

# Defining Indonesian and African Small-Holder Farmers' Climate Change Adaptive Capacity and Practices: A Brief Argument

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**Abstract**—The aim of this paper is to review literature on smallholder farmer's adaptive capacity and practices in the African continent and Indonesia. Climate change has been the centre of attention across all sectors worldwide. African and Indonesian agriculture is dominated by majority of smallholder farmers of which most of them are located in rural areas and resource-poor. Given this and other disadvantages of African and Indonesian smallholder farmers, climate change does affect their levels of production. It is important for African and Indonesia's smallholder farmers to implement adaptive strategies in order to retain production sustainability. Reviewed literature revealed that, most of the farmers across the African and Indonesia continent are not capacitated and willing to practice climate adaptive strategies suggested by researchers outlined in this paper. However, deeper in-depth quantitative and qualitative analysis is still required to find out as to why these smallholder farmers are not capacitated and not willing to practice climate change adaptive strategies. The findings of this review paper solicits further areas of research into climate change adaptive capacity and practices by small holder famers but the other countries worldwide.

Furthermore, the findings of the quantitative research will better inform farmers and policy makers as to how to improve capacity and willingness to adopt adaptive strategies by small holder farmers across the African and Indonesia continent.

**Keywords:** *smallholder farmers, climate change, adaptive, strategy*

## 1. INTRODUCTION AND BACKGROUND

Agriculture is at the core of economic development in majority of developing countries. In most of these countries, smallholder farmers dominate the agricultural sector in general. Montmasson-Clair and Zwane (2016) further stated that, the agricultural sector has been subject to drastic economic and social change over the last two decades and unarguably climate change has been changing the environmental, social and economic conditions of small-holder farmers in Africa. As a result this small-holder farmers who rely only on agricultural production are mostly vulnerable especially those in the drier regions (Adger, *et al.*, 2007). The changes have significant implications on the farmers in the developing continent of Africa and Indonesia as a developed country. The paper focus on adaptation as an independent respond to this above mentioned climatic changes that affect small-holder in and around Africa and Indonesia region.

According to Montmasson-Clair ( 2016) the agricultural sector in Africa is exposed to a whole range of risks associated with climate change, this include variations in rainfall, increased evaporation, higher temperatures, increased pests and disease distribution, reduced yields, and spatial shift in optimum growing regions, making smallholder farmers in this areas more and more vulnerable. The mentioned extreme events together with drought and floods among others have become common incidences in Africa. As a result, smallholder farmers who rely particularly on rain fed agriculture for their livelihoods are

affected. In Indonesia, the change in climate have impacted both the natural and societal systems. Previous studies denoted that smallholder farmers have expected some adaptation measures in their current farming practices, which array from variation on planting calendar to investment on contribution and groundwork. Their existing adaptations, however, have been reported to be insufficient and still leave significant enduring effects unused. However since the phenomenon is a global crisis the international governing bodies have been making efforts to minimize the effect of climate change.

Hasiang and Narita (2012) stated that societies need to adapt for them to minimize losses from climatic extremes and variabilities. Nevertheless, according to Adger (2003) adaptation cannot solve the problem of climate change and other extreme occurrences during but it can reduce their impacts on smallholder farmers which will help restore livelihood stability. Adaptation does not take place in isolation it will require a number of multiple participants who contribute directly, this involves policy makers, extension officers, NGOs, researchers, communities, and small holder farmers themselves (Belay *et al.*, 2017). Morton (2007) supported this view by stating that, climate change adaptability is determined by the location because factors such the socio-economic setting and institutional factors have an influence on the effectiveness of adaptation.

Extreme weather conditions as a result of climate change have impacted people's lives rather negatively, from taking their lives to an increase in the spread of diseases and an indirect effect it has on their welfare through the depletion of savings were such individuals have to incur health care costs. These kind of effects are predominantly felt by smallholder farmers especially in less privileged countries such those in Africa (Hallegate *et al.*, 2016). Efforts should be made to ensure that smallholder capacity is assessed for them to adapt to an increased risk environment as a result of climate change.

Therefore a better understanding of how smallholder farmers in various locations perceive climate change and adaptive measure they are using is pivotal to help policymakers develop policies that will accommodate this smallholder farmers needs and improve their

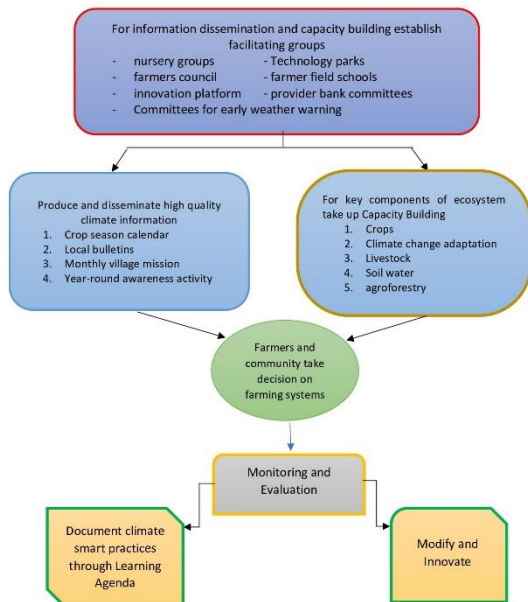
livelihoods in the long-run and ensure successful adaptation and sustainable practices in the agricultural sector (Belay, 2017). A number of external and internal factors play a major role in shaping the way these smallholder farmers perceive climate change and the decision on which decision to take in selecting the adaptive measures at their disposal (Deressa *et al.*, 2009). The varieties of adaptive measures proposed to smallholder farmers particularly in developing countries provide them with a chance to become more resilient to the risks associated with climate change (Belay, 2017). Then again, in Indonesia, smallholder farmers who have been lower educated-, older age-, and female-headed; having no-access to credit; having smaller farm size; and having farm plot with shorter distance to water reservoir tended to adopt types of existing adaptation practices other than the combined on- and off-farm adaptation (Candradijaya, 2015).

Agricultural adaptation to climate change in Africa is highly recognized as an imperative policy option to decrease smallholder farmers' vulnerability to a changing climate and consequently address the negative impacts related to climate change; the international community is pressed to pursue the adaptation of the agricultural sector in Africa (Tambo & Abdoulaye, 2012). According to the IPCC, adaptation refers to the 'adjustment in natural or human systems in response to actual or expected climatic stressor or their effects, which minimizes harm or exploits beneficial opportunities' (IPCC, 2007). Smallholder farmers in Africa have not been adapting to changes in climate, and therefore it very important to understand these adaptive measures and their challenges to their implementation could offer an advantage in limiting the effects of climate change.

There are different stage processes to adaptation of the agricultural sector but the two stages that are at the core of the process involves; firstly recognizing the change in climate and lastly making a sound decision to adapt (Maddison, 2016). The smallholder farmers' perception in this regard is the ultimate stepping stone towards the adaptation of agricultural sector. According to Komba & Muchapondwa (2012) it is of great significance to know whether these smallholder farmers

respond to their perceptions about changing climatic and if so then the state will be able to help them overcome the obstacles they face and eventually take up adaptive measures that would ensure sustainable agriculture.

**Figure 1. Overview of adaptation measures as a concept**



Source: (ICRISAT, 2016)

## 2. Assessment of current adaptation measures

Adaptation practices as a concept of mitigating the effects of climate change as felt by the smallholder farmers, refers to the actual adjustments and changes in a conventional way of farming by smallholder farmers in bid to increase their resilience towards climate change and reducing vulnerability to the observed or predicted changes in climate ( Adger *et al.*, 2007). Thus, the change in conventional ways of crop and livestock production as well as investing in the infrastructure that shifts their production to a more sustainable way of production are examples of adjustment. Different dimensions can be used to differentiate adaptation measures. This include; by spatial scale, sector scale, type of action, by actor (government, local organizations, NGOs and international bodies etc.), by climatic zones, and by integration of these and other categories (Adger *et al.*, 2017). Adaptation can be viewed in three general perspectives namely, responses to : the current changes in climate using the past as our reference point; observed

medium of climate change and forecasted long-term climate trends. Adaptation by smallholder farmers to present climate changes is beneficial in a broader context of economic development especially in poor countries of Africa (Goklany, 1995). In addition, the adaptation to current variabilities can be justified by the fact that these adaptation can enhance the resilience of this smallholder farmers to long-term climatic variabilities.

## 3. ELEMENTS OF ADAPTIVE CAPACITY

Adaptive capacity refers to the ability or the potential of smallholder to respond with successfully to climatic stressors and climate variability posing threats to their production, and this include making adjustment to their conventional ways. These adaptive strategies lays a foundation for the design and implementation of sound adaptive measures in the agricultural sector reducing the possibility of negative outcomes that are as a result of climate change (Brooks and Adger, 2005). Adaptive capacity also offers opportunities or advantages to the government and other institutions, such an increased span of growing crops and increased tourism advantage. It as a result of vulnerability assessment that we are able to understand the adaptive capacity of smallholder farmers to climate change. The vulnerability assessment might not include indices of determinants of adaptive capacity but it does represent or show which structural and institutional factors promote or hinder the effectiveness of adaptation capacity (Ericksen and Kelly, 2005).

Technology play an important role in the adaptation of climate change. Advanced cooling systems, technological improved seeds, desalination technologies are some of the options offered by the advancement in technology that can help smallholder farmers cope better under changing climatic conditions (Adger *et al.*, 2003). In most time, adaptation technological advancements and innovations are developed in a form of research programmes spearheaded by the governments in collaboration with other private agencies (Smit and Skinner, 2002). Although technological capacity can be considered a vital component of adaptive capacity, most tech responses are closely related to the type of

impact, such the higher temperatures and decreased precipitation.

#### **4. ADAPTIVE PRACTICES IN AFRICA AND INDONESIA AGRICULTURE**

There is evidence to practices of adaptation on impacts of climate change, weather variabilities on seasonal or annual bases- especially to the El Niño-Southern Oscillation (ENSO). These include methods that avoids or minimizes the effects of the phenomenon such as, crop diversification, water storage, sowing early, changing enterprises that rely more on climate, crop and livestock insurance, and seasonal climate forecasting. They also include reactive adaptive measures such as emergency response and disaster recovery (Sperling and Szekely, 2005). Past studies have shown that the reactive approach is often insufficient because it lacks the ability to address the issues of irreversibility and unrecoverable environment damage that is caused by the change in climate (Easterly *et al.*, 2003). As result, the proactive adaptive measures have improved in recent years such the advanced operating system that is able to forecast days and months the La Niña and El Niña occurrence (Cane *et al.*, 1986).

In Africa, different approaches have been used or applied in smallholder agriculture these approaches include: the watershed management approach, this type focuses on the rehabilitation the agroecosystems with the application climate-smart agricultural practices which increase drought tolerance and eventually improve smallholder farmer's income. The futuristic multi-model approach is also another approach, it uses computer simulated scenarios to forecast future climate conditions of over a decade, it is also utilized in Zimbabwe to assist policymakers promote sustainable development. Digital technologies approach is another approach that has assisted smallholder farmers in Ghana by introducing the use of mobile phone apps that allows them to make cropping decisions by obtaining climatic conditions from their devices. Meteorological advisory and farm systems approach is also used in Mali by introducing eco-friendly methods and climate information to smallholder farmers and lastly, climate and crop modelling approach this helped smallholder farmers in a drought prone region of Kurnool in Andhra Pradesh these farmers were provided with advisories on how to make

their crops tolerant to drought (ICRISAT, 2016).

In Indonesia, likely the adapted households were more resilient to the impact of future climate, which indicated by : a) changing cropping pattern involves introduction of new crops to add to or replace existing crops (IPB, 2015), b) forest management which involves the community in the immediate vicinity of an area in the prevention, control and utilization of fires through participation in decision-making and implementation of activities (Ganz *et al.* 2003; FAO 2003), and c) application of agroforestry.

#### **5. CONCLUSION**

Numerous studies recently conducted shows that the adaptive measures taken by smallholder farmers does not depend on the economic development of their countries and technological advancement, but the socio-economic factors, governance institutes and human capital play a major in the adaptation process (Berkhout *et al.*, 2006). Moreover, the adaptive measures are not a concern unique to areas or communities with low levels of economic development. Although the development in economy might offer an advantage to the access of adaptive measures and resources needed to invest in adaptation, an advanced economy with a high per capita income is not considered as a factor that allows individuals to adapt to changes in climate (Moss *et al.*, 2001). As result, the need for Indonesian and African smallholder farmers to adopt a variety of adaptive measures is justified regardless of their state of economy or household income at their disposal.

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