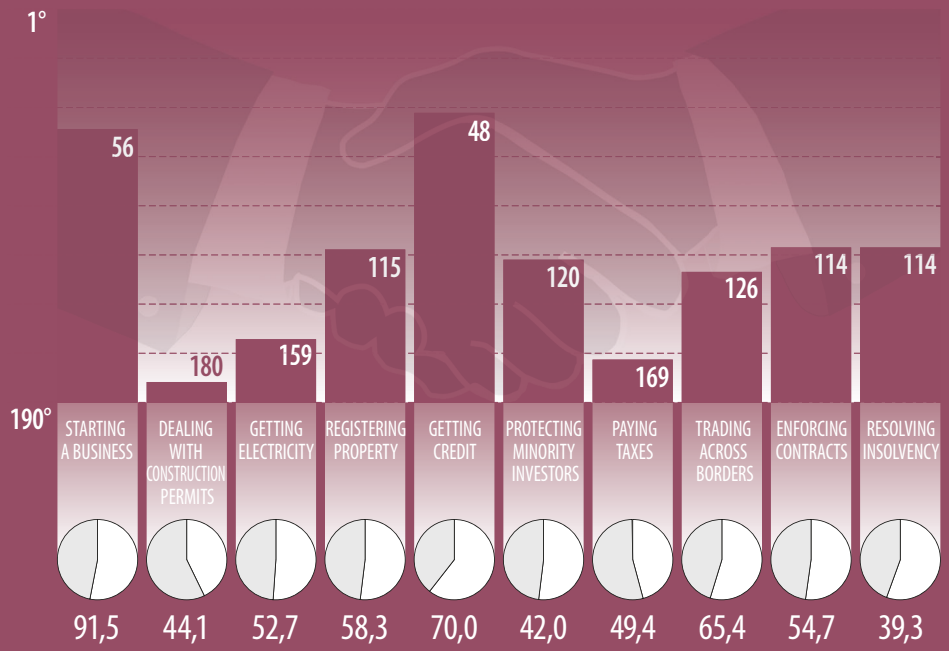
Côte d'Ivoire

27.4 million population

About

Côte d'Ivoire is a leading global exporter of cocoa and cashew nuts, a net oil exporter, and the largest economy in the West African Economic and Monetary Union. Its thriving agricultural sector and its diverse manufacturing industry, including food processing, textiles, chemicals, and automobile assembly, contribute to employment and economic growth.

Rankings on doing business topics

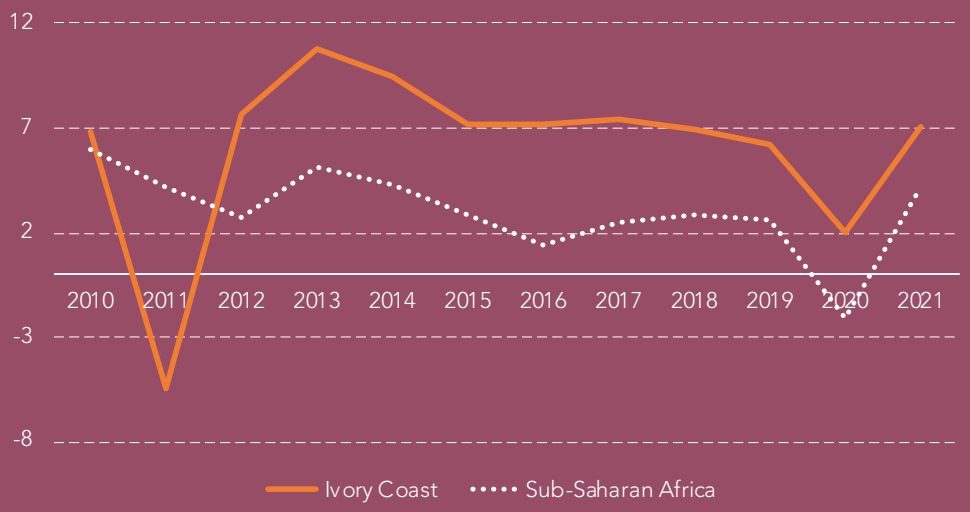


Ease of doing Business
Côte d'Ivoire World Rank **110**

Economic Overview

Côte d'Ivoire has witnessed remarkable and sustained economic growth in Sub-Saharan Africa for more than a decade. With an average annual real GDP growth of 8.2% from 2012 to 2019, the country effectively managed the impact of the COVID-19 pandemic, maintaining positive growth of 2% in 2020. In 2021, Côte d'Ivoire resumed its upward growth trajectory, solidifying its position as a prominent regional economic hub and a preferred destination for individuals from the Economic Community of West African States (ECOWAS) and beyond.

GDP growth (annual %) - Sub-Saharan Africa, Côte d'Ivoire



Survey

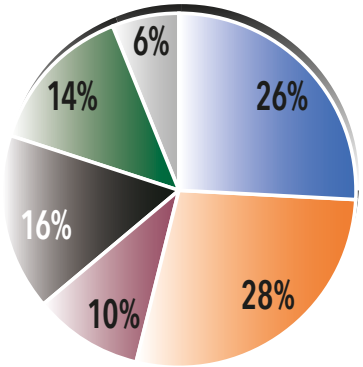
Respondents Background profile

The analysis of surveys in Cote d'Ivoire involved 14 participants, mainly from public institutions. Average age was around 50 years, with about 20 years of professional experience. Participants held various roles like managers, technicians, engineers, researchers, ministers, and advisors of public affairs. Institutions included, among many others, the Ministère du Plan et du Développement, Ministère des Affaires Étrangères, and the Ministère de l'Hydraulique.

Mostly selected technical assistance packages by participants

A list of different technical assistance packages have been proposed to the participants during the survey. Here under are the most interesting focus points as selected by participants from the exhaustive list of the survey.

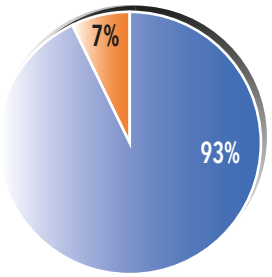
Selected technical assistance



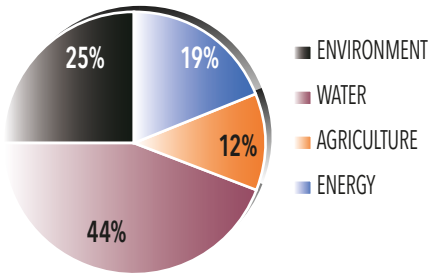
- FINANCING
- DECENTRALIZED RENEWABLE ENERGY SOLUTIONS
- WATER MANAGEMENT
- WEF NEXUS
- DEVELOPMENT OF THE AGRIBUSINESS SECTOR
- NATURAL RESOURCE MANAGEMENT

Educational profile

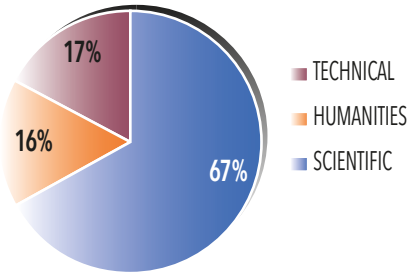
Level of education



Professional Nexus Expertise

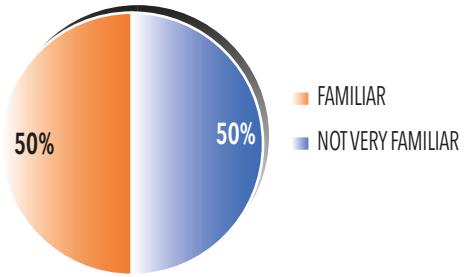


Domains of education

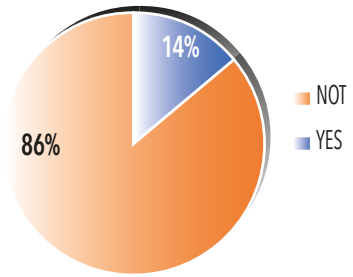


Familiarity to Nexus Concept

Nexus concept familiarity



Participation in activities related to the WEF approach



Energy

SDG7 - Affordable and Clean Energy			Overtime trend	
Population with access to electricity (%)	68.6	2019		
Population with access to clean fuels and technology for cooking (%)	30.3	2019		
CO2 emissions from fuel combustion per total electricity output (MtCO2/TWh)	1.4	2019		
Share of renewable energy in total primary energy supply (%)	62.7	2018		

Challenge

Côte d'Ivoire relies significantly on biomass, such as fuel wood and charcoal, to meet its energy demands, accounting for 56% of the country's energy needs. Biomass is used for household consumption, small-scale businesses, and generating steam or electricity in agro-industrial enterprises and sawmills. The country has a trade surplus in petroleum products and exports crude oil.

in numbers

2232 MW installed electricity-generating capacity

45.2 % access to electricity in rural population

Food security

SDG2 - Zero Hunger			Overtime trend	
Prevalence of undernourishment (%)	14.9	2019		
Prevalence of stunting in children under 5 years of age (%)	21.6	2016		
Prevalence of wasting in children under 5 years of age (%)	6.1	2016		
Prevalence of obesity, BMI ≥ 30 (% of adult population)	10.3	2016		
Human Trophic Level (best 2-3 worst)	2.1	2017		
Cereal yield (tonnes per hectare of harvested land)	2.3	2018		
Sustainable Nitrogen Management Index (best 0-1.41 worst)	0.9	2015		
Exports of hazardous pesticides (tonnes per million population)	2.1	2019		

Challenge

Approximately 15% of rural households in the country face a significant risk of food insecurity, with rural women and youth being particularly susceptible. The agricultural, livestock, and fishing sectors collectively employ nearly 46% of the active population and serve as the primary source of income for two-thirds of households. Côte d'Ivoire boasts considerable agricultural potential, with ample opportunities for enhanced productivity in its wetlands (known as bas-fonds) and plateau regions.

in numbers

4.4 % of prevalence of undernourishment

45 % of employment in agriculture

Major challenges remain
Significant challenges remain
Challenges remain
SDG achieved
Trend information unavailable

Decreasing
Stagnating
Moderately improving
On track or maintaining SDG achievement

Water

SDG 6 - Clean Water and Sanitation			Overtime trend	
Population using at least basic drinking water services (%)	70.9	2020		
Population using at least basic sanitation services (%)	34.6	2020		
Freshwater withdrawal (% of available freshwater resources)	5.1	2018		
Anthropogenic wastewater that receives treatment (%)	0.6	2018		
Scarce water consumption embodied in imports (m3 H2O eq/capita)	406.0	2018		

Challenge

50 percent of the population in Ivory Coast currently has access to safe and clean drinking water, with the figure plummeting to 35 percent in rural areas. Alarming statistics reveal that approximately 41 percent of households have tested positive for e.coli contamination in their water, thereby contributing to the country's rising infant mortality rate. Moreover, the detrimental effects of contaminated water extend to the educational prospects of children, as frequent illnesses impede their ability to learn and hinder overall personal development.

in numbers

3190 total renewable water resources per capita (m3/inhab/year)

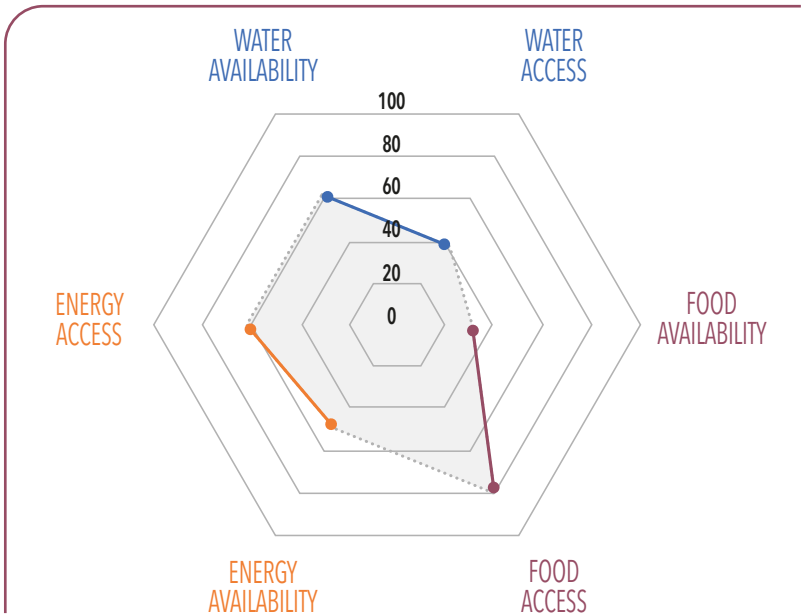
1187 National Rainfall Index (2020)[1]

51,64 % agricultural water withdrawal as % of total (2020)

[1] NRI is defined as the national average of the total annual precipitation weighted by its long-term average.

Water-Energy-Food Nexus INDEX

The WEF Nexus Index is an inclusive metric that amalgamates 21 indicators from worldwide data repositories. The WEF Nexus Index value for Côte d'Ivoire is 52.7, placing the nation in the 129th position worldwide. Côte d'Ivoire has a value of 49.2 for the Water pillar, 55.2 for the Energy pillar and 53.6 for the Food pillar.



in numbers

52.7 WEF index score

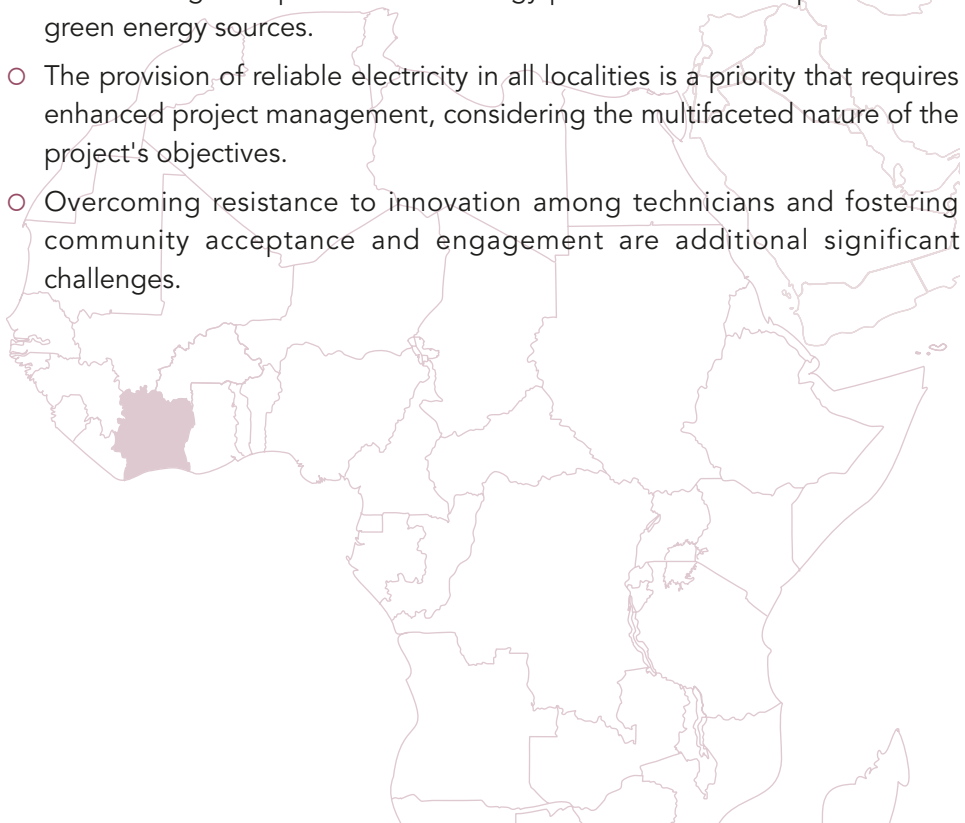
129th global rank

The way forward

Focus on public sector: understanding the local Côte d'Ivoire context

Challenges in implementing the Water Energy Food Nexus in Côte d'Ivoire

- Crucial to address the issues of water quality and ensure effective management to prevent frequent disruptions in water supply.
- Pollution of resources remains a persistent concern that demands immediate attention.
- Rainwater management can play a significant role in off-season production, contributing to the overall objective of food security.
- The current energy supply exhibits strong seasonality and irregularities, necessitating the optimization of energy production and the promotion of green energy sources.
- The provision of reliable electricity in all localities is a priority that requires enhanced project management, considering the multifaceted nature of the project's objectives.
- Overcoming resistance to innovation among technicians and fostering community acceptance and engagement are additional significant challenges.



Recommendations for a more efficient implementation of the Water Energy Food Nexus in Côte d'Ivoire

- Proactive measures must be taken to adapt to climate change and mitigate the ongoing challenges related to resource pollution.
- It is imperative to foster greater synergy among the various stakeholders involved in the nexus domain by integrating the concept into ongoing projects.
- This integration should prioritize the utilization of underground water pumping for both human consumption and agricultural purposes, along with the installation of solar energy systems for sustainable water supply.
- Enhancing knowledge and practices related to water usage is crucial, particularly emphasizing the generation of revenues from agriculture.
- Integration of resources is essential to mitigate the challenges posed by irregular production and insufficient revenue generation.
- Addressing the high cost of energy necessitates diversification of production resources.
- Projects in the nexus domain should be designed to incorporate multiple interconnected elements while upholding environmental preservation.
- Promoting understanding and awareness of the concept within the population is essential.
- Adequate budget allocations are necessary to integrate project-specific data and local variables.

Focus on private sector: Agritech 4 Africa

To digitize the agricultural and poultry sectors, they have developed an onboard electronic system to help farmers trigger their remote irrigations from their mobile app or schedule the hours watering their crops. The same system allows farmers to give water remotely to their chickens without moving. They also offer other services, such as the construction of poultry farms and agricultural greenhouses combined with their system.

Barriers

Entrepreneurs are faced with high financial burdens: young companies must declare the first year's taxes, while declaring their financial accounts every month – instead of every six months as it was beforehand. They also need to pay 4% of the turnover of the first months. Startups in agriculture should have more favor than other businesses because the country depends on agriculture production.

In terms of financial support, startups are confronted with intense competition especially within incubator programs. Many selection criteria are based more on seniority, while disregarding indexes as innovation – key topic for a new business. Moreover, the cost of drilling is also still too high and not yet accessible to all of Ivory Coast.

Prerogatives

Ivory Coast highly relies on agriculture for its food reserves, and that is why innovation in this sector should be encouraged. The government is called to establish an aid fund for startups, with a special focus on youth. Agriculture is strictly linked to water reserves and energy uses, and that is why Ivory Coast should invest in entrepreneurs who are keen to foster WEF Nexus penetration in country. Locals need more information and awareness regarding the benefits of WEF Nexus projects.

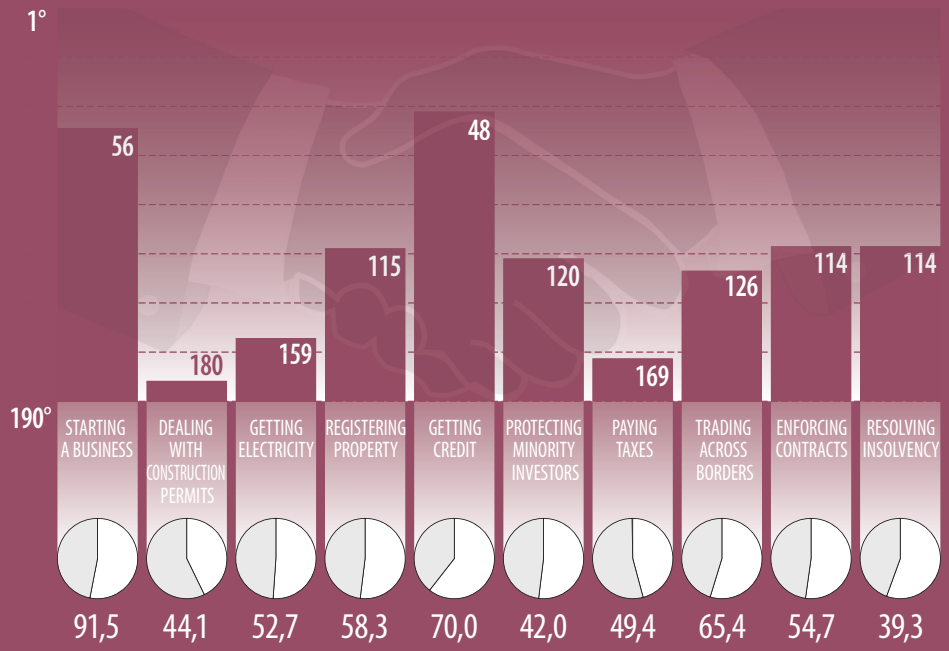
Niger

25.2 million population

About

Niger, a desert state bordering the Sahara, is classified as one of the least developed nations by the UN. In 2021, over 10 million people (41.8% of the population) lived in extreme poverty. Political instability, droughts, poverty, and challenges such as slavery, illiteracy, and disease persist. Niger's economic modernization relies on oil exploration and gold mining.

Rankings on doing business topics

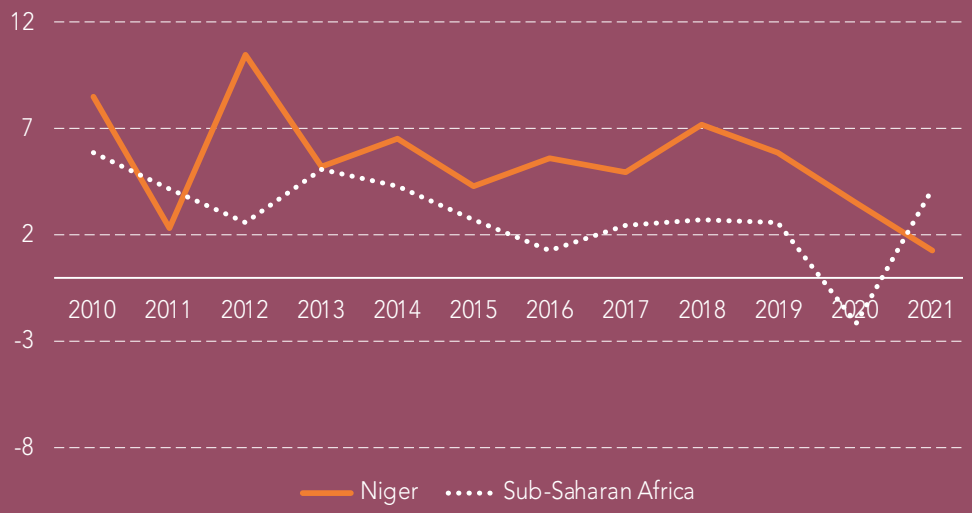


Ease of doing Business
Niger World Rank **132**

Economic Overview

Niger possesses an economy that lacks diversification, with agriculture representing 40% of its GDP. Nonetheless, Niger's GDP is projected to grow by 11.5% in 2022, driven by a 27% increase in agricultural production and the services sector's expansion. Inflation reached a 10-year high of 4.2% due to global commodity prices and domestic food market pressures. The outlook for 2023-2024 includes further growth fueled by oil production and exports, with GDP per capita rising by 15%. However, uncertainties remain, including climate change impacts, security concerns, oil price fluctuations, and delays in economic reforms and investments.

GDP growth (annual %) - Sub-Saharan Africa, Niger



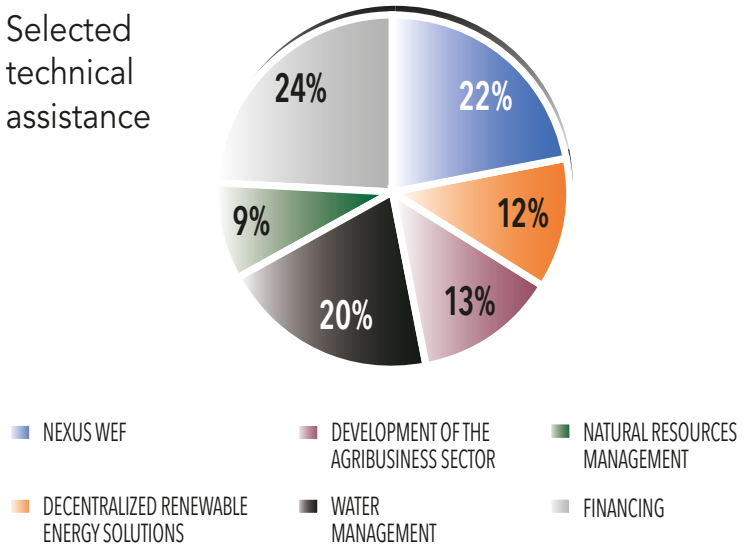
Survey

Respondents Background profile

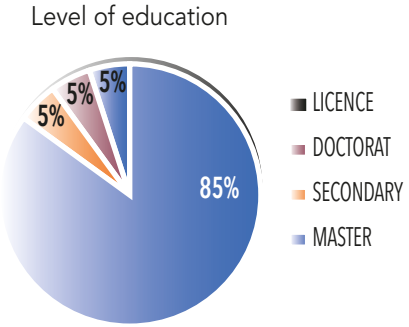
The analysis of surveys in Niger involved 20 participants, mainly from public institutions. Average age was around 53 years, with about 23 years of professional experience. Participants held various roles like managers, technicians, researchers, geologists, and engineers. Institutions included, among many others, the Ministere des Mines, Ministere des Finance, Ministere de l'Elevage, and the Institut National de la Recherche Agronomique du Niger (INRAN).

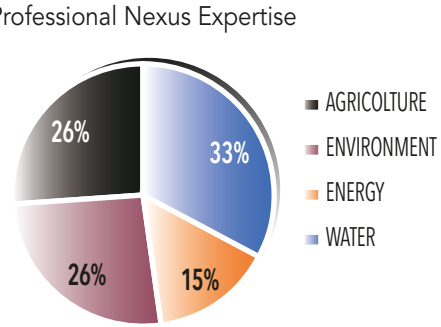
Mostly selected technical assistance packages by participants

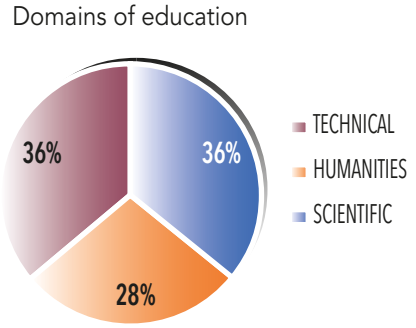
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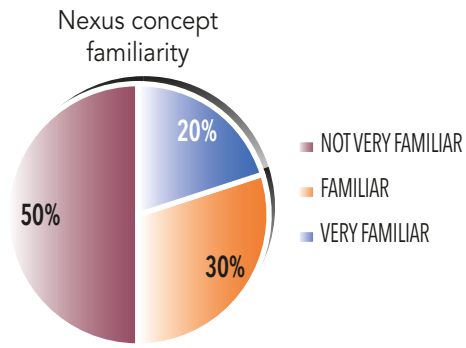
Educational profile

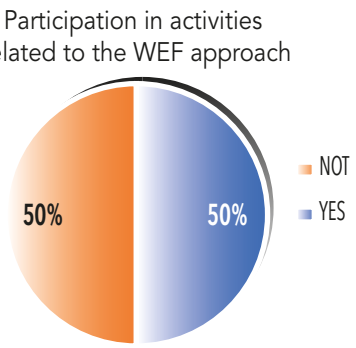






Familiarity to Nexus Concept





Energy

SDG7 - Affordable and Clean Energy			Overtime trend	
Population with access to electricity (%)	18.8	2019		
Population with access to clean fuels and technology for cooking (%)	2.4	2019		
CO2 emissions from fuel combustion per total electricity output (MtCO2/TWh)	4.2	2019		
Share of renewable energy in total primary energy supply (%)	75.9	2019		

Challenge

Niger's electrification rate is among the lowest in sub-Saharan Africa, with only one in seven individuals having access to modern power. Additionally, the national utility provides electricity to a mere four percent of rural households. The lack of electricity hinders economic growth, development, and limits opportunities for those living below the poverty line.

in numbers

380 MW installed electricity-generating capacity

9.1 % access to electricity in rural population

Major challenges remain
Significant challenges remain
Challenges remain
SDG achieved
Trend information unavailable

Decreasing
Stagnating
Moderately improving
On track or maintaining SDG achievement

Food security

SDG2 - Zero Hunger			Overtime trend	
Prevalence of undernourishment (%)	NA	NA		
Prevalence of stunting in children under 5 years of age (%)	47.1	2019		
Prevalence of wasting in children under 5 years of age (%)	9.8	2019		
Prevalence of obesity, BMI ≥ 30 (% of adult population)	5.5	2016		
Human Trophic Level (best 2-3 worst)	2.1	2017		
Cereal yield (tonnes per hectare of harvested land)	0.6	2018		
Sustainable Nitrogen Management Index (best 0-1.41 worst)	0.9	2015		
Exports of hazardous pesticides (tonnes per million population)	14.2	2019		

Challenge

Agriculture plays a pivotal role in Niger's economy, serving as the largest sector in terms of employment and gross domestic product share (GNP). The country's self-sufficiency in food and livestock production heavily relies on rainfall, making it vulnerable to periods of drought that necessitate imports of food aid. In an effort to enhance productivity and mitigate cereal shortages, the government has made investments in irrigation projects and implemented a program focused on small-scale production and off-season cropping through irrigation.

in numbers

19.8 % of prevalence of undernourishment

71 % of employment in agriculture

Water

SDG 6 - Clean Water and Sanitation			Overtime trend	
Population using at least basic drinking water services (%)	46.9	2020		
Population using at least basic sanitation services (%)	14.8	2020		
Freshwater withdrawal (% of available freshwater resources)	7.5	2018		
Anthropogenic wastewater that receives treatment (%)	0.0	2018		
Scarce water consumption embodied in imports (m3 H2O eq/capita)	163.2	2018		

Challenge

In Niger, many households lack access to safe drinking water, forcing families to spend hours collecting water. This often prevents girls from attending school. Water-related infections and poor hygiene contribute to high child mortality rates. In 2017, only 50% of the population had basic water supply. Climate change disrupts rainfall patterns, impacting agriculture and food security. Inadequate water management and land degradation further exacerbate water and arable land scarcity.

in numbers

1406 total renewable water resources per capita (m3/inhab/year)

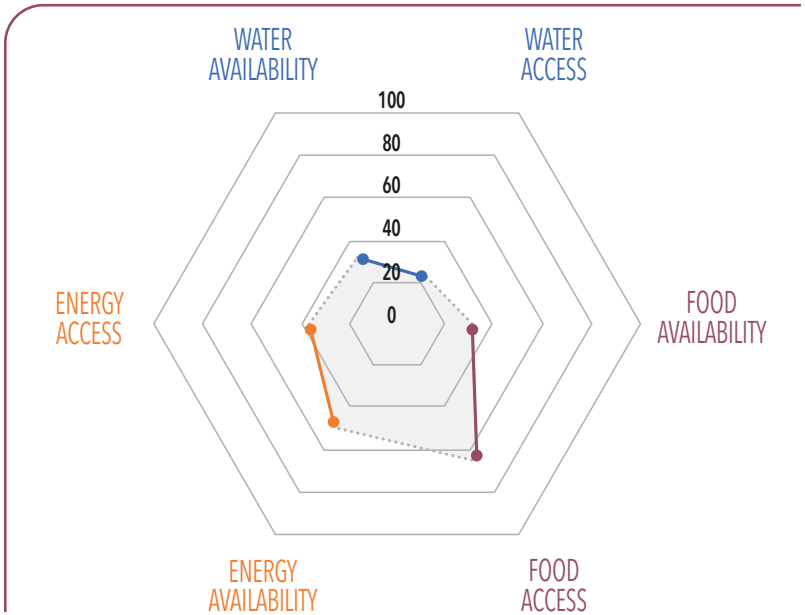
310,4 National Rainfall Index (2020)[1]

91 % agricultural water withdrawal as % of total water withdrawal

[1] NRI is defined as the national average of the total annual precipitation weighted by its long-term average.

Water-Energy-Food Nexus INDEX

The WEF Nexus Index is an inclusive metric that amalgamates 21 indicators from worldwide data repositories. The WEF Nexus Index value for Niger is 39.5, placing the nation in the 171st position for the countries worldwide. Niger has a value of 27.3 for the Water pillar, 43.4 for the Energy pillar and 47.9 for the Food pillar.



in numbers

39.5 WEF index score

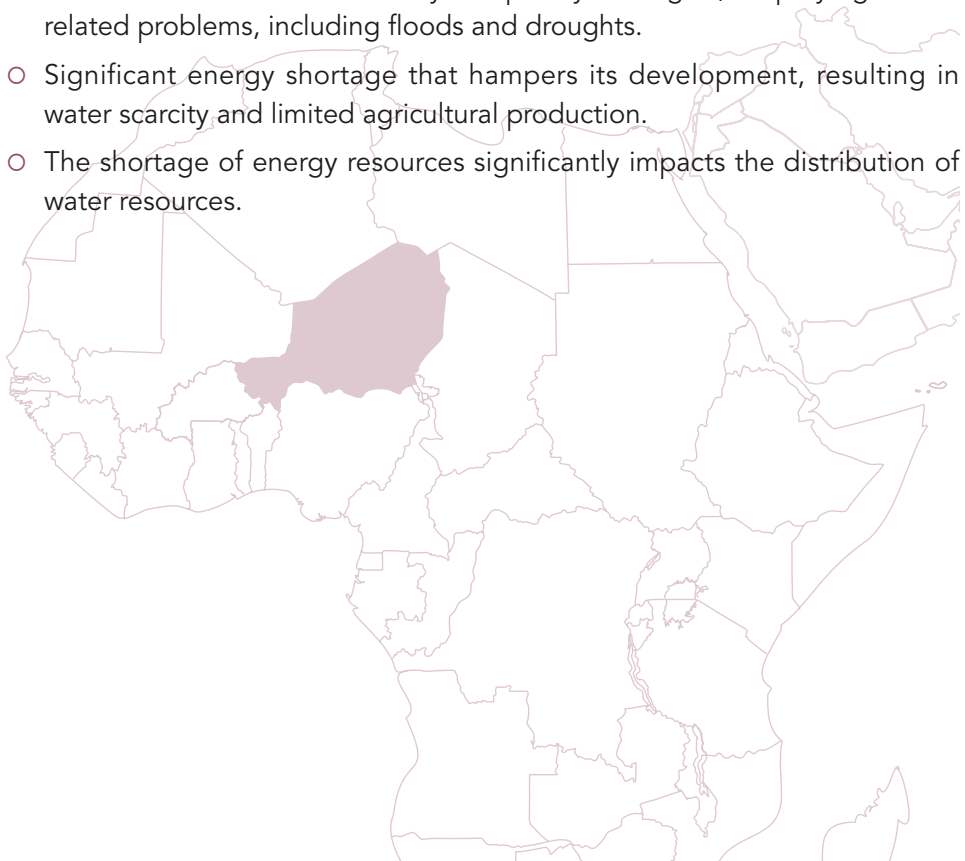
171th global rank

The way forward

Focus on public sector: understanding the local Niger context

Challenges in implementing the Water Energy Food Nexus in Niger

- Food insecurity: it stems from inadequate soil fertility, resulting in low agricultural yields and increased poverty.
- The land is becoming increasingly dry and rainfall distribution becoming erratic, leading to further food deficits.
- The Niger River is facing silting issues, negatively affecting water availability, conservation, and utilization.
- Water resources in the country are poorly managed, amplifying water-related problems, including floods and droughts.
- Significant energy shortage that hampers its development, resulting in water scarcity and limited agricultural production.
- The shortage of energy resources significantly impacts the distribution of water resources.



Recommendations for a more efficient implementation of the Water Energy Food Nexus in Niger

- Need to promote the use of solar energy, especially in food production.
- Comprehensive training, extension services, and practical applications in water security, food, and energy sectors are essential for sustainable development.
- Increased regional investment, market development, and cross-border resource management are crucial for fostering the adoption of the WEF Nexus effectively.
- The development of localities of intervention and better living conditions for populations, with the availability of water and energy and household security.
- The mobilization of financing, strengthening sector capacities, while ensuring that the beneficiaries take ownership of the results.
- Develop virtuous value chains.
- To implement capacity-building initiatives to foster the adoption of efficient techniques among producers.
- To educate the population about the relevance of the WEF Nexus, and especially about how the three components can synergize their actions.
- WEF Nexus is a multi-sectoral principle, so a coordination structure is needed.
- To increase knowledge on how to efficiently manage resources to ensure their long-term sustainability.

Focus on private sector: Green Business Consulting

Green Business Consulting is a start-up producing and marketing green charcoal for cooking, biochar, and organic fertilizer by pyrolysis of water hyacinth. Green Business Consulting is helping to protect underground water tables and the Niger River through this project. They are also replanting trees and making the soil in Niger more fertile. The project helps meet some of the energy needs of households by making green coal.

Barriers

The biggest challenge for young entrepreneurs is, first of all, taxes. More public-private communication should be established to allow young people to understand the procedures and the constraints of what is expected of them. Most young people who want to innovate are not aware of the complexity of entrepreneurship. Taxes are often a hindrance and cause some people to give up. In Niger, more than 60% of young entrepreneurs cannot last two years. For the sector to grow, young people should not have to pay taxes for the first two to three years, making them more comfortable in business.

As of now, entrepreneurs can plan to spend their credits after deferring them by a few months, but there are constraints on the ground that will prevent them from honoring their commitments. Banks negatively affect this situation by focusing majorly on loans' reimbursement rather than the entrepreneurs' success.

Furthermore, support is limited only to the preparation of documents and the acquisition of funds, but there is a need to support the entrepreneur on the field. Involved stakeholders should establish a modus operand where the entrepreneur is followed during its first step on the field. These are crucial because a rushed and poor-quality product can negatively impact the reputation of the company and its owner. The discrepancy between what is valid on paper and how the same solution could be profitable in the real market is still an obstacle.

Beyond funding, most of the equipment must be imported and is too expensive for local businesses. On top of this, import procedures are lengthy and administrative and associated taxes are costly as more than 30% of the amount. Small businesses that buy equipment or materials should have an exemption on taxes.

Moreover, the schooling system should be modernized. The need of innovation should be fostered at a young age, and as of now the schooling system in Niger is not linked with everyday issues that pupils might face once they leave school. Students should develop the skill to have critical ideas, conduct research in order to be up to date, and have relevant ideas.

Prerogatives

Niger needs to organize regional bootcamps where entrepreneurship is discussed and its penetration is fostered. The creation of a series of bootcamp would encourage the interest of the local youths regionally and it would benefit the region as a whole. The school environment should be the first environment of awareness; organize small entrepreneurial competitions at the end of the year, which allow the establishment to reward young people who propose innovative ideas. It will stimulate young people to innovate by creating a culture that will be interested in the field, to go beyond what they learn at school.

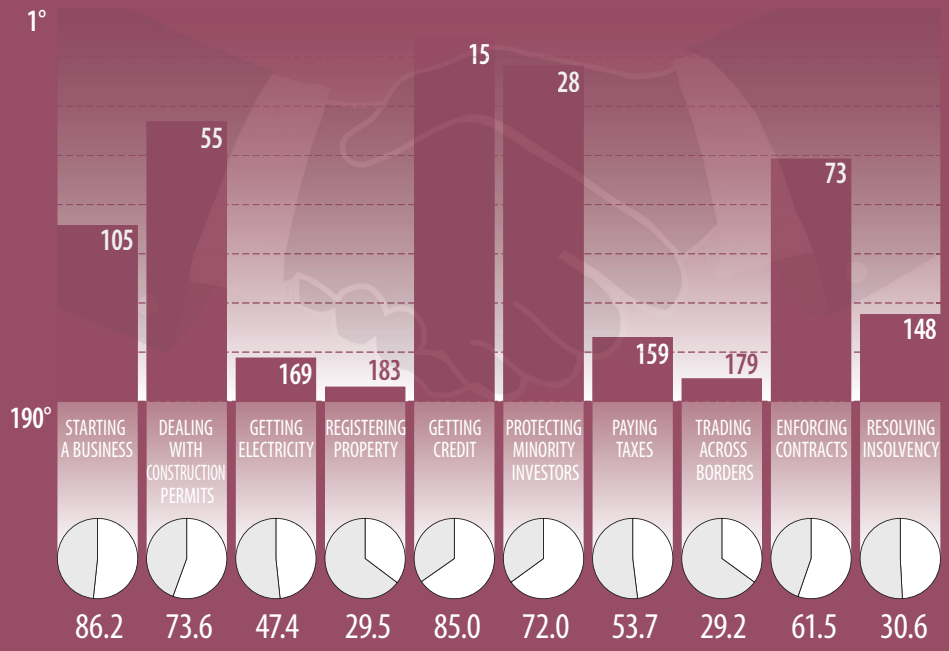
Nigeria

213.4 million population

About

Despite being the leading national economy in sub-Saharan Africa, Nigeria faces substantial obstacles in its path towards development and effective governance in order to fully unlock its potential. Approximately 96 million Nigerians survive on less than $1.90 per day, making it the country with the highest number of people living in extreme poverty worldwide.

Rankings on doing business topics



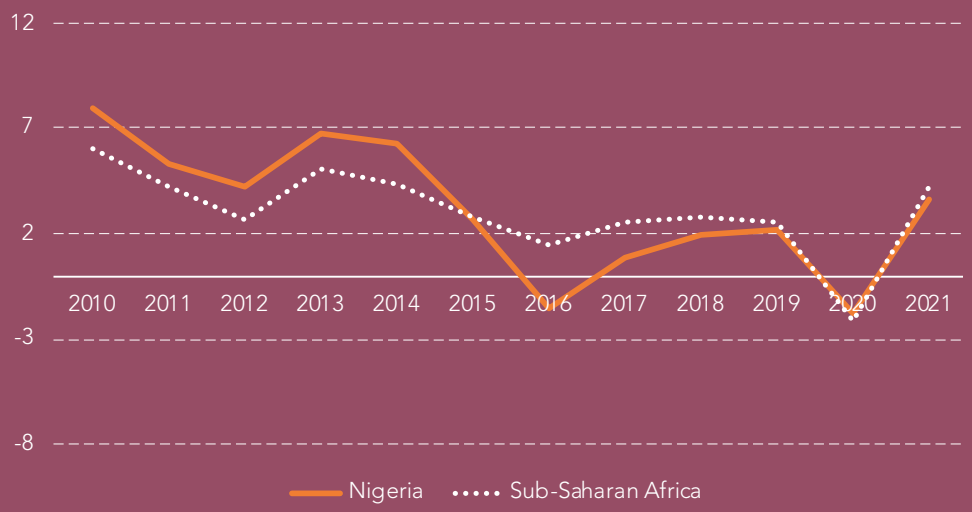
Ease of doing Business

Nigeria World Rank **131**

Economic Overview

Even if high oil prices occurred, the Nigerian economy has not seen the expected boost. Weak macroeconomic stability, declining oil production, costly petrol subsidies, exchange rate distortions, fiscal deficit monetization, and high inflation have led to increased poverty. If current trends continue, the number of Nigerians living below the poverty line will rise by 13 million by 2025. The projected economic growth of 2.9% between 2023 and 2025 is only slightly higher than the population growth rate of 2.4%. Downside risks include domestic policies, low oil production, and a scarcity of foreign exchange and local currency.

GDP growth (annual %) - Sub-Saharan Africa, Nigeria



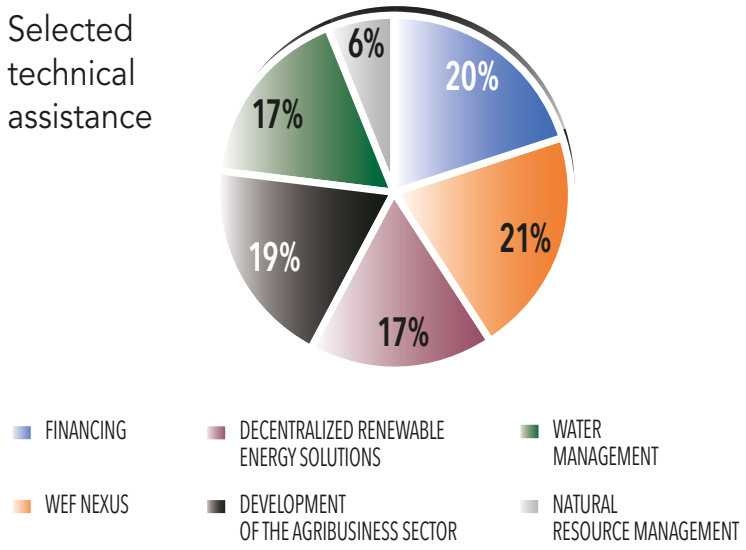
Survey

Respondents Background profile

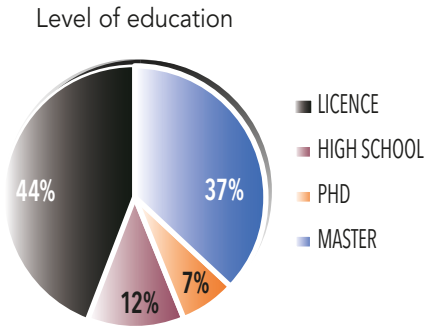
The analysis of surveys in Nigeria involved 52 participants, mainly from public institutions. Average age of the participants was approximately 50 years, with an average professional experience of around 24 years. They held various profiles, including engineer, agronomist, hydrogeologist, consultant, and project manager. The institutions involved, among many others, were: Nigerian Association of Hydrogeologists, Federal Ministry of Agriculture and Rural Development, and Federal Ministry of Water Resources.

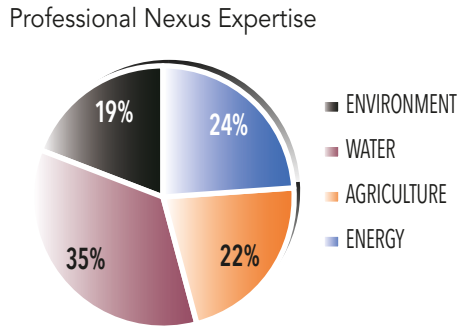
Mostly selected technical assistance packages by participants

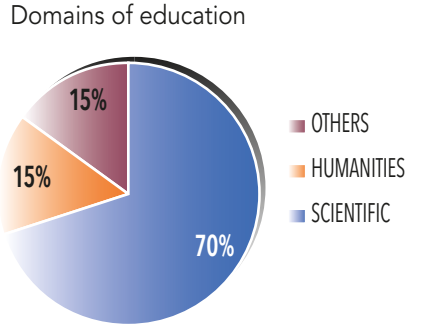
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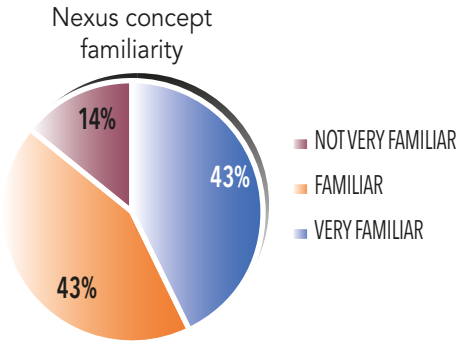
Educational profile

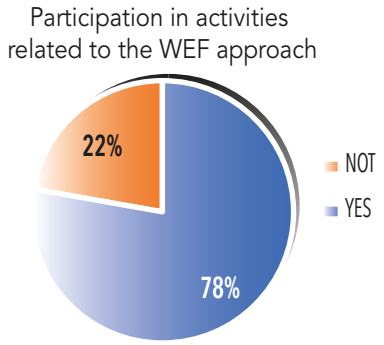






Familiarity to Nexus Concept





Energy

SDG7 - Affordable and Clean Energy			Overtime trend	
Population with access to electricity (%)	55.4	2019		
Population with access to clean fuels and technology for cooking (%)	13.0	2019		
CO2 emissions from fuel combustion per total electricity output (MtCO2/TWh)	4.4	2019		
Share of renewable energy in total primary energy supply (%)	75.1	2019		

Challenge

Despite abundant oil, gas, hydro, and solar resources, existing power plants can generate 12,522 MW, but daily dispatches average only around 4,000 MW for a population of over 195 million. Challenges in electricity policy enforcement, regulatory uncertainties, gas supply, transmission constraints, and planning shortfalls hinder the sector's commercial viability.

in numbers

13154 MW installed electricity-generating capacity

26.3 % access to electricity in rural population

Major challenges remain
Significant challenges remain
Challenges remain
SDG achieved
Trend information unavailable

Decreasing
Stagnating
Moderately improving
On track or maintaining SDG achievement

Food security

SDG2 - Zero Hunger			Overtime trend	
Prevalence of undernourishment (%)	14.6	2019		
Prevalence of stunting in children under 5 years of age (%)	31.5	2020		
Prevalence of wasting in children under 5 years of age (%)	6.8	2018		
Prevalence of obesity, BMI ≥ 30 (% of adult population)	8.9	2016		
Human Trophic Level (best 2-3 worst)	2.0	2017		
Cereal yield (tonnes per hectare of harvested land)	1.5	2018		
Sustainable Nitrogen Management Index (best 0-1.41 worst)	0.8	2015		
Exports of hazardous pesticides (tonnes per million population)	2.4	2019		

Challenge

More than 70 percent of Nigerians are involved in the agriculture sector. The key challenges deal with land tenure, limited irrigation farming, climate change, and land degradation. Additionally, low technology adoption, high production costs, inadequate input distribution, limited financing, significant post-harvest losses, and limited market access further impede progress. These obstacles have negatively impacted agricultural productivity, leading to a decreased contribution to Nigeria's GDP and an increased reliance on food imports due to population growth, ultimately affecting food sufficiency levels.

in numbers

12.7 % of prevalence of undernourishment

35 % of employment in agriculture

Water

SDG 6 - Clean Water and Sanitation			Overtime trend	
Population using at least basic drinking water services (%)	77.6	2020		
Population using at least basic sanitation services (%)	42.7	2020		
Freshwater withdrawal (% of available freshwater resources)	9.7	2018		
Anthropogenic wastewater that receives treatment (%)	0.2	2018		
Scarce water consumption embodied in imports (m3 H2O eq/capita)	177.1	2018		

Challenge

In 2018, Nigeria declared a state of emergency in the Water, Sanitation, and Hygiene (WASH) sector. By 2019, 60 million Nigerians lacked basic drinking water, 80 million lacked adequate sanitation facilities, and 167 million lacked basic handwashing facilities. Insufficient WASH services disproportionately affect women and girls, impacting their well-being, school attendance, and vulnerability to gender-based violence. As of 2021, 25% of the Nigerian population relies on unsafe water sources.

▼ in numbers

1388 total renewable water resources per capita (m3/inhab/year)

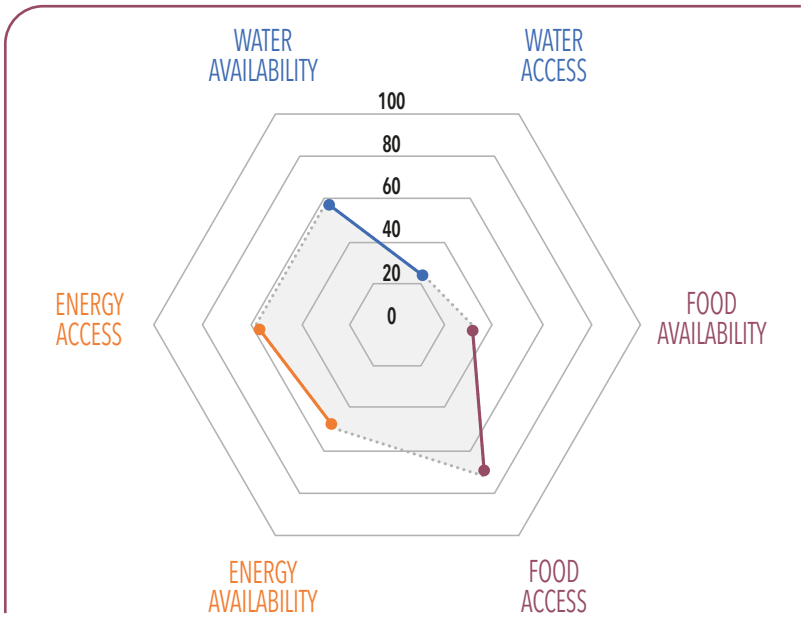
1295 National Rainfall Index (2020)[1]

44,17 % agricultural water withdrawal as % of total (2020)

[1] NRI is defined as the national average of the total annual precipitation weighted by its long-term average.

Water-Energy-Food Nexus INDEX

The WEF Nexus Index is an inclusive metric that amalgamates 21 indicators from worldwide data repositories. In Nigeria, the WEF Nexus Index value is 51.5, ranking the country 132nd globally. Specifically, Nigeria scores 51.5 for the Water pillar, 54.7 for the Energy pillar, and 48.5 for the Food pillar.



▼ in numbers

51.5 WEF index score

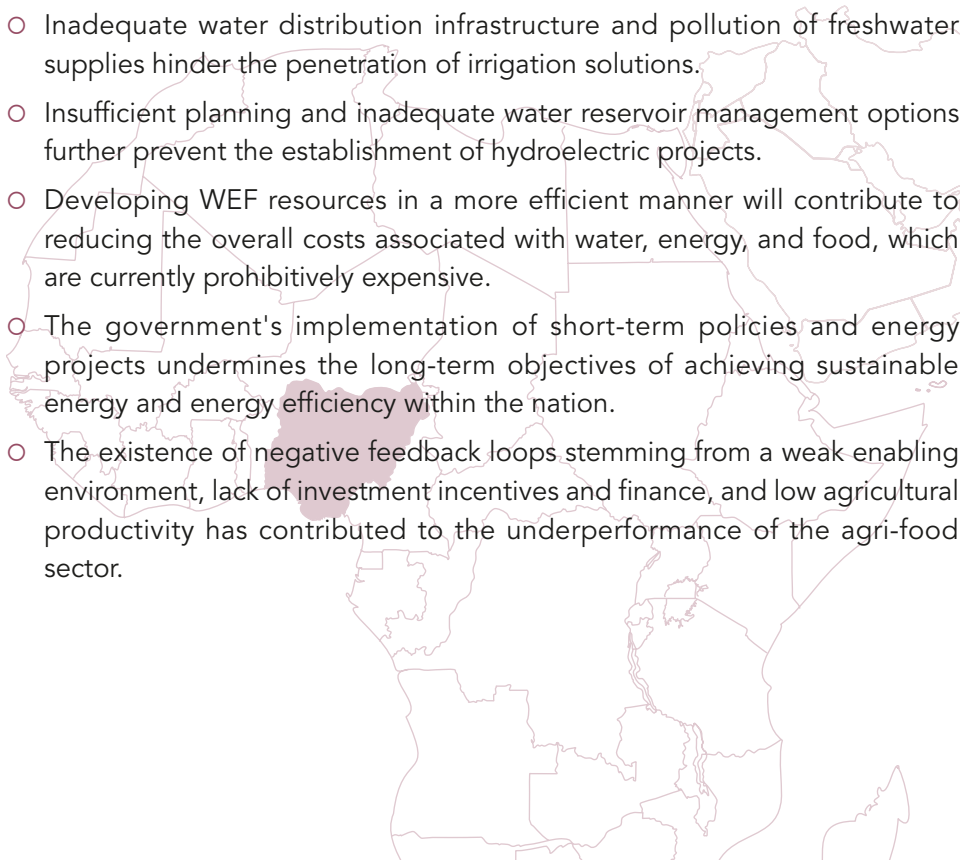
132th global rank

The way forward

Focus on public sector: understanding the local Nigeria context

Challenges in implementing the Water Energy Food Nexus in Nigeria

- The country's food production has failed to keep pace with population growth, resulting in a rise in food imports and a decline in food self-sufficiency.
- The Niger Delta, the world's third-largest wetland, has experienced severe environmental and social consequences due to continuous oil spills resulting from oil extraction activities.
- Desertification is spurring in rural areas where fuel wood is still the main cooking system for the majority of the population.
- Inadequate water distribution infrastructure and pollution of freshwater supplies hinder the penetration of irrigation solutions.
- Insufficient planning and inadequate water reservoir management options further prevent the establishment of hydroelectric projects.
- Developing WEF resources in a more efficient manner will contribute to reducing the overall costs associated with water, energy, and food, which are currently prohibitively expensive.
- The government's implementation of short-term policies and energy projects undermines the long-term objectives of achieving sustainable energy and energy efficiency within the nation.
- The existence of negative feedback loops stemming from a weak enabling environment, lack of investment incentives and finance, and low agricultural productivity has contributed to the underperformance of the agri-food sector.



Recommendations for a more efficient implementation of the Water Energy Food Nexus in Nigeria

- It is imperative to implement environmentally friendly extraction technologies alongside clean energy sources to alleviate the pressure on the environment and the communities residing in the delta region.
- Irrigation-focused integrated water resources management project are needed to complete and rehabilitate existing irrigation schemes and dams as well as to improve their irrigation management system.
- Efforts should be made to ensure a more balanced distribution of water resources.
- The quality of groundwater resources should be improved while minimizing energy consumption, thereby enhancing the overall sustainability of the interconnected components within the water-energy-food nexus.
- The effective utilization of food waste promotes environmental and social sustainability by mitigating economic losses and minimizing the climate impact associated with it.
- The government should foster a conducive environment to encourage entrepreneurial investment in the relevant sectors.
- The attainment of sustainable well-being in Nigeria necessitates a shift towards a new paradigm of business and industrial activities, with a focus on professional and intertwined resource utilization.

Focus on private sector: Achonsan venture

The enterprise provides agro-allied products/services to farmers and retailers, providing employment to local communities. Moreover, they plan to construct a Greenhouse with a fully solar-powered borehole. The Greenhouse would help ameliorate shortages during the dry season with estimated good Returns on Investment (ROI).

Barriers

Nigeria has market opportunities but there is a lack of capital to develop them. Loans are hard to access as the paperwork needed is costly and lengthy. Another key concern for companies is the difficulty of accessing hard cash to buy products, stock, and other services abroad. Central bank's procedures and regulations are slowing the sector's growth. For example, a company transferring and exchanging money from foreign to local currency can hinder its growth. Furthermore, recurrent shortages of power supplies across the country undermine the ease of doing business, leading to an extra financial burden for entrepreneurs.

Prerogatives

The WEF Nexus approach is not common or widespread in Nigeria, even if it would add significant added value. Electricity is a significant problem in the country, and the Government should focus on skilling or re-skilling the youth on the benefits of renewable energy. Nigeria has water resources but they are often underutilized: no water conservation occurs due to the lack of dams and no hydroelectricity is generated. Investors need to engage young generations who are keen to entrepreneurship. For example, Nigeria needs solutions on how to conserve water especially during the dry season, because many farmers depend on natural rainfalls. If this scenario is secured, the total produce will be abundant.

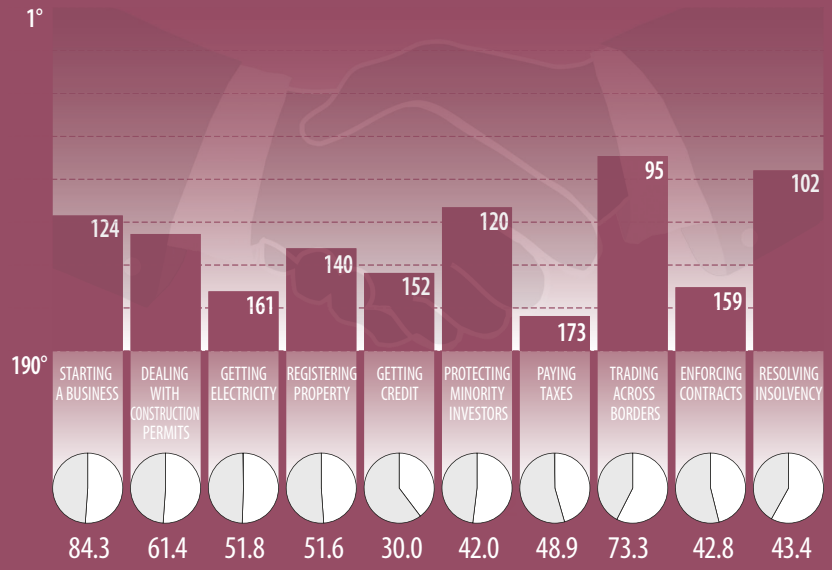
Mali

21.9 million population

About

Nearly half of Mali's population lives in poverty, largely attributed to challenges in various sectors such as agriculture, energy, education, employment, and services. Effective management of natural resources, particularly land and water, is crucial for this arid region to address climate change, meet food demands, and enhance its economy sustainably.

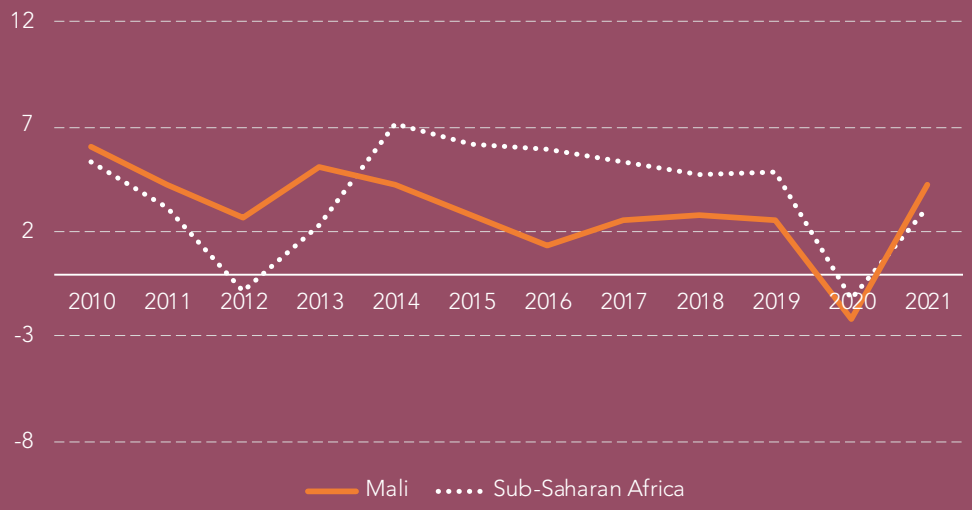
Rankings on doing business topics



Economic Overview

Mali's economy experienced a modest recovery in 2021, with a GDP growth rate of 3.1%, primarily driven by the agriculture and services sectors. However, the imposition of ECOWAS sanctions and the impact of the Ukraine conflict on commodity prices contributed to a slowdown in GDP growth, estimated at 1.8% in 2022. The favourable terms of trade, influenced by rising international gold prices since 2019, weakened in 2022 due to the increase in oil prices. Nonetheless, the impact of ECOWAS sanctions on imports resulted in a decrease in the current account deficit to 7% of GDP, although there was a worsening decline in external financial inflows during 2022.

GDP growth (annual %) - Sub-Saharan Africa, Mali



Ease of doing Business
Mali World Rank **148**

Survey

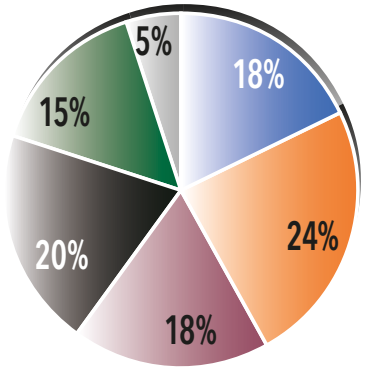
Respondents Background profile

The analysis of surveys in Mali involved 19 participants, mainly from public institutions and international organisations. Average age was around 43 years, with about 16 years of professional experience. Participants held various roles like managers, technicians, researchers, teachers, and engineers. Institutions included, among many others, the Ministère des Affaires étrangères et de la Coopération internationale, Direction des Grandes Entreprises, Office de Développement Rural de Sélingué (ODRS), and the Énergie du Mali (EDM).

Mostly selected technical assistance packages by participants

A list of different technical assistance packages have been proposed to the participants during the survey. Here under are the most interesting focus points as selected by participants from the exhaustive list of the survey.

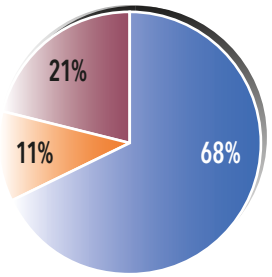
Selected technical assistance



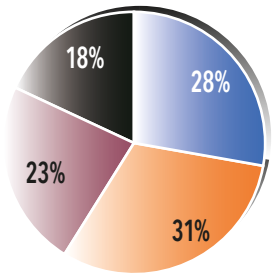
- FINANCING
- DECENTRALIZED RENEWABLE ENERGY SOLUTIONS
- WATER MANAGEMENT
- WEF NEXUS
- DEVELOPMENT OF THE AGRIBUSINESS SECTOR
- NATURAL RESOURCE MANAGEMENT

Educational profile

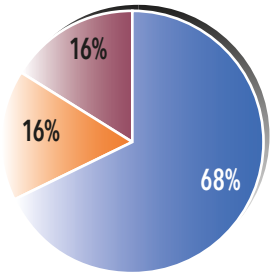
Level of education



Professional Nexus Expertise

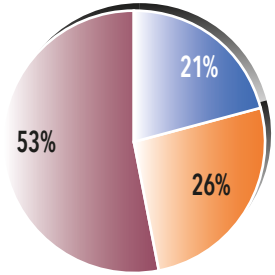


Domains of education

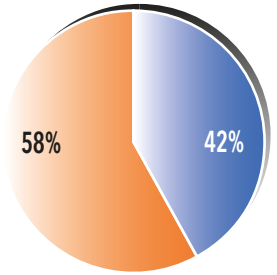


Familiarity to Nexus Concept

Nexus concept familiarity



Participation in activities related to the WEF approach



Energy

SDG7 - Affordable and Clean Energy			Overtime trend	
Population with access to electricity (%)	48.0	2019		
Population with access to clean fuels and technology for cooking (%)	0.9	2019		
CO2 emissions from fuel combustion per total electricity output (MtCO2/TWh)	1.0	2019		
Share of renewable energy in total primary energy supply (%)	NA	NA		

Challenge

Mali has 904 MW of grid-connected generation capacity for a population of over 19 million. While hydro, diesel, and HFO sources contribute to the current capacity, efforts are underway to diversify the energy mix. The government aims to increase solar and wind energy production to reach a 28% share by 2033.

in numbers

884 MW installed electricity-generating capacity

18.3 % access to electricity in rural population

Major challenges remain
Significant challenges remain
Challenges remain
SDG achieved
Trend information unavailable

Decreasing
Stagnating
Moderately improving
On track or maintaining SDG achievement

Food security

SDG2 - Zero Hunger			Overtime trend	
Prevalence of undernourishment (%)	10.4	2019		
Prevalence of stunting in children under 5 years of age (%)	26.4	2019		
Prevalence of wasting in children under 5 years of age (%)	9.3	2019		
Prevalence of obesity, BMI ≥ 30 (% of adult population)	8.6	2016		
Human Trophic Level (best 2-3 worst)	2.2	2017		
Cereal yield (tonnes per hectare of harvested land)	1.8	2018		
Sustainable Nitrogen Management Index (best 0-1.41 worst)	0.8	2015		
Exports of hazardous pesticides (tonnes per million population)	0.5	2019		

Challenge

Mali has untapped agricultural potential, particularly in the southern and central regions. The Niger River Authority, represented by Office du Niger, manages around 127,000 hectares of organized agricultural land, overseeing land transactions and water resources. Mali allocates approximately 12% of its national budget to agriculture and provides subsidies for cotton production. Despite investment opportunities, the sector faces challenges from unpredictable rainfall patterns and fluctuating commodity prices.

in numbers

9.8 % of prevalence of undernourishment

68 % of employment in agriculture

Water

SDG 6 - Clean Water and Sanitation			Overtime trend	
Population using at least basic drinking water services (%)	82.5	2020		
Population using at least basic sanitation services (%)	45.4	2020		
Freshwater withdrawal (% of available freshwater resources)	8.0	2018		
Anthropogenic wastewater that receives treatment (%)	0.0	2018		
Scarce water consumption embodied in imports (m3 H2O eq/capita)	305.7	2018		

Challenge

Access to safe water, sanitation, and hygiene in Mali is challenging, with insufficient water points and inadequate school toilets. Open defecation and limited water availability contribute to diseases and malnutrition, particularly among children. Despite progress in basic water coverage, population growth and climate change present ongoing obstacles. Addressing these challenges is vital for sustainable access to water and sanitation, improving health outcomes in Mali.

▼ in numbers

5926 total renewable water resources per capita (m3/inhab/year)

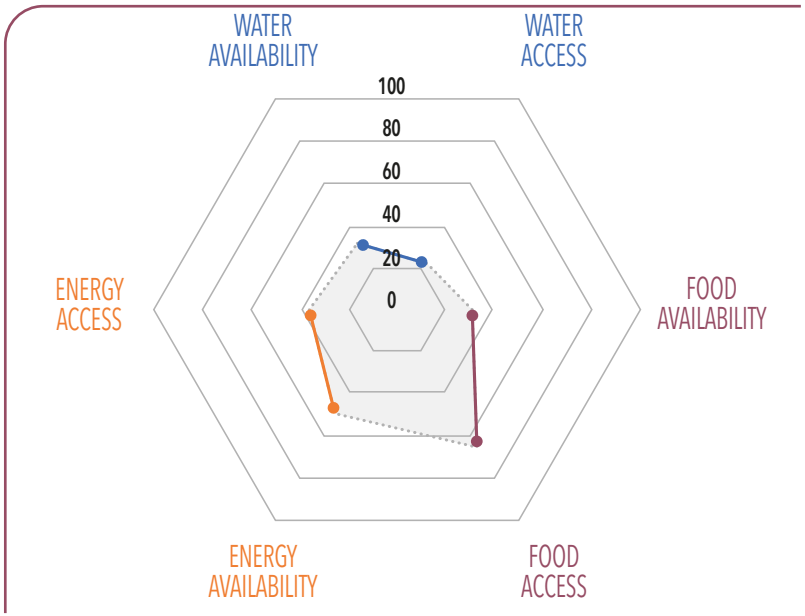
577,6 National Rainfall Index (2020)[1]

97,86 % agricultural water withdrawal as % of total (2020)

[1] NRI is defined as the national average of the total annual precipitation weighted by its long-term average.

Water-Energy-Food Nexus INDEX

The WEF Nexus Index is an inclusive metric that amalgamates 21 indicators from worldwide data repositories. The WEF Nexus Index value for Mali is 55.2, placing the nation in the 115th position for the countries worldwide. Niger has a value of 50.3 for the Water pillar, 59.1 for the Energy pillar and 56.2 for the Food pillar.



▼ in numbers

55.2 WEF index score

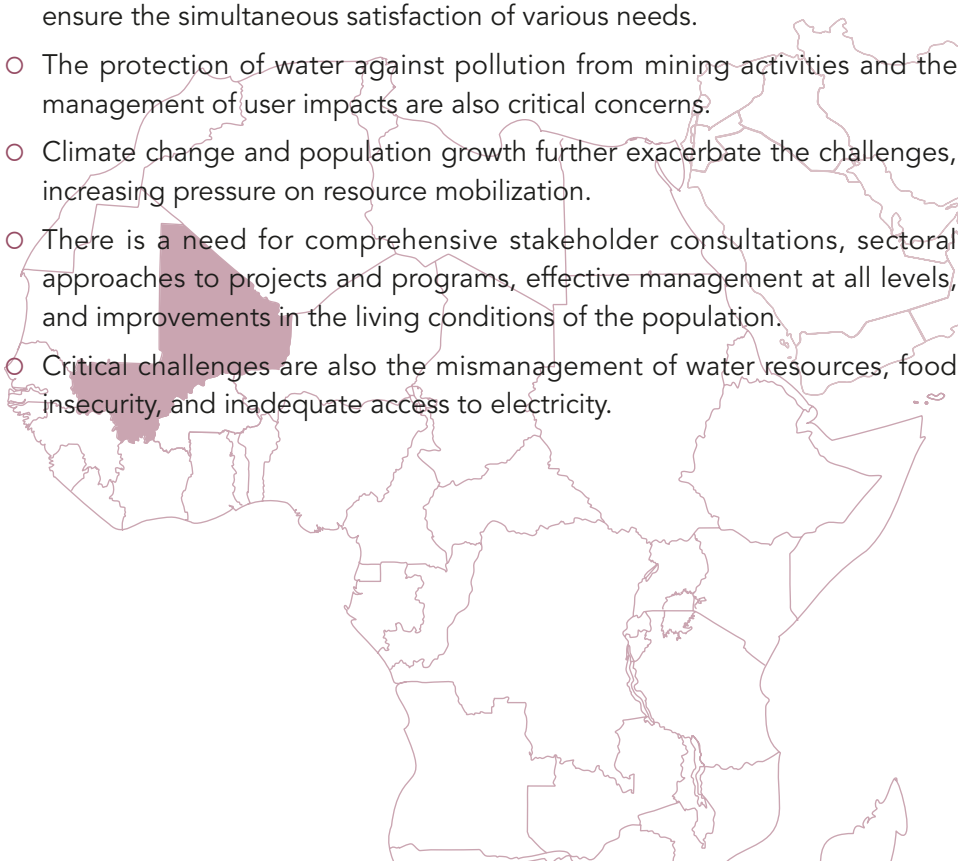
115th global rank

The way forward

Focus on public sector: understanding the local Mali context

Challenges in implementing the Water Energy Food Nexus in Mali

- The challenges faced in Mali are compounded by factors such as limited financing, internal conflicts, terrorism, unskilled labor, and frequent changes in government, which undermine trust in the system.
- One significant obstacle is the high cost associated with photovoltaic solar pumping installations, solar power plants with storage, and other investments, coupled with limited financing options.
- There is a need to effectively utilize existing resources in certain areas and ensure the simultaneous satisfaction of various needs.
- The protection of water against pollution from mining activities and the management of user impacts are also critical concerns.
- Climate change and population growth further exacerbate the challenges, increasing pressure on resource mobilization.
- There is a need for comprehensive stakeholder consultations, sectoral approaches to projects and programs, effective management at all levels, and improvements in the living conditions of the population.
- Critical challenges are also the mismanagement of water resources, food insecurity, and inadequate access to electricity.



Recommendations for a more efficient implementation of the Water Energy Food Nexus in Mali

- Continuous awareness-raising efforts, promoting the appropriation of the nexus concept and its solutions by technical services, and fostering dialogue among stakeholders are crucial steps in achieving the desired outcomes.
- To establish synergies in ongoing projects, integrate gender perspectives, and select effective water management policies.
- Enhancing green practices along riverbanks through the creation of green belts can also contribute to sustainable resource management.
- Integrating the nexus approach into the planning of bioenergy development projects/programs, optimizing water management for energy production, improving water availability for agriculture and livestock, and ensuring efficient use of drinking water are key priorities.
- Integrated water resources management (IWRM), improving living conditions, promoting renewable energy, and guaranteeing food security are essential components of sustainable development.
- Increasing stakeholder awareness and promoting the nexus concepts among policymakers are crucial for securing the necessary financial means. By fostering stakeholder engagement, improving policy design, and promoting sustainable practices, Mali can effectively address the complex challenges it faces.

General conclusions

The nine Niger Basin countries (Benin, Burkina Faso, Cameroon, Chad, Ivory Coast, Guinea, Mali, Niger, and Nigeria) share common challenges related to the water-energy-food (WEF) nexus River:

- all nine countries heavily rely on the Niger River as a critical water resource for agriculture, energy production, and various other activities.
- In the last decade the GDP growth of the nine countries has been similar or slightly above the average for the whole sub-Saharan Africa, with countries like Chad and Mali struggling to recover from the effects of the pandemic outbreak.
- a significant portion of the population in each country depends on the Niger River for their livelihoods, making the nexus issues directly impact the well-being of millions of people, as on average more than 70% of population works in the agriculture sector.
- All countries are vulnerable to the effects of climate change, such as erratic rainfall patterns, droughts, and increased temperatures, which exacerbate challenges related to water availability, energy production, and food security.
- In rural areas most countries face difficulties in access to energy; generally, less than 20% of the rural population has access to reliable energy, with the sole exception of Côte d'Ivoire above 30%.
- many countries in the region face challenges in providing safe drinking water to their populations, leading to water scarcity issues.
- the majority of the Niger Basin countries are among the poorest nations globally, which affects their capacity to invest in infrastructure and technologies to address WEF challenges adequately.

In light of these common challenges, it becomes even more relevant to highlight the differences among the nine riparian nations, as these differences jeopardize their ability to address the challenges in a coordinated manner. Due to diverse economic development and overall infrastructure, some may have better resources and capacities to address WEF challenges, while others might face more significant constraints. At the same time, different governance structures, policy frameworks, and institutional capacities make it difficult to address WEF nexus issues effectively and in a coordinated manner. Moreover, disparities exist in access to technology and finance: this has considerable impacts on the countries' ability to adopt sustainable and innovative solutions in the WEF sectors.

The survey contributes to highlight these differences and the need perceived by the public sector and by private sector young representatives to build capacities in the WEF Nexus space, ranging from financial knowledge to sector-specific technical training. Interestingly, the perception of lack of competences is well distributed and shared across the interviewees independently from their background and level of education.

Among the public sector actors, a major concern is managing water resources to achieve food security. Rainwater control is crucial to ensure crop resilience during dry seasons, especially when soil degradation already threatens production. Additionally, limited knowledge of groundwater use and storage technologies contributes to water management issues. Access to safe drinking water is also problematic in some countries.

The agri-food sector underperforms due to a weak enabling environment, lack of investments, and inadequate finance. Many countries need to import food due to insufficient production compared to the growing population. High costs and limited capacity for new technologies further exacerbate food and agriculture insecurity.

Energy is vital for water and agriculture development, but the high cost of clean technologies and lack of funding hinder farmers from adopting renewable solutions. Unreliable electricity networks disrupt food supply chains, particularly in certain climate areas.

Consequently, the silo approach and inadequate resource management planning hinder the implementation of an integrated approach.

The private sector perspective complements the survey, highlighting similar issues. Bureaucracy, lack of incentives, and tax regulations hinder young entrepreneurs from starting and managing companies. They face difficulties competing with established companies using traditional solutions.

Addressing these differences and fostering greater cooperation among the countries is essential to effectively tackle the WEF nexus challenges and achieve sustainable and resilient development for the entire Niger Basin region. By promoting shared knowledge, resources, and experiences, the countries can collectively work towards building a more secure, equitable, and sustainable future for their people and the environment.

Bibliography

African Union, Ivory Coast, 2023
AquaStat, 2020
Baitulmaal, Ivory Coast, 2023
Central Intelligence Agency, The CIA World Factbook 2020-2021, Simon and Schuster, 2020
Coulibaly, Ousmane Nafolo, Mali - Land, Climate, Energy, Agriculture and Development: A Study in the Sudano-Sahel Initiative for Regional Development, Jobs, and Food Security, 2021
Dang Mvongo, V., Blaise Mabou, P., Defo, C., Fabrice Nguema, P., Kumar Mishra, A., & Ombolo, A. (2022). Perspective Chapter: Access to Rural Water and Sanitation Services in Cameroon within the Context of Sustainable Development Goals (SDGs), 2022
Department of Commerce, USA, Mali - Country Commercial Guide, 2020
FAO, FAO in Nigeria, Overview, 2023
FAO, the state of food security and nutrition in the world, 2022
Global Food Security Index, 2022
IFAD, Chad Overview, 2021
IFAD, Ivory Coast Overview, 2022
IFAD, Policy case study - Benin: Farmers' organizations interview presidential candidates on agricultural development, 2023
International Trade Administration, Benin - Country Commercial Guide, 2023
IRENA, renewable energy market analysis - Africa and its regions, 2020
Join for Water, Benin Overview, 2023
Laya, D. and Fuglestad, Finn (2023). Niger. Encyclopedia Britannica, 2023
Medecins Sans Frontieres, Conflict in Burkina Faso: when the whole day is devoted to fetching water, 2021
Nigeria, Country Overview, USAID, Nigeria, Country Overview, 2023
Sustainable Energy for All, Guinea Overview, 2022
Ujile, Awajiogak. (2020). Evaluating water-energy-food-nexus for sustainability of healthy living in Nigeria. 21-31, 2020
UNICEF, Niger, Water, Sanitation and Hygiene, 2023
UNICEF, Water, sanitation and hygiene, Guinea, 2023
USAID, Niger, Power Africa Fact Sheet, 2023
USAID, Power Africa in Burkina Faso, 2023
USAID, Power Africa in Chad, 2021
USAID, Power Africa in Mali, 2022
USAID, Power Africa, Nigeria Overview, 2023
WaterAid, Chad Overview, 2022
Water Energy Food Nexus, Nigeria Box, 2022
WFP, Guinea Overview, 2023
World Bank, 2021
World Bank, Benin Overview, 2023
World Bank, Cameroon Overview, 2021
World Bank, Chad Overview, 2023
World Bank, Doing Business, Economy Profile Benin, 2020
World Bank, Doing Business, Economy Profile Burkina Faso, 2020
World Bank, Doing Business, Economy Profile Cameroon, 2020
World Bank, Doing Business, Economy Profile Chad, 2020
World Bank, Doing Business, Economy Profile Cote d'Ivoire, 2020
World Bank, Doing Business, Economy Profile Guinea, 2020
World Bank, Doing Business, Economy Profile Mali, 2020
World Bank, Doing Business, Economy Profile Niger, 2020
World Bank, Doing Business, Economy Profile Nigeria, 2020
World Bank, Doing Business, Region Profile Sub-Saharan Africa, 2020
World Bank, Guinea Overview, 2023
World Bank, Ivory Coast Overview, 2023
World Bank, Mali Overview, 2023
World Bank, Nigeria Overview, 2023
World Bank, Niger Overview, 2023
World Bank, The World Bank in Burkina Faso, 2023
World Food Programme, Burkina Faso, 2023
Yvan Ayuketah, Samuel Gyamfi, Felix Amankwah Diawuo, Athanasios S. Dagoumas, Power generation expansion pathways: A policy analysis of the Cameroon power system, Energy Strategy Reviews, 2022

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