Synthesis Paper

Governance of Climate Change in Yemen

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1. Introduction

As a Least Developed Country (LDC), Yemen is highly vulnerable to climate change-related impacts because of its fragile socio-economic development and inadequate adaptive capacity. The potential impact of climate change on the development of Yemen is expected to make the current sustainability challenges further complicated. Rural livelihoods are expected to decline due to decreasing water access and agriculture productivity, severe natural disasters including for instance floods and associated asset destruction. As an LDC, Yemen has only very limited capacities including weak governance structures while experiencing tremendous development challenges compounded by potential climate change associated impacts. This article aims at exploring governance contexts in general and local institutions in particular via climate change adaptation in Yemen.

In addition, the potential roles through which local institutions could cope with and adapt to climate change associated impacts in a cost-effective manner will be highlighted. The majority of the population in Yemen is living in rural areas- (about 75 percent), whereas the minority- about 25 percent in urban cities. To put local governance into contextual perspective, rural and urban dimensions will be considered for facilitating the organization of discussion of this paper. This paper will additionally highlight the present state of local governance via climate change adaptation in urban cities of Yemen, and how it is being (or not being) interpreted and implemented in Yemen. In general, this article will focus on governance and climate change adaptation as a priority for Yemen being and LDC country. Also, the paper tries to answer a question of whether climate change adaptation is present within the local governance frameworks in Yemen.

Consequently, the paper will seek to explore insightful policy implications which would contribute towards outlining the way forward through placing greater emphasis on enabled local governance frameworks (i.e. institutions and mainstreaming tools, etcetera) for enhanced climate change adaptation in Yemen. The synthesis paper has reviewed relevant national strategies, technical assessments and reports (i.e. the various reports, and studies produced with support from UNDP, GEF, World Bank, among others) such as various thematic studies on vulnerability and adaptation to climate change across pilot areas including coastal cities in Yemen.

This synthesis paper has therefore established a thorough argument for presenting structured and critical concluding policy implications and recommendations. Structurally, this paper is composed of seven sections: First, Introduction; Second, Socio-economic, and eco-climatic settings of Yemen; Third, National climate change policy framework; Forth, Climate change projects and potential impacts in Yemen; Fifth; Governance barriers and climate change in Yemen; Sixth, Institutional framework and climate change in Yemen; and Seventh, Policy implications, recommendations, and conclusion.

2. Socio-economic, and eco-climatic settings of Yemen

Yemen is an arid Middle Eastern country, occupying an area of about 527,970 square kilometers at the southern end of the Arabian Peninsula. In 2009, Yemeni total population reached about 22.5 million, of which about 75 percent are in the rural areas. The annual population growth rate of Yemen is about 3 percent which puts much pressure to the limited basic infrastructure and services such as water, education, health and access roads. The
economy is dominated by the oil sector, which accounts for about 27 percent of the Gross Domestic Product (GDP) and more than about 70 percent of export Government revenues.

Agriculture sector in Yemen is labeled as traditional one. It mainly depends on primitive methods and rain steams which make it vulnerable to extreme climate changes such as draught and floods. The sector also faces various challenges the most important of all is the scarcity of water resources. It absorbs almost 50 percent of the work force and accounts for 11.4 percent of GDP (current prices) in the average during the period 2001-08. Rainfall varies widely across the country, from less than 50 mm along the coast, and rising with the topography to between 500 and 800 mm in the Western Highlands, and dropping again to below 50 mm in the desert interior.

The water sector in Yemen faces formidable challenges, and water table is declining in average by about 6-7 meters annually due to groundwater over-abstraction. The capital Sana’a is one of top ten water scarce cities in the word and its groundwater is being drastically depleted. The increasingly growing water crisis in Yemen has severe socio-economic and environmental consequences including decreased agriculture productivity, reduced food security, increased conflict over resources and accelerated land degradation, and increased livelihood vulnerability. With the current weak adaptive and institutional capacity, climate change associated impacts including more frequent, and prolonged droughts under specific climatic sceneries will push livelihood vulnerability of the poor into further declines, leading to further environmental resource degradation, increased ecological scarcities, and hardship, and hence increased poverty expansion.

Geographically, Yemen in general is characterized by five major ecological systems, as follows: Hot and humid coastal plain; Temperate Highlands; High Plateaus; Desert interior; and Islands. Some of Yemen’s ecological zones are confined to small areas (e.g., islands), with human communities, flora and fauna highly adapted to subsist within them. Other zones are much larger (e.g., Temperate Highlands) and support the majority of the country’s agricultural production. In both cases, climate change poses major threats.

3. National climate change policy framework in Yemen

Yemen has been party to the UN Framework Convention on Climate Change (UNFCCC) since 1996, and to the Kyoto Protocol since 2008 as non-Annex I Party. The Environmental Protection Authority is the national focal point for the implementation of the UNFCCC Convention and Kyoto protocol. To meet its commitments under the Convention, Yemen has initiated a process to establishing legislation, institutional and policy frameworks in order to fulfill the requirements of the Convention and the Protocol with support from international development partners including UNDP, GEF, World Bank, and Netherland.

In general, the environmental regulatory and policy frameworks have been developed in Yemen. For instance, the environmental policy including the National Environmental Action Plan (NEAP), and the National Strategy for Environmental Sustainability (NSES) specify the major environmental concerns and highlights constrains which includes capacity building of institutions to actively implement climate protection policies and meet the obligations of international agreements such as UNFCCC. Under the Kyoto Protocol, the Clean Development Mechanism (CDM) has been institutionalized. Also, Yemen has established the Inter-Ministerial Committee for
Climate Change (IMCCC) in 2009 to strengthen institutional coordination capacity, and enhance climate change political leadership in the country. The IMCCC is supported by a Technical Committee which is composed of related agencies representatives to provide technical support for enhancing the decision-making process on climate change agenda in Yemen.

Yemen has also developed short- and long-term policy frameworks for climate change mitigation and adaptation under its UNFCCC commitments. Yemen’s Initial National Communication (INC 2001), National Adaptation Programme of Action (NAPA 2008), and Yemen’s Second National Communication (SNC 2011) have been developed. National communications to the UNFCCC provides update on national Greenhouse Gases (GHG) inventory, sketches out emission sceneries and proposes frameworks for national long-term mitigation, and adaptation strategies. On the other hand, short-term adaptation strategies were under NAPA in which the vulnerability of Yemen to climate change has been highlighted, and three key most vulnerable sectors including water resources, agriculture and coastal zone are outlined.

Notably, NAPA in 2008 has proposed urgent pilot adaptation measures for the aforementioned top three vulnerable sectors. However, yet only very limited interventions have been implemented due to lack of adequate insititutional capacity, as well as resource limitations. The INC, and SNC have carried out pilot vulnerability and adaptation (V&A) assessment for agriculture, water, and fishery across a number of Govenrnerates including the costal vulnerability to sea-level-rise (SLR) for two major cities of Aden and Al-Hodiedah. However, there is a still tremendous climate change V&A knowledge gap which requires further study and analysis. As for agriculture, about 5 main rain-fed crops including Wheat and Sorghum were the focus of the SNC V&A studies across only about six pilot areas in Yemen. But yet, generalizing adaptation recommendations may not be feasible due to the diverse climatic, and topographic, and the socio-economic settings of the country. Additionally, possible SLR of the two major coastal cities of Al-Hodeida, and Aden were assesses by the INC, and SNC studies respectively. However, the 2000 KM costal line of the country is not identical and proper assessments, and locality-based planning is essential to ensure cost-effective adaptation.

In nutshell, taking the diverse geographic, and eco-climatic as well as socio-economic contexts in Yemen into account, locality-specific adaptation planing is quite relevant. Following this understanding, national shoreline topography mapping is essential for cost-effective national-wide costal spatial land-use planning under changing climate, and hence contributes towards improving the Governance systems vis-à-vis climate change in Yemen. National shoreline Topography Mapping is essential for assessing the entire coastal SLR vulnerability in Yemen. It will facilitate analysis of the topographic locality-specific costal vulnerability of coastal line and hence allowing for drawing cost-effective, location-specific adaptation strategies. Potential impacts of climate change on the health sector is critically urgent due to outbreak of emerging serious disease which used to be unknown across the country. As such, exapnading the scope of the V&A studies to include new sectors, emerging thematic issues across the different eco-climatic, topgraphic, and localities as well as socio-economic rural-urban settings is necessarily critical to ensure cost-effective area- as well as eco-climatic based spatial land-use planning under changing climate, and therfore contributes towards enhancing the Governance systems vis-à-vis climate change in Yemen.
For the time being, NAPA serves as Yemen’s national climate change policy framework which outlines priority and urgent adaptation needs to climate change. However, as one of nine pilot countries under the Pilot Program for Climate Resilience (PPCR), Yemen is being supported undertake scaled-up climate action and transformational change by integrating climate resilience in their national development planning. The PPCR helps countries build on their NAPAs and helps fund public and private sector investments identified in climate resilient development plans. The PPCR is expected to provide Yemen with an opportunity to further understand climate change, and prepare a road map for climate resilience to be mainstreamed into development planning, while showcasing transformation changes at the institutional and sector levels through the implementation of key pilots. Additionally, climate change was mainstreamed into key developmental and sectoral polices including agriculture, and fisheries. The fourth National Plan for Development and Poverty Reduction (DPPR) recognizes climate change as a major threat. As reported in NAPA (2008), proper measures to address climate change associated potential impacts would necessarily entail enhanced governance including institutional coordination, community participation, and transparent and accountable policy and decision making processes for the vulnerable sectors, and the poor in rural areas.

4. Climate change projections and potential impacts in Yemen

As indicated earlier, several studies were conducted to assess the impacts of climate change in Yemen, among which: Yemen’s Initial National Communication (INC 2001); National Adaptation Programme of Action (NAPA 2008); Yemen’s Second National Communication (a draft SNC 2012); and Assessing the Impact of Climate Change and Variability on the Water and Agriculture Sectors (2010). As indicated earlier, it worth-mentioning that Yemen is distinguished by five major land and eco-climatic systems in addition to the different socio-economic rural-urban settings, and geographical and topographical characteristics, and localities across the various governorates, and districts of the country. Each and every specific locality would probably have its own locality specific adaptation needs. However, it can be noted that each of the aforementioned studies has only covered a limited number of sectors through scattered and selected pilot areas. Different areas have not been covered, and new emerging climate change associated impacts including spread of diseases such as Dengue have not yet been explored In addition, these studies have only provided a generic outlook rather than location-specific information which sounds to have very low applicability across the diverse geographic, topographic landscapes of the country.

On the other hand, climate change projections and predictability at national and local levels is relatively weak in Yemen due to lack of capacity in climate analysis, interpretation, and downscaling. In general, climate change projections usually uncertain due to reliance on global GHG emission scenarios which tends to be uncertain too. Scenarios are essential for evaluating possible futures but they do not represent conditions that will actually occur. Understanding uncertainty implications under the different possible climate scenarios is important for cost-effective adaptation planning across the different geographical and topographical landscapes in Yemen.

Further downscaling modeling and analysis is critical to provide further information on future climate scenarios across the different geographical and topographical landscapes, and localities as well as socio-economic rural-urban settings, governorates, and districts of the country. This sound to be essential to enable Yemen ensures that adequate decision support is provided for designing locality-specific informed coping and climate resilient strategies. Yet, it is recognized that such capacity in climate analysis may not be easily realized in the short and
medium terms as certainly requires long term efforts. Nevertheless, conditions similar to the scenarios are possible, and as such they should be used to explore possible adaptive measures. For instance, NAPA and SNC, and piloted thematic vulnerability and adaption (V&A) studies can provide insights on this regard when it comes to localities with generic similarities compared to those of the pilot areas.

Counting on the current climate change projections indicate that Yemen is anticipated to experience steadily rise in temperatures, and an increase in variability of rainfall and in heavy precipitation events. In recent decades, Yemen rainfall patterns have shown increasing extremes. For instance, rainfall has decreased considerably leading to major agricultural losses, losses of animals and water shortages. On the other hand, flooding was clearly observed in 1996 and during the period 2005-2008. According to the World Bank’s study (2010), three climate change scenarios in Yemen are projected illustrating the range of possibilities up to 2080. The three scenarios are as follows:

- A “hot and dry” scenario of higher warming of 2 to 4.5 °C, with aridity dramatically increased due to the combined effects of low rainfall and high ET.
- A “mid” scenario, with considerable warming of 1.6 to 3.1 °C over the twenty first century but no significant change in rainfall.
- A “warm and wet” scenario with lower warming of 1 to 1.6 °C and an increase in rainfall.

Under warmer climate, these features are likely to be further aggravated. In addition to the likelihood that rainfall may decrease over much of Yemen, the timing of rainfall, the intensity of individual storms, the delay between falls and the frequency of inter-annual variability may all change. Rainfall changes will be accompanied by changes in the intensity of wind and frequency of high temperatures and changed cloudiness.

5. Governance barriers and climate change in Yemen

According to NAPA, NCSA, INC, SNC, and NSES, several barriers of various types (i.e. technical, economic, financial and institutional) across various levels (i.e. national policymaking, and local and implementation levels have been as constrains for implementation climate change adaptation in Yemen which includes following:

- Weak institutional structures
- Lack of access to climate information
- Uncertainties in regional, local climate change scenarios, and socio-economic scenarios;
- Low awareness for policy- and decision makers regarding climate change;
- Inadequate institutional, technical and financial capacity to develop, modify, or interpret existing models and methodologies, lack of financial sources to implement the adaptation measures;
- Poverty and livelihood vulnerability including lack of access to proper infrastructure, and services such as water, sanitation, education, roads, health, and finance.
- Limited capacity to formulate and plan climate change issues.
- Limited Climate Change related Research.
- Inadequate capacity to plan and adapt against the negative impact of climate change.
- Lack of funding for implementing climate change Programs.
6. Institutional framework and climate change in Yemen

Although EPA is the focal point for implementation of the UNFCC in Yemen, climate change should not only be perceived as an environmental issue but rather a development matter. Different institutions and line ministries, and their respective agencies should be engaged and proper coordination among them should be established. As indicated earlier, Yemen has established the IMCCC to strengthen the coordination actions and enhance the political leadership on national climate change agenda. However, the involved ministries yet lack adequate institutional, technical capacities to coordinate, plan, and implement climate change projects. In addition, the current quite limited institutional, and technical capacities of line ministries, and affiliated technical agencies impedes conducting deeper V&A studies, and implement proper locality-specific adaptation measures. Among others, lack of financial resources, decisions-support systems, technical expertise, mainstreaming tools including spatial, and land-use planning for carrying out, and implementing cost-effective adaptation across the country in general and the most vulnerable in particular.

On the other hand, local communities in general, and the those who are highly prone to climate change associated impacts such as floods in particular usually lack access to services including water, sanitation, health, education, finance and information. Climate change is expected to add formidable challenge to their livelihoods sustainability. Lack of access to climate information including early warning systems, and relatively weak community participation and organization increase the vulnerability of those local communities including those live along disaster prone area including for instance low-lying coastal areas (i.e. vulnerable to inundation by possible SLR in some parts of Aden city, and Al-Hodeida), as well as communities living across Wadie, and even flood stream areas (i.e. sizeable number of urban, and rural communities across several governorate including Sana’a, Taiz, and Hadhramout).

As indicated earlier, there are limitations including access to climatic information; climate data in Yemen are poor and erratic, and only useful for building a general picture of the resource balance. The current meteorological records in Yemen are weak. Given the uncertainty over climate models, early warning systems, together with improved data collection and sharing, public awareness and stakeholder involvement are among the key local preparedness measures to adapt to climate change. Therefore, adequate local capacity will be essential for developing sufficient climate monitoring and analysis through targeted training and setup of appropriate meteorological station across the country. Community preparedness and access to climate information will be enhanced through development of a community-based early warning system in coordination with relevant agencies. Such systems will empower the local communities across the piloted areas in generating valuable climate information that assist raising their awareness about the livelihood hazards and risks associated with changing climate besides enhancing preparedness to cope with and adapt to such hazards which include for instance farmers to adapt their farming practices accordingly.

In general, access to climatic information is essential, enables cost-effective spatial land-use adaptation planning under changing climate, and allows local communities to proactively engage in coping with and adapting to the associated impacts. As far as this paper is concerned- it can be concluded that the current national and local
governance structures and institutional frameworks via climate change agenda in Yemen is still among the key and plausibly the foremost contextual constraint for cost-effective adaptation planning across the country.

Failing to do so, the cost of climate change impacts (i.e. potential biophysical, and socio-economic impacts including natural hazards and environmental degradation, hardship and scarcities, loss of lives, assets, and infrastructure damage) would be extremely expensive under certain climatic scenarios, and plausibly may go beyond the current quite limited capacities of an LDC county with weak governance systems, as well as fragile socio-economic and environmental settings. The potential loss of lives, assets, and infrastructure damage under certain climatic scenarios with relatively inadequate adaptive actions compared to proactive adaptation planning. Altogether, access to climatic information is essential, enables cost-effective spatial land-use adaptation planning under changing climate, and allows for engaging proactively in coping with and adapting to the associated impacts.

7. **Policy implication, recommendation, and conclusions**

7.1 **Policy implications and recommendations**

1. Based on the aforementioned findings including the diverse socio-economic, geographical, and eco-climatic contexts of the country imply that locality-specific adaptation planning is relevant and hence may provide cost-effective spatial land-use adaptation planning under changing climate. Therefore, this paper recommends locality-specific adaptation planning for enhancing the adaptive capacity of the current weak governance systems in Yemen with respects to climate change adaptation.

2. In addition, weak institutional frameworks compounded by poverty, poor community participation, lack of access to basic services, and proper infrastructure, and fragile social settings imply community preparedness including climatic information is essential for reducing livelihood vulnerability to climate change associated impact across rural areas in general and disaster prone settlements in particular. Therefore, this paper recommends community-based preparedness strategies to enable cost-effective spatial land-use adaptation planning under changing climate, and allows local communities to proactively engage in coping with and adapting to the associated impacts, and eventually enhances institutional adaptive capacity at the local level to cope with and adapt to changing climate in Yemen.

7.2 **Conclusion**

This paper found that governance related barriers of various types including institutional, and across various levels including national as well as local has likely constrained Yemen to peruse cost-effective climate change planning and adaptation. Therefore, this paper firmly confirms that the current national and local governance structures and institutional frameworks via climate change agenda in Yemen is still among the key and plausibly the foremost contextual constraint for cost-effective adaptation planning across the country.
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