Climate change in Sudan:
Review of policies and Institutional framework

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Abstract: This paper aims to overview policies and institutional framework related to climate change issues in Sudan and highlight the main barriers hindering effective climate change management in the country. Investigation of environmental policy issues in the country indicate challenges facing effective implementation of climate change policies include weakness in implementation of adaptation strategies and environmental management plans. Due to shortage of qualified staff in environmental policy issues there is a no assessment of environmental and socio-economic impacts of climate change. Another barrier is poor capacity, both institutional and individual, at the national and state levels which would require sustained strengthening to realize the benefits from the NAPA process. The lack of capacities at the institutional level, coupled with poor allocation of resources by the Government to address mitigation measures and adaptation actions makes implementation of effective climate changes policies at risk. Additional barriers include finance for adaptation and mitigation measures, proper awareness, improper institutional arrangements and policies. Technological research and knowledge sharing is also a key barrier which is usually linked to lack of funds specially funds related to climate change and health issues, which could be addressed through integration of health into other sectors of the economy. Other barriers identified are the staff retention in the health services sector and the imbalance in skills mix in the states. In addition, service conditions including wages are not attractive to retain health care professionals in health facilities across the country, especially remote locations. The paper also highlights post- covid 19 pandemic effect on different sectors in the economy in Sudan for the coming few years.

Keywords: Climate change, Sudan, Policy issues; post-covid-19

1. Introduction:

As Sudan is semi desert country is highly vulnerable to climate change due to the country's dependence on rain-fed agricultural food crops and livestock production for income and employment. The increasing dependence of Sudanese communities on environmentally vulnerable natural resources for survival has created conflict and competition over scarce resources between farmers and pastoralists. In the past few decades, Sudan has adopted a number of climate change assessment programs to better understand the range of adaptation opportunities that are available such as the assessments for the National Action Plan for Adaptation (NAPA, 2007, 2014). These efforts aimed to help clarify a number of strategies for building adaptive resilience to future climatic changes. An examination of Sudan's ecological zones reveal that the a large part of its land is vulnerable to changes in temperature and precipitation. In Sudan's agro-pastoral economy, changes in temperature and rainfall variability causes high risk to food security. The country's inherent vulnerability to rainfall pattern changes can be viewed by the fact that, food security in Sudan is mainly determined by rainfall shortage, particularly in rural areas, where more than 80% of the total

population live. The NAPA has developed a program to identify hotspots that are more vulnerable to rainfall shortage in order to identify priorities for adaptation (NAP, 2014). Climate change is expected to cause greater health risks to the people in Sudan due to the frequency and magnitude of extreme weather events such as more heat events of longer duration, floods, droughts, sand storm surges (figure 1), which causes poor air quality, and impact on drinking and recreational water quality, as well as causing food-borne diseases[1].

Sudan's Second National Communication (SNC, 2013) indicated that air temperatures have been progressively increasing over the period 1960 – 2009, with temperature increases between 0.2°C and 0.4°C per decade for the periods March – June and June – September. This implies that on average temperatures in the 2000-2009 periods are approximately between 0.8°C and 1.6°C warmer than they were in the 1960 – 1969 period. Rainfall is also becoming increasingly unpredictable and significantly decreased in the period 1981 – 2012 compared to the period 1971 – 2000[2].

Table (1): Climate change variability and its impact on Sudan regions

Event	*Occurrence*	*Vulnerable areas*	*sectors*	*Impacts*
Drought	Frequent	North & Western Sudan (North Kordofan and Darfur), Kassala State and some parts of the rain-fed areas in central Sudan.	Agriculture, livestock, water resources and health.	Loss of crops and livestock (food shortage), decline in the hydroelectric power, displacement wildfire.
Floods	Frequent	Areas within the River Nile basin and low areas from extreme South to far North. Mountain areas along Red Sea.	Agriculture, livestock, water resources and health.	Loss of life, crops, livestock; insects & plant diseases, epidemic/vector diseases, decline in hydro power; damage to infrastructure & settlement areas
Dust storms	Frequent	Central and northern parts of Sudan	Transport (aviation and land traffic)	Air and land traffic accidents and health.
Thunder - storms	Infrequent	Rain-fed areas throughout all Sudan	Aviation	Loss of lives and properties.
Heat waves	Rare	Northern, central parts of Sudan besides the Red Sea State.	Health, agriculture & livestock.	Loss of live, livestock and crops.
Wind-storms	Rare	Central and north central Sudan	Settlements and service infrastructure	Loss in lives, property; damage to infrastructure (electricity and telephone lines)

Source: NAPA, 2007

[1]Sudan: Environmental and Climate Change Assessment- Prepared for IFAD's Country Strategic Opportunities Programme 2013-2017 and Sudan National Adaptation Plan, July 2016

The most frequent climatic risks in Sudan are droughts, floods, and dust storms (figure 1), while heat waves is rare in most part of the country but frequent in red sea state (see table 1). During past three decades there has been large-scale human suffering including forced out migration from rural to urban areas in the country due to such climatic shocks. Rain-fed farmers and pastoralists are the most affected by these shocks that created disintegration of communities and disruption in their life styles. An initial step in the NAPA consultation process was to categorize the communities or sub-regions within each of the five ecological zones indicated in the table (1) to identify most vulnerable communities to climatic shocks with the purpose of preserving agricultural production potential, inhibit the spread of disease, and conserve water resources, (NAPA, 2007).

The effects of climate change on agricultural productivity have been tackled in many papers among them Deryng et al. (2016), Alam (2013), Kimball et al. (2002), Adams et al. (1998), Adams et al. (1995), Lobell and Field (2008), Lang (2007), Schlenker et al. (2006), Derner et al. (2003), Tubiello and Ewert (2003), and Fischer et al. (2002), Onour (2019). Deryng et al. (2016) and Alam (2013) indicated that increased CO2 concentrations in the atmosphere may reduce the utilization of water in crops and alleviate significantly the yield losses due to climate change; however, Alam (2013), Onour (2019), and Adams et al., (1998) states that the increasing concentration of CO2 may cause a decline in agricultural productivity and "will act as a fuel to the higher prices of goods and services in the economy." However, Blanc (2011) and Lobell and Field (2008) show that CO2 concentration has significant long-run and short-run effect on millet yield but not on cassava and maize yields and has an insignificant impact on sorghum yields.

The remaining parts of the paper include discussion on environmental policy analysis, and institutional and regulatory issues related to climate change. The final section concludes the study.

2-Policy analysis

Sudan has taken strong actions and displayed political will to minimize the risks generated by climate change to its natural resources and economy by specifying and implementing adaptation measures while engaging in low-carbon development strategies to stimulate its national economy in a sustainable manner, despite Sudan has a voluntary general obligation for adopting a low carbon development approach. As a result Sudan government ratified the United Nations Framework Convention on Climate Change UNFCCC in 1993 and Kyoto Protocol in 2005 (TNA, 2013). In response to its commitment under the UNFCCC, Sudan government prepared a number of national documents, including the Initial/first National Communication (INC). Sudan's Initial National Communication (INC) identified water resource, agriculture, and public health as most vulnerable sectors to climate variability risks. The Second National Communication (SNC) has also been prepared and submitted (2013) to UNFCCC to update the INC. The SNC (2013) designated the coastal zones in the country as increasingly vulnerable areas that needs to be taken into account in climate change adaptation policies. Furthermore Sudan submitted in 2015, its Intended Nationally Determined

Contribution (INDC) for COP21. Currently preparing its Third National Communication (TNC) program. All these processes led to the believe that effective adaptation to climate changes will be critical for protecting the country's most vulnerable populations and for maintaining long-term sustainable national development program. These concerted efforts of adapting to climate change evidenced by the completion of Sudan's National Adaptation Plan and the implementation of a series of pilot adaptation initiatives in rural communities to survey the technical and socioeconomic viability of specific adaptation plans while putting in place conducive environment for implementing NDC.

Sudan's NAP aims to integrate risks of climate change into all national development plans and reduce vulnerability to climate change, by building resilience and adaptive capacity. As such, Sudan's NAP program entails vulnerability assessment and adaptation in all Sudan's States, covering the essential development sectors, such as agriculture, water, health and coastal zones.

Sudan has conducted its Technology Needs Assessment (TNA) for adaption and mitigation in 2013, and the TNAs covers industry, forestry and energy, in addition to two priority sectors namely agriculture and water sectors. In line with this Sudan aims to adopt sectoral measures to engage in low-carbon development, guided by the long-term national development strategies , policies, and plans, which are stated in the Strategic Plan document 2007-2033. Furthermore, Sudan has also prepared a proposal for a low-carbon development strategy, its implementation is still pending depending on access to international climate funding.

3-Regulatory framework on climate change:

The Interim Constitution of Sudan has a provision under Chapter II, article 19, stating that the State of Sudan shall "promote public health and guarantee equal access and free primary health care to all citizens". Furthermore, Article 11 of the Interim Constitution also states that: "(1) The people of Sudan shall have the right to a clean and diverse environment; the State and the citizens have the duty to preserve and promote the country's biodiversity. (2) The State shall not pursue any policy, or take or permit any action, which may adversely affect the existence of any species of animal or vegetative life, their natural or adopted habitat. (3) The State shall promote, through legislation, sustainable utilization of natural resources and best practices with respect to their management".

Sudan was among the first African countries to propagate legislation concerning the management and protection of the environment since the early years of the 20th Century . Magzoub (1998) indicated that there were about 150 orders and acts and related regulations addressing environmental issues for Sudan. However, these regulations and acts have been confronted from the early beginning by challenges of legislative and institutional dualism at national, state level and local levels, as well as between the three levels of governance, and difficulties of building consistent and socially acceptable system of environmental legislation. Accordingly, the current institutional set up needs to be enhanced with more clearly specified climate change policy, as there are still major threats to climate change in Sudan, due to discontinuity of external funding corresponding to the UNFCCC obligations.

4- Institutional framework:

A key feature in the environmental governance structure in Sudan is diversity of small units linked to environmental authority but not directly linked to each other. Federal level environmental key

institutions include the Ministry of Environment, the Higher Council for Environment and Natural Resources (HCENR), and Forestry and Physical Development (MEFPD) . Other important institutions at the federal level include: the Ministry of Agriculture, the Ministry of Tourism and Wildlife, Desertification Control and Coordination Unit of the Ministry of Agriculture, and the Ministry of Industry, the Ministry of Water Resources and Electricity. The HCENR is required to play the role of management between the various government agencies and national and state government on all efforts linked to the environment and natural resource management. HCENR was established in 1992 as a government agency with a mandate of coordinating governmental efforts for adapting to climate change related issues, and organizing national policies and legislation for conservation and environmental protection, and liaising international agreements related to environmental and climate change risk exposure.

4.1: The Ministry of Environment and Physical Development (MEPD) was established in 2003 with mandate stated in the Environment Act of 2001, with the Higher Council for Environment and Natural Resource (HCENR). The MEPD mandate includes urban planning, surveying, and construction. However, MEPD is ill equipped to in terms of human resources the Department of Environmental Affairs is located within the MEPD and has only 10 staff members.

4.2: Sudan's Higher Council for Environment and Natural Resources (HCENR) is the central institution for the design of climate change instruments including the NAP. The HCENR carry out its operations through secretariat, headed by a Secretary General. Almost all activities of the HCENR are funded by donors due to the fact that the resources allocated to the HCENR and the Ministry of Environment from the Government's budget are not enough to carry out significant climate change related work . The HCENR was established in 1992 to coordinate government efforts for sustainable development. In 1995 the Ministry of Environment was established and in 2006 the HCENR membership was expanded to include 26 ministries, two representatives of universities and a representative for environmental NGOs. The revised task of the HCENR, as stated by the 2001 Environmental Act, include; coordinating efforts on natural resource management among concerned government bodies and between the federal and state governments; setting up long term plans for environmental protection and sustainable use of natural resources; intermittent review of environmental legislation to make them more effective tools for sustainable development; supporting research on environmental and natural resource management; raise environmental consciousness and education . With responsibilities that include both coordination and implementation activities, the HCENR is playing the role of lead national agency in climate change issues management in the country. The HCENR also assumes the role of encouraging state governments to set up State Environmental Councils (SECs) with mandate of practicing functions associated with environmental protection at state and local levels, guided by HCENR guidlines. At present, only five state councils are operating in North Darfur, Sinnar, Gedarif, River Nile , and Khartoum States . Although these institutions are operating at low profile level, capacity building efforts and increased funding would increase their effectiveness. At the state levels, one of the main areas of interest is setting up adaptation-focused planning institutions in each of Sudan's 18 states of the country. In each state inter-agency technical team of experts from related government agencies, and research institutions have been established. The capacities of these units have been boosted by intensive training workshops and the establishment of networks to exchange experience and knowledge.

Table 2: Evaluation of Sudan's Higher Council of Environment & Natural Resources

Institution	Strength	Weakness	Threat	Opportunity
Higher Council of Environment and Natural Resources	Climate Change Coordination Unit in Place	Enforcement of Environmental polices/laws are weak	Coordination is a must for ensuring climate financing is mobilized	Resources available from Donors and UN agencies to Climate Change activities
	In charge of coordination of climate resilience work	Lengthy Environmental Impact Assessment Approval Process	Ministry of Environment has control over the HCENR and appointment of Minster is political	Two Communications developed and NAP is in place
	Focal point for climate financing	Allocation of resources by Government for environment is low	Lack of financial assessment for climate change management	Lifting of US sanctions would make it easier to mobilize funding for Climate Change
	Mainstreaming adaptation and mitigation of climate change into development plans	Local level environment offices do not have adequate resources to meet needs	Guidelines for community based interventions may not be in place	Ministry of Finance developing guidelines for Public Private Partnerships which may entice Private Sector to invest in renewable energy

Source: Sudan National Adaptation Plan, July 2016

4.3:The Ministry of Energy and Mining

The General Administration for Environment and Safety is one of the administrative bodies of the Ministry of Energy and Mining. These bodies have the following mandates: Setting policies and strategies of environmental plans; overseeing the application of environmental laws by commercial energy companies; establishing energy information system; and assisting in environmental awareness.
A major weakness of the administration includes under-staff and low technical capacity of the existing staff hinder its effective role to carry out its mandate.

4.4: The Ministry of Water Resources and Electricity

Objectives and responsibilities include:

- Setting strategies and plans related to national water resources policies;
- Assessing, the nation needs of water resources, and its efficient utilization;
- Utilising Sudan's share of Nile Waters, and developing cooperation between Nile Basin countries;
- Exploring, and managing non-Nile water resources;
- Assessing and monitoring ground water basins;

- Mitigating and controlling the effects of floods using hydraulic structures and flood forecasting techniques.

4.5: Ministry of Health (MoH)

Ministry of health aims to provide quality health services that meets the needs of the people in the country. Such an objective is attained through putting health at the centre of the country's development policy, and using efficient utilization of resources. The National Health Insurance Fund (NHIF) which was established in 1995 is a mandatory scheme that covers to date about 1/3rd of the Sudanese population (11.8 million beneficiaries), mainly from the formal employed sector. The NHIF provides for the medical insurance needs of its members through a national insurance fund that is partially funded by its members and the rest being funded by the State. Members are categorized into "contributory" and "non-contributory". The NHIF, headquartered in Khartoum, has branches in all states. Given that the states are devolved, the NHIF varies from state to state in its operation and other characteristics. The NHIF covers over 37% of the population, but only funds 4% of the country‟s total health expenditure. As such, the level of benefits provided, the quality of services offered and the funding for the scheme is open to question.

Table (3): Other relevant institutions for climate change

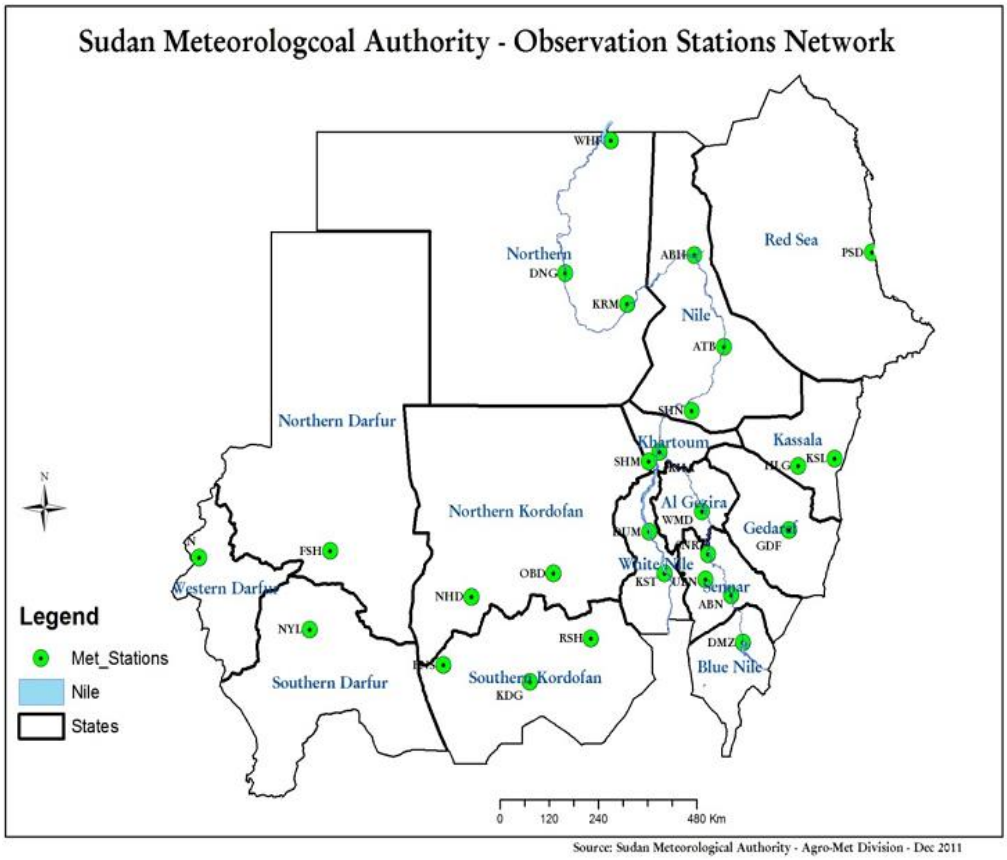
No.	Name of Ministry/Institution	No.	Name of Ministry/Institution
1	Federal Ministry of Health	9	Sudanese Metrological Authority
2	Higher Council for Environment and Natural Resources (HCENR) Ministry of Environment	10	Ministry of Agriculture
3	Ministry of Electricity, Irrigation and Water Resources (http://wre.gov.sd/en/);	11	Faculty of Agriculture, University of Khartoum
4	Sudan Farmers Union	12	Ministry of Science and Technology
5	Ministry of Foreign Affairs	113	Faculty of Forestry University of Khartoum
6	Sudanese Environmental Conservation Society;	14	Institute of Environmental Studies, University of Khartoum;
7	National Council for Strategic Planning	15	Ministry of Finance and Economic Planning
8	Ministry of International Cooperation	16	

4.6: Sudan Meteorological Authority (SMA)

Sudan Meteorological Authority has a mandate from the Government of of Sudan to observe all the meteorological activities in the country. No another institution is allowed to carry out such activities without cooperation with SMA. The role of Sudan Meteorological Authority is to provide Meteorological information and services for the safety of life, and conservation of the natural environment to ensure safety of society, growth of the economy, and poverty alleviation via sustainable development of the

economy. Currently SMA is working under very hard working situations to enhance the adequacy of the observation network (see figure below) to support key stations installed across the country through self-financed project and technical assistance to revive the silent stations in the selected states of NAPA project and the Project of Climate risk finance for sustainable and climate resilient rainfed farming and pastoral systems. SMA mandate is to watch and avail the weather information and forecast for policy issues supporting small farmers, and pastoralists as end users.

Figure 2: Meteorological stations in Sudan.



Source: Sudan metrological Agency

5: Post-Covid-19 effect:

Sudan recorded the first COVID-19 case on 15 March 2020 and, at the beginning of August, the Federal Ministry of Health had confirmed that nearly 15,000 people had contracted the virus, including over 800 who died from the disease across the country. Despite the Government, and local organizations' efforts to raise awareness of the risks associated with COVID-19 and how to prevent transmissions, as social/physical distancing and other practices have not been widely adhered to by the population. Denials, misinformation, stigma and rumours have emerged as key

challenges to the COVID-19 response, preventing positive health seeking behaviour in the affected populations. The COVID-19 pandemic comes against a backdrop of increasing humanitarian needs, as communities grapple with multiple and simultaneous shocks. The ongoing economic crisis, years of internal political conflicts, recurring droughts and floods, and disease outbreaks continue to lead to displacement, high levels of food insecurity and malnutrition that affect the lives and livelihoods of many Sudanese people. The necessary COVID-19 containment measures adopted by the Ministry of Health will exacerbate the economic crisis as Sudan's health system was under extreme stress prior to the pandemic and has been further stretched in an effort to contain, prevent, and treat COVID-19.

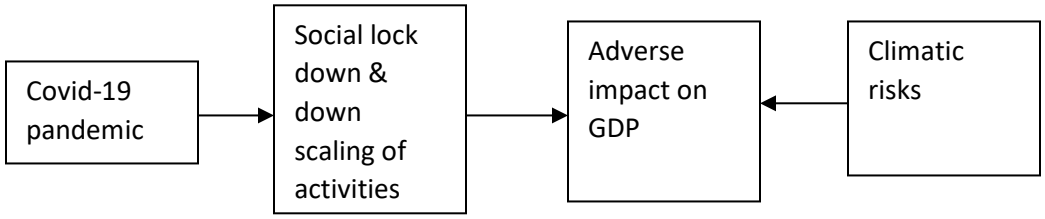
FAO (2021) estimates that the COVID-19 in Sudan and related containment measures are adversely impacting on all four dimensions of food security: availability, access, utilization and stability. Availability is affected due to labour shortage in the farms plus shortage due to lack/increased cost of transportation of items while access to food will be challenged as many micro-enterprises and small informal businesses are restricted or curtailed, causing loss of income sources that enable vulnerable people to purchase basic commodities. With limited access of food availability, poor families will resort to low quality and less quantity of food which will cause under nutrition. Sudan's Food Security Technical Secretariat (FSTS) already projected that the consumption patterns will be shifted towards low quality food which will increase malnutrition. Restrictions and interruptions in the flow of goods and services that ensure the pandemic containment is expected to have a significant impact on food security situation in the country for the coming two years. As a result, families in rural areas also expected to resort to livelihood-based coping strategies including sale of productive assets or animals, thus depleting their assets. According to WFP, majority of households already spend more than 75 per cent of their expenditure on food, limiting their ability to create or invest in livelihood assets. Safely managed water, sanitation, and hygiene services are an essential part of slowing the spread of COVID-19 in Sudan but this is being challenged by the limited resources and access. According to the Joint Monitoring Programme for Water Supply, Sanitation and Hygiene, only 20 per cent of people in Sudan have regular access to basic hygiene services (soap and clean water).

The vulnerable and poor whose income and livelihoods heavily depend on a daily wage, especially people living in urban, will also be affected by containment measures and risk of not being able to provide basic food needs to their families. The vulnerable and poor households whose income and livelihoods depend mainly on informal economic activities and daily wage are already struggling to provide meals for their families. Domestic trade disruptions are expected to create unstable food market prices as already witnessed by the increase in prices of basic goods in major urban centers.

The agriculture sector will be negatively impacted; fuel scarcity and increased transportation costs exacerbated by containment measures have also led to an increase in the price of food and agricultural inputs. Transportation blockages or interruptions will disrupt the distribution of inputs like animal feed, some farmers may encounter shortages in labour and farming inputs and may experience difficulties in deliveries which could also affect domestic and regional supply chains.

In summary, the COVID-19 pandemic has had an unprecedented social and economic impact on Sudan, including increased prices of basic foods, rising unemployment, and falling exports (figure 3). The crisis has also highlighted the importance of safe water, sanitation, and hygiene practices, which remain inadequate. The outbreak is anticipated to further challenge the county's public health preparedness and response systems and adversely impact the economy.

Figure (3): Covid-19 pandemic impact



5: Concluding remarks:

From the outline of the regulatory and institutional frame associated with climate change we can deduce the main barriers to effective adaptation action in Sudan as follows.

Climate change directives and policies are not well incorporated in the national policy and planning systems. This is mainly because of weakness and limitations of the national management of climate change and data processing system. There have been limited efforts to raise awareness and understanding of climate change risks. As government institutions related to climate change are vulnerable to political instability in the country policies and strategies related to environment issues, do not effectively incorporate Multilateral Environment Agreements such as UNFCCC.

At the institutional level, weakness in implementation of adaptation strategies and environmental management plans have hindered effective climate change management. Due to shortage of qualified staff in environmental policy issues there is a no assessment of environmental and socio-economic impacts of climate change.

A sustained process of awareness building among policymakers regarding climate-related risks would need to be undertaken to ensure solid political will and commitment to adaptation measures. Another barrier is poor capacity, both institutional and individual, at the national and state levels which would require sustained strengthening to realize the benefits from the NAPA process. The NCSA Report as well as the NAP, both delineate the capacity gaps that exist at the institutional level at the HCENR which is the agency that oversees climate change adaptation and mitigation efforts. The various instruments, documents and studies that were developed under the auspices of the HCENR were funded by different donors including the UN. Capacities to formulate these different documents were outsourced to individual national and international experts either directly or through funded projects. In these projects the role of the HCENR is usually supervisory or logistical in nature. However, the Head of the Climate Change Unit within the HCENR is the main key technical staff that participates in the discussions related to the formulation of projects as well as other relevant activities. The lack of capacities at the institutional level,

coupled with poor allocation of resources by the Government to address mitigation measures and adaptation actions makes the HCENR dependent entirely on donor assistance to address the various obligations, requirements and projects implemented as part of the MEAs which Sudan is signatory to.

At the local level, Government related climate change mitigation and adaptation measures are entrusted to line ministries which varies from State to another. In some cases, the line ministry may be the State Ministry of Environment, in others it may be the Ministry of Agriculture or other relevant Ministry. The staff in charge of activities related to climate change discharge their functions mostly through committees formed by the Ministry or through ad hoc committees formed through the projects which are at the central level. All this work is guided through the HCENR. The capacities of these staff are modest and they usually receive training or orientation to carry out the assignments directed through the relevant projects or through the State Ministry usually through central guidance by the HCENR.

Shortage of funds both at the national and international levels hindered the implementation of key measures identified in the Sudan NAPA. Majority of the people in the country are affected by extreme poverty and poor health conditions, making them more vulnerable to climate change.

Additional barriers include finance for adaptation and mitigation measures, proper awareness, improper institutional arrangements and policies. Technological research and knowledge sharing is also a key barrier which is usually linked to lack of funds specially funds related to climate change and health issues, which could be addressed through integration of health into other sectors of the economy. Other barriers identified are the staff retention in the health services sector and the imbalance in skills mix in the states. In addition, service conditions including wages are not attractive to retain health care professionals in health facilities across the country, especially remote locations.

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