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Working Paper

Can Nationally Determined Contributions (NDCs) enhance Agricultural Risk Management policies in sub-Saharan Countries?

National Determined Contributions linked ARM

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Abstract

Following the Paris agreement on climate change in December 2015, the signatory countries have proposed their national Climate Plans called Nationally Determined Contributions (NDCs) to mitigate future changes in climate and adapt to their consequences. These NDCs can be an opportunity to mainstream agricultural risk management (ARM) policies that respond to the new risk and uncertainty environment created by Climate Change. A review of the NDCs of the nine sub-Saharan countries that work with the Platform for Agricultural Risk Management (PARM) highlights that many climate adaptation strategies proposed respond to agricultural risk management needs: climate smart agricultural practices, enhancement of information systems and capacity building, access to finance and markets, improved pest control, and better early warning and humanitarian plans, are some of the measures proposed in their adaptation plans. Countries climate plans are called to have international financial and technical support. Some international institutions like PARM are investing on agricultural risk assessment and management capacities in developing countries as a means to reduce leverage investment and resilient livelihoods. Proposed risk management tools, if aligned with NDCs, can also contribute to successful adaptation policies.

1. Introduction

Since 1995, the reports from International Panel on Climate Change (IPCC) have found evidence that drought has increased in frequency in sub-Saharan Africa over the past few decades due to the increase in rainfall variability. The average global temperature on earth has followed an increasing trend during the last three decades caused by greenhouse gas emissions, stocking heat in the earth's atmosphere that affects ecosystem, including oceans, weather, snow and ice. Mitigation actions are undertaken by countries to reduce and limit the greenhouse gas emissions. However, on regional scales there is clear evidence of changes in some extremes and climate variability indicators (IPCC, 1995). The global climate change increases farmers' exposure to natural disaster risks affecting their productivity and increase their probability to be hit by food insecurity. A sustainable agricultural risk management strategy is important to reduce and limit the impact of adverse climate change on farmers and boost their opportunities to invest in their livelihoods.

While sub-Saharan countries are small contributors of the total greenhouse gas emissions (7% , according to the Center for Global Development in 2015), they are more vulnerable to the impact of climate change because they have limited financial and technical capacity to manage the consequences of extreme events. The Paris Climate Agreement moved forward the Climate Change agenda beyond mitigation, including specific commitments on adaptation strategies. The adaptation is also linked to natural hazard management and disaster risk reduction. The insertion of the adaptive component on the UNFCCC offers to developing countries means and opportunity to assess their risks and identify the right management strategies.

Some institutions are working to enhance agricultural risk management tools and strategies in Africa. For example, PARM is a program supporting 9 sub-Saharan African countries to make ARM an integral part of policy planning. Its interventions cover the following countries: Cabo Verde, Cameroon, Ethiopia, Liberia, Mozambique, Niger, Senegal, Uganda and Zambia. ARM can help those countries to consolidate and facilitate their adaptation plan. This document reviews the Nationally Determined Contributions (NDCs) of these countries and identifies significant ARM measures that are part of Climate Plans.

The paper focus on the opportunity that the Paris agreement and the related NDCs can enhance the management of agricultural risks as part of the Global 2030 Agenda. ARM strategies will reduce farmers' exposure and vulnerability to climate change and empower them to manage their risks and invest in their future. The goal of the agreement was to put in place systems that facilitate global emissions reductions by providing incentives for as many countries as possible to join and finalize a binding global climate emission agreement, and to promote adaptation strategies. The financial mobilisation facilitates synergies by all actors, including climate experts, institutions, government and private sectors to build a sustainable agricultural system. This document is laid out as follows: in section 2, we discuss the context of the COP21 and NDC implication. In section 3, we identify mitigation strategies of NDCs related to agriculture, while section 4 identifies the adaptation strategies under which a lot of risk management strategies are proposed. We finish by the financial component and a conclusions section.

2. COP 21 and NDCs

The UNFCCC, an international environmental treaty, was established by Nations in 1992 in Rio to stabilize greenhouse gas concentrations in the atmosphere to a level that would not deteriorate the ecosystem. The nations meet annually during the COP to discuss and provide solutions to climate change since 1995. The framework proposes a negotiation system to limit countries' emission but does not contain any enforcement mechanism.

Climate negotiations are long and often fail to achieve commitments to reduce greenhouse gas emission. However, during the 21st COP in Paris from November 30 to December 11, 2015, 197 countries successfully discussed and agreed on responding to the threat of climate change by 3 means. First, the mitigation actions aiming to achieve the long-term temperature goal of reducing the increase in global average temperature bellow 2°C and limit the increase of temperature to 1.5° C above the pre-industrial level. Second, protection of food production by the adaptation to adverse climate change and new risk environment, with climate resilient agriculture. Finally, making finance flows to develop and support related mitigation and adaptation actions. The protocol entered into force on 04 November 2016.

Countries have announced the actions they intend to undertake from 2020 to reduce the risk and impact of climate change. In additional they investigate on the possibility to adapt to climate change impact. Countries will voluntarily join the Paris Agreement by finalising their national climate plan and submitting the approval of the NDC to the UNFCCC from 22 April 2016 to 21 April 2017. The NDCs will require a regular submission of national emissions inventories and report on their progress. It will be revised every 5 years.

3. Mitigation actions

The greenhouse gases emissions are stocking more heat in the earth's atmosphere, which is causing average temperatures to rise all over the world. The mitigation actions will focus to reduce the greenhouse gas emission. Human activity impacts the ecosystem through different sectors and channels: energy, industry, transportation, the deforestation and bad waste management. In terms of mitigation actions related to agriculture the main focus

is on the protection of the forest and the use of smart agricultural technics to reduce gas emissions (Table 1). Countries intend to tackle mitigate the causes of the climate change by a more appropriate and sustainable use of the land.

Forests have been destroyed for many causes: fuel production, land for farming and urbanisation, industry, cattle ranching, etc. The deforestation is the second largest contributor to climate change after the burning of fossil fuels. It has impact on climate change through the releasement of the store of carbon and the decrease in global vapor flows (A. Bradford,2015). Many actions have been proposed regarding the forestry in the NDCs of sub-Saharan countries. Indeed, parties promote the forest management through afforestation and reforestation system by planting trees. Also, they seek to protect forests by limiting and transforming the industry that use forest derivative as input to use renewal and sustainable source. As an example, the development of cook stove that use firewood, charcoal, palm oil to new equipment based on electric, gas and biomass ethanol system.

While agriculture is not a big contributor of greenhouse gas emission, it is important as well to use smart agricultural system not only to adapt to the new climate but also to reduce emissions and pollution. The parties focus on the conservation practice of land and a sustainable land management. They also prevent farmers from the use of brush fire or others agriculture technique that have consequences on the environment. The agroforestry practice presents adaptation and mitigation actions because it presents a good strategy to preserve the environment and biodiversity, save energy and increase crop yield. In additional the agricultural waste management and transformation is a good initiative and strategy to reuse the waste for manure or animal breed.

The mitigation actions are a step ahead to adaptation. If efforts are not maintained to limit and reduce the greenhouse gases emission, the world will become warmer and warmer and that will affect dramatically the ecosystem and all natural processes. The occurrence of extreme events could become so frequent and damaging that it will not be possible to manage. Adaptation and mitigation can complement each other and together can significantly reduce the risks of climate change. So, mitigation is required for adaptation to be efficient.

Table 1 : Mitigation Strategies related to agriculture and Forestry in 9 African countries

Mitigation sectors	Cabo Verde	Cameroon	Ethiopia	Liberia	Mozambique	Niger	Senegal	Uganda	Zambia
Forestry	. New afforestation or reforestation system by a planting effort of 400 trees per hectare to reach 20,000 ha until 2030 .Elimination of trees stone cooking stove by 2025 . Improvement of forestry governance by investing in inventory and land registry systems and preparing long-term sustainable land management plans . Economic Transformation Strategy proposes the sustainable management of resources and the development of agroforestry and the participatory management of forest	. Sustainable management and valorisation of forest and biodiversity through special land monitoring . Rehabilitation of degraded land and reforestation of savanna . Integrate sectors of activities on agriculture, agroforest for private and common plantation . Reduce wood consumption by promoting gas and improved fireplace	. Protect and re-establish forests for their economic and ecosystem services	. Replace cooking stoves that use firewood, charcoal and palm oil with low thermal efficiency . Increase the amount of forested land through reforestation of degraded lands	. Reduce soil degradation and promote mechanisms for the planting of trees for local use . land use change and forestry actions	. Limit deforestation and sustainable management of forest: 2,220,000 ha . Improve cook stove, promote gas used and Reduce wood energy demand . Promote private forestry and assisted natural regeneration . Restoration of agricultural/forestry/pastoral lands planting multiuse of species and Moringa oleifera . Increase resilience of ecosystem and household by sustainable land management	. Reduce cooking stoves that use firewood and charcoal by diversification of household fuel . Protections of existed forest and management of 20 forests par year during 5 years . Reduce deforestation by 25% from 2023 and promote reforestation of 200 thousand ha par year . Reduction of 30% of burned areas by 2020 and 90% by 2025	. Promote intensified and sustained forest restoration . Encourage agro-forestry . Strengthening of Forest management institutions and promote forest management group activities	. Promote natural regeneration and afforestation or reforestation . Sustainable charcoal production . Improved cooking devices by biomass, ethanol and electric stoves . Forest and forest fire management
Agriculture		. limit methane emission from rice farming by reducing submersion . Valorisation of agricultural wastes for energy production	. Promote food security and greater income of farmer by improving crop and livestock production practice while reducing gas emission			. Increase resilience of ecosystem and household by sustainable land management	. Promote the intensified rice growing system . Sustainable land management, use of organic fertilizer, practice of agroforestry, assist natural regeneration and combination of trees and animals		. Smart agriculture and rural biogas plant . Facilitate rural biomass electricity

Sources: NDCS of PARM countries

4. Adaptation plan

Adaptation is defined as the process of adjustment to actual or expected climate and its effects in order to the limit climate change consequence (IPCC report, 2012). Risk management stands as the most appropriate framework for assessing climate change adaptation (R. Jones et al, 2011). Depending on their risk profile and their current and upcoming climate situation, countries and farmers decide on their priorities and on their production and policy decisions. They plan strategies to limit damage in case of adverse climate change or extreme events. It is very important to identify the type of risk, the frequency and the severity to develop appropriate tools.

a. Intergovernmental Panel on Climate Change reports on risk and the role of ARM in adaptation

The IPCC 2012 report defines the climate change as an alteration in the state of the mean and (or) the variability of climate that persists for an extended period. Climate change alters the future variability and occurrence of extreme events by affecting the weather and climate variables such as wind, temperature and precipitation. In 1995, IPCC reported that drought had increased in frequency in sub-Saharan Africa in the context of higher variability of rainfall. ARM provides the appropriate tools to deal with the variability of climate. Indeed, ARM involves learning, having a corrective and prospective component dealing with existing and projected future risk. Furthermore, others adaptation plans can benefit and complement from managing risks. They allow the adjustment to the climate change, both the change in the trend and in the variability and extreme events.

The consequences of disaster risk are increasing because some types of extreme weather and climate events have increased in frequency or magnitude, but also because the populations and asset at risk have increased. Indeed, the character and severity of impacts from climate extremes depend not only on the extremes themselves, but also on exposure and vulnerability of farmers. Weather and climate-related disaster risk management exist and strategies can be developed at local and international scale. Some strategies for effectively managing risks and adapting to climate change involve adjustments to current activities while others require transformation or fundamental change. The IPCC 2012 report analysed adaptation and disaster management through a holistic approach, including the reduction of exposure, the increase of resilience to changing risks, the transformation, the reduction of vulnerability, the preparation, response and recover and the transfer and share of risk.

b. Types of ARM measures included in NDCs

Countries, based on their own context, have identified in the NDCs their needs for adaptation to climate change. Country's NDCs are mostly focused on production risk. But, they also cover some aspects of market and macro level risk. Table 2 groups the ARM measures of the nine countries in five categories.

i. Good agricultural practices and Climate Smart Agriculture

Climate change affects the natural growing conditions for crops: temperature, soil structure and water availability. Indeed, the planet is getting warmer and, in many locations, the soil becomes poorer due to erosion and drought. Water scarcity is exacerbated by large variability in the quantity and duration of rainfall. For adapting to new conditions of their environment, farmers can use more appropriate inputs, equipment and practices. The development of agricultural technology and the use of fertiliser and climate resilience and certified seeds with high yield and short cycle open opportunities for an agriculture that is smart with respect to the climate, increasing the farmer productivity, nutrition and resilience. To deal with rain variability and limit access to water by farmers, a sustainable management of water is very important. The creation of new water plants, dams to facilitate irrigation and water harvesting technic are other proposals that some countries (Cabo Verde, Ethiopia, Mozambique, Senegal, Uganda and Zambia) are including in their NDCs.

ii. Diversification

While improving agricultural practices, countries can also promote the diversification of activities to avoid putting "all eggs in one basket". Diversification strategies apply to crops production but also on other farmer household activities (Cabo Verde, Ethiopia, Liberia, Uganda and Zambia). For the culture side, diversify crops with different resilient to climate and different period of production can increase the probability to avoid the loss of all the production. In addition, diversification of economic activities from farming to livestock growing, artisanal activity

and fishery are good risk management strategies that are mentioned in the adaptation proposals in the NDCs. The goal of diversification is to allocate resources to different assets that have negative or low correlation with each other and the climate events.

iii. Information system and capacity building

The information on weather and climate is a key requirement to respond to the impacts of climate change. There is scarce data available to make assessments regarding changes of the frequency or intensity of extreme events. All the nine PARM countries announced the development of information system in their NDC. The collection of climate and meteorological data has been included in the countries development plan. They seek to strengthen institutions working to collect and deliver information to farmers. Countries not only propose to create a climate information system, but also to facilitate access to information by decentralising organizations and supporting extension services. The early warning systems for climate information will prevent farmers on their environmental context and upcoming hazards. This will improve the integration of climate information to production decisions. After delivering information, many countries seek to develop knowledge for agricultural actors and reinforce the capacity of farmers to practice smart agriculture.

iv. Resilient access to market and finance

Develop farmers agricultural business is one of the important steps to remove them from poverty traps. Countries' NDCs aim to facilitate the access to finance to farmers by developing micro-credit and microfinance institutions. Access to finance will help farmers have good agricultural practice. Since agriculture is very risky business, to reduce the risk of loss their crops, they reduce their investment on fertilizer and grow crops which are more-resistance to weather change but less profitable (Schickele, 2016). Countries propose also to tackle the weather risks with transfer farmers risk to international market by providing agricultural insurance (Ethiopia, Mozambique, Niger, Senegal and Zambia). This facilitates farmer's investment in more risky, but more profitable crops. This risk transfer increase bank and microfinance willingness to provide loans. Then, farmers can achieve higher production and more resilient livelihoods. Moreover, countries propose to develop storage for the consumption and trading purposes, protecting farmers from production loss. Finally, they also propose to improve the transportation infrastructures and create markets for selling the production.

v. Enhance pest control and humanitarian plans

Even if efforts are multiplied by countries to minimise normal and marketable risks, catastrophic risks happen (Anton et al, 2013). Indeed, there is an increase in frequency and severity of extreme climate events such as droughts, floods, storms and pest attacks and plant diseases. Some countries develop policies to deal with emergency situations. For plant diseases case, Ethiopia and Liberia are proposing to invest on research for improving and facilitate their prompt reaction and intervention to address such event. Also, some policies are proposed to finance and capacity humanitarian institutions.

c. Some country examples of synergies between NDCs and ARM

Each country has defined its NDCs based on its own environmental context. The Platform for Agricultural Risk Management (PARM) is working closely with nine sub-Saharan countries to enhance the management of agricultural risk for improving farmers' livelihoods. PARM follows a holistic approach that encompass the analysis of many sources of risk: market risks, macro level risks, pest and diseases and other production risks. The adaptation strategies of NDCs, match with the evidence of PARM studies, especially for production risks related with climate. PARM has identified information systems as a basic priority for ARM in all the countries. In line with this result, all these countries have mentioned information systems as a priority for their adaptation plan. A brief analysis of two countries (Uganda and Ethiopia) shows the potential convergence and synergies between NDCs and the improvements on the Agricultural Risk Management systems proposed by PARM. Other synergies are found for all PARM countries as presented in Table 2.

The PARM agricultural risk assessment study on Uganda (PARM, 2015) concluded that crop pests and diseases, output prices and postharvest losses as the three greatest agricultural risks in Uganda. Additionally, Ugandan farmers are affected by drought, livestock diseases, counterfeit inputs and a fast rising in temperature. Several actions of the NDC adaptation strategies addressed the agricultural risks identified by PARM. Indeed, the improvement of agricultural practices by the resilience and variated crops and farmers training can help to reduce the risk of crop pests and diseases, and manage droughts. Risks of postharvest losses can be better managed

with the handling and storage systems proposed in the NDCs. Finally access to financial instruments has been an identified priority both in the NDC and in the PARM process.

Farmers in Ethiopia are affected by many risks. According to the agricultural risk assessment study PARM (2017), the major agricultural risks in Ethiopia are the drought, livestock's and plant pests and diseases. The NDC adaptation strategies of the Ethiopia covers all these areas of risks management identified by PARM in collaboration with the Ethiopian Government and the stakeholders. The proposed promotion of the use of drought tolerant plants and resilient crops can reduce farmers' vulnerability to drought. Other proposals in the NDC of Ethiopia include the reduction of production losses through storage techniques and the pests and diseases control. In consistency with all these measures, a key priority identified by PARM is the development of capacities in the extension services to assess and manage risks. Finally the transfer of risk through index insurance that is proposed in the NDCs is an interesting initiative that, according to the results of the PARM work, would need to be well designed to ensure the complementarity and synergies with social protection policies and humanitarian assistance, which are very significant in Ethiopia.

Table 2 : Countries NDC adaptation strategies linked to ARM

Adaptations	Cabo Verde	Cameroon	Ethiopia	Liberia	Mozambique	Niger	Senegal	Uganda	Zambia
CSA and improved seeds	No	Climate resistance and certified seeds and species with high yield, short cycle for rapid rotation	Drought tolerance plants and improved crop varieties to increase productivity	Drought-resistant, flood-tolerant and early maturing crop species	Transfer and adoption of clean and climate change resilient technologies	Schooling and literacy of farmers, rural extension system to practice climate smart agriculture	Improve and adapt seeds and plants production to climate change	Research on climate resilient crops and animal breeds	Conservation agriculture, agroforestry, use of drought tolerant varieties, and fertilizer
Water management and irrigation	New distillation, water pumping units and at least 5 dams by 2030	No	Irrigation system through rain water harvesting and conservation of water	No specified corresponding actions	Climate resilient hydraulic infrastructures	No specified corresponding actions	Hydraulic infrastructure in rural area	Expand small scale water infrastructure	Dams and water technologies for irrigation and water harvesting
Food storage	No	No	Traditional food and feed storage technic	No	No	No	No	Post-harvest handling and storage	No
Diversification	Artisanal fishing activities and providing training, equipment, micro-credit	No	Agroforestry and sustainable afforestation	Variate crop cultivation and small ruminants rearing	No	No	No	Different crops and livestock production	Different crops and livestock and fishery production
Pests and diseases Control	No	No	Reducing the incidence and impact of fire, plants diseases and pest epidemics	Pest control including fencing of farms against rodents, bird's scarecrows	No	No	No	No	No
Access to Market, finance and insurance	Micro-credit	Micro finance, markets and equipment	Insurance system on extreme weather events	No	Climate insurances	Index-based agricultural weather insurance	Agricultural and livestock insurance	Access to markets and micro-finances	Insurance market against climate change
Emergency and humanitarian	No	Emergency fund	Medicines to deal with the expansion and emergency of animal, crops and plant diseases	Emergency to response to epidemics	No	No	Response to emergency case	Institution for emergency action du to extreme climate event	Emergency responses in face of adverse climate events that impact on the productive systems
Information system and capacity development	Data collection, workshop on crops varieties and species	Climate database, observation, information and warning system	Warning system and wider public participation	Hydro-meteorological and climate monitoring system , platform for knowledge and experience sharing on best adaptation practices	Early warning system and data collection	Weather information, early warning system, schooling and literacy of farmers, rural extension services	Climate and geography information system, training program at different level on adaptation to climate change	Climate information, early warning systems extension service, research on climate resilient crops and animal breeds	Early warning system information dissemination, trainings at different levels on climate change topics

Sources: NDCs of PARM countries

5. Financial tools

The implementation of the mitigation and adaptive policies generally involves a portfolio of actions to reduce and transfer risk, and it may require significant financial resources. There exist synergies in international finance for disaster risk management and adaptation to climate change. One of the important goals of the COP 21 was to establish the mechanism that will develop and make flow the finance to the climate actions. Indeed, besides the countries' national budget, others external sources have been set up or strengthen by developed countries to finance mitigation and adaptation actions: carbon market, international climate fund, multilateral partnership. There is a commitment to support the achievement of NDCs proposals of developing countries with a flow of 100 billion dollars per year by 2020 in public and private sectors.

The NDCs of the nine countries analyzed propose generic financial sources without committing specific resources for financing their proposals in the climate plans. They rely on public and private investment and international support. Indeed, they intend to allocate a substantial portion of their national annual budget to finance mitigation and adaptation actions. Also, they intend to promote policies to improve the attractiveness of investments on climate change and facilitate the business environment through the development of the stock markets and local bank systems to mobilize funds that finance climate resilient projects (Cameroon and Senegal). In addition, the Green Climate Fund and the partnerships with other international organisations and relevant stakeholders are opportunities that will be explored by some countries to access finance. Finally, some countries support the international carbon market to develop a profitable mechanism to sell carbon credits at the highest price (Liberia, Cabo Verde, Cameroon, Ethiopia, Niger and Zambia).

6. Conclusion

Climate change affects the climate variability and increase farmers' exposure and vulnerability to adverse climate and extreme events. Agricultural Risk Management (ARM) approaches and tools reduce impacts of climate variability on farmers. Enhancing ARM systems and policies directly contributes for the adaptation strategies, especially if the climate risk becomes increasingly persistent and frequency. Both the adaptation strategies and the risk management approaches aim to reduce and manage the impact of extreme climate events on farming. ARM includes risk reduction, mitigation, transfer and coping strategies and a method to assess risk priorities that will enhance the results of any adaptation package.

The agreement of the COP 21 aims to reach a decarbonized highly resilient economy by realistic and concrete propositions. The NDCs are based on countries' national interest, conciliated with their priority and consistent with their national development plan. The adaptation measures included in the NDCs give opportunities for countries to develop and implement their ARM strategies as integral part of their national policies. In addition, the financial support for the accomplishment of the policies makes the agreement more realistic. This is an opportunity for PARM and for the countries with which PARM is engaged.

Countries aim to adapt to climate change and to manage the agricultural risk, achieving sustainable and profitable business activities. This objective requires good land use and management, good agricultural practice and market developments. Farmers should be informed about the climate change and its possible impact on their activity and on the subsequent risk environment. Farm household resilience needs good adaptation to climate change, but also a broader approach to resilient businesses and livelihoods that requires a holistic agricultural risk management approach.

PARM is working with the governments and stakeholders of nine sub-Saharan countries, drawing their risk profile, assessing and analysing their agricultural risks and proposing tools for the management of these risks. PARM process and finding fit well with the countries NDCs adaptation plan. For instance, any specific adaptation and risk management measures need to be accompanied by the enhancement and accessibility of information systems and by the creation of capacities to assess and manage risks. This is reflected both in the NDCs and in the PARM work in the countries. PARM policies and recommendations and ARM mainstreaming can clearly contribute to the accomplishment of countries' NDCs and can benefit from these existing commitments. This opportunity for synergies deserves to be further explored and exploited at country level.

List of acronyms

ARM : Agricultural Risk Management

COP: Conference of Parties

IPCC : Intergovernmental Panel on Climate Change

INDC : Intended Nationally Determined Contribution

NDC : Nationally Determined Contribution

PARM: Platform for Agricultural Risk Management

UN: United Nations

UNFCCC: United Nations Framework Convention on Climate Change

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