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Adaptive Capacity to Climate Change among Smallholder Farmers' in Busia County, Kenya

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Abstract: *This paper emanates from a study that was carried out to assess smallholder farmers' adaptive capacity to climate change effects in Busia County. Qualitative and quantitative data was collected from 376 respondents selected using multistage and simple random sampling techniques. Six determinants (financial, social, knowledge and information, institutions and flexible decision making) of adaptive capacity to climate change were assessed using a five point Likert scale. Findings indicated a moderate (2.65) adaptive capacity among smallholder farmers in Busia County. Low adaptive capacity was indicated in financial/economic resources (2.4), but moderate in knowledge/information (2.5), social (2.8), technology and innovation (2.7), institutional (2.8) and informed farming decision making resources. Therefore, low financial and economic resources limit ability to plan, prepare for, facilitate and implement adaptation measures. This paper recommends that development and climate change efforts should focus on climate change awareness and diversification for both on-farm and off-farm livelihood activities.*

Key words: *Climate change, adaptive capacity, Busia County, Kenya*

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I. Introduction

Climate change is one of the greatest challenge facing human and natural systems in the contemporary world. Temperature and rainfall variations are being manifested through flooding, increased heat waves, increased length and frequency of droughts, sea level rise, and increased salinity have become common (Rahman et al, 2007). Despite the unpredictable nature of these challenges, human and natural systems have the capacity to cope with the adverse circumstances, but with continuing climate change, adaptation is needed to maintain this capacity (Noble et al, 2014). The propensity of a system to adapt to impacts of climate change is known as adaptive capacity and is influenced by certain characteristics known as determinants of adaptation (Olmos, 2001). Adaptation depends greatly on the adaptive capacity of an affected system, region, or community to cope with the impacts and risks of climate change (IPCC, 2001). Therefore, understanding of adaptive capacity and their enhancement reduces the vulnerability of a region, community or household and promotes sustainable development (Abaje, et al, 2015).

Systems are considered more or less vulnerable depending on two factors: the severity of the specific stressful event (for example, a prolonged drought) and the degree of adaptive capacity (that is, the ability to cope with the impacts from such an event). The capability to adapt is a fundamental determinant of how vulnerable a specific system is to external and internal stresses (Keskitalo, 2004). For climate change, this attribute is referred to as 'adaptive capacity', defined as 'the ability of a system to adjust to climate change (including climate variability and extremes), to moderate potential damages, to take advantage of opportunities, or to cope with the consequences' (McCarthy et al., 2001). Thus, focusing on adaptive capacity as actions that lead to adaptation can serve to enhance a system's coping capacity and increase its coping range thereby reducing its vulnerability to climate hazards (Brooks and Edger, 2004).

Since, adaptive capacity is considered inherent to the system (Kandlikar & Risbey, 2000), it is a set of characteristics that allows a given system to perceive change or threatening circumstances, evaluate them, decide on a solution path and both develop and adopt processes and tools to manage the risk, thereby maintaining itself throughout (Kandlikar & Risbey, 2000; Berkes & Jolly, 2001; Klein, 2002). Adaptive capacity exists at different scales, from the individual through family, community, region and nation. It is fundamentally dependent on access to resources (Easterling et al., 2004; Adger et al., 2004); not only must these exist in adequate quantities, but the system requiring resources must also be able to mobilize them effectively. Seemingly, the capacity of a household to cope with climate impacts or risks depends to some degree on the enabling environment of the community, while adaptive capacity of the community is reflective of the resources and processes of the region (Yohe and Tol, 2002; Smit and Wandel, 2006, Abaje and Giwa, 2010).

In order to understand how adaptive capacity can be influenced at the local level, it is important to characterize it (Jones et al., 2010). The Intergovernmental Panel on Climate Change (IPCC) identifies economic wealth, technology, information and skills, infrastructure, institutions and equity as the principal determinants of adaptive capacity (IPCC, 2001), though no distinction is made between determinants at national and local level. Recent assessments argue that social factors, in particular power relations that include social capital, governance structures and the role and functions of institutions have been underplayed in earlier studies (IPCC, 2007).

Similarly, a number of both context-specific and generic determinants of adaptive capacity have been cited by various authors (Adger et al. 2004; Brooks et al. 2005; Brooks and Adger, 2004; Dulal *et al*., 2010; Füssel 2007; Haddad, 2005; Tompkins & Adger 2004; Yohe & Tol 2002; Vincent, 2007; Kelly and Adger, 2000; Smit and Wandel, 2006; Moser and Satterthwaite, 2008; Deressa *et al*, 2008a; Deressa *et al*, 2008b; Gbetibouo *et al*, 2010). However, most of these research works on assessments of adaptive capacity have their focus at the national level or have their emphasis on assets and capitals as indicators of adaptive capacity (Jones et al, 2010). The national level indicators generally fail to capture many of the processes and contextual factors that influence adaptive capacity, and are not, therefore, an effective reflection of adaptive capacity at the local level, where the actual adaptation actions take place (Eriksen and Kelly, 2007). These earlier frameworks tended to ignore the local level indicators of adaptive capacity with little studies focusing on them.

Thus, understanding adaptive capacity entails recognizing the importance of various intangible processes: decision-making and governance; the fostering of innovation, experimentation and opportunity exploitation; and the structure of institutions and entitlements, for example. Doing this requires moving away from simply looking at what a system has that enables it to adapt, to recognizing what a system does to enable it to adapt (WRI, 2009). Therefore, Local Adaptive Capacity framework (LAC) developed as part of the Africa Climate Change Resilience Alliance (ACCRA) programme incorporate intangible and dynamic dimensions of adaptive capacity, as well as capitals and resource-based components, into an analysis of adaptive capacity at the local level. LAC is based on an analysis of the characteristics that contribute to the adaptive capacity of a system at 'local' level, recognizing that, while much of the attention has so far been given to developing characteristics and indicators at the national level, little research and analysis has been done on adaptive capacity at the community or household levels (Jones et al, 2010).

The LAC framework lays out five distinct yet interrelated characteristics of adaptive capacity, with the underlying assumption that positive impacts on these characteristics should enhance the system's adaptive capacity. These are: the asset base, institutions and entitlements, knowledge and information, innovation, and flexible forward-looking decision-making. These parameters influence and determine the degree to which a community is resilient and responsive to changes in the external environment (Jones et al, 2010). However, factors that represent adaptive capacity will be determined to a certain extent by the nature of the hazard(s) faced and by the characteristics of the system or population in question including the types of livelihoods that sustain the communities in question. Since, it is not possible to provide a list of "off-the-shelf" indicators to capture universal determinants of adaptive capacity, appropriate indicators for assessing adaptive capacity must be tailored to each case (Brooks and Edger, 2004). Thus, this study borrows from the LAC framework adaptive capacity characteristics and different indicators customized for each characteristic.

Past climatic events in Busia County have had tremendous impacts on the agricultural sector and the livelihoods of the smallholder farmers. A major concern of this study is how smallholder farmers have had to manage risks, uncertainties and fluctuations posed by climate change on their livelihoods. However, despite the fact that smallholder farmers in Busia County have overtime developed coping strategies, their adaptive capacities in the face of climate change seem to be limited, exposing them to more vulnerability. Thus, an assessment of adaptive capacity among smallholder farmers in Busia County is vital in informing appropriate adaptation strategies to cushion livelihoods against climate change.

II. Study Area

Busia is one of the forty seven (47) counties of Kenya and is situated at the extreme western region of the country. The County borders three other counties which include; Bungoma to the north, Kakamega to the east and Siaya to the South West. Part of Lake Victoria is in Busia County on the South East and borders the Lake with the Republic of Uganda to the West. It lies between latitude 0º and 0º 45 north and longitude 34º 25 east.

Busia County receives an annual rainfall of between 760mm and 2000mm. Fifty percent of the rain falls in the long rain season which is at its peak between late March and late May, while 25% falls during the short rains between August and October. The dry season with scattered rains falls from December to February. The temperatures for the whole County are more or less homogenous. The annual mean maximum temperatures range between 26ºC and 30ºC, while the mean minimum temperature range between14ºC and 22ºC.

Most parts of Busia County falls within Lake Victoria Basin. The altitude is undulating and rises from about 1130m above sea level at the shores of Lake Victoria to a maximum of about 1500m in Funyula and

North Teso Hills. The central part of the county, especially Butula and Nambale Sub-counties, are occupied by peneplain marked by low flat divides of approximately uniform height, often capped by lateritic and a shallowly incised swampy drainage system.The Samia Hills represent a basement complex and consist of acidic and sub-acidic lavas, tuffs, and agglomerates, banded quartzite and iron stones. The Kavirondo series rocks are developed around Busia, Nambale and Butula, while granites dominate the northern parts of the County. The northern central region features granite out crops, which is essentially part of the peneplain and is characterized by the presence of large granitic hills in Amukura and Chelelemuk. The southern part is covered by a range of hills comprising the Samia and Funyula hills, which run from the north east to the south west culminating at Port Victoria; forming a very conspicuous topographic feature. The southern part is covered by the Yala Swamp, which is a down warped area associated with the formation of Lake Victoria. This area is covered with locustrine and alluvial deposits of recent and Pleistocene times.

Whereas most parts of Busia County have sandy loam soils, dark clay soils cover the northern and central parts of the County. The land formation and structure makes the northern part suitable for both food and cash crops like tobacco and cotton. The lower northern parts of Nambale, Butula and Amukura in Teso South are suitable for maize, robusta coffee and sugarcane cultivation. The central southern parts of the County are suitable for maize, cotton and horticultural crops. Apart from the lower parts of Samia and Bunyala Sub-Counties to the south which require irrigation, most parts of the county have high potential for agriculture and promises faster growth (GOK. 2013).

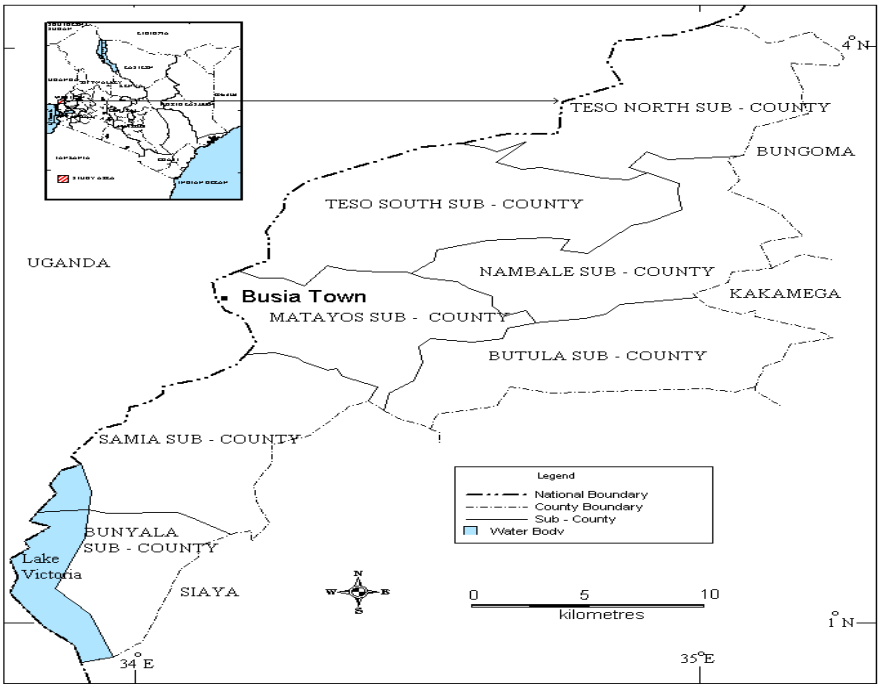

Figure 1: Map of Busia County Showing the Study Area

III. Methodology

Descriptive survey was employed used to generate both qualitative and quantitative data. Multistage and simple random sampling procedures were used to select a sample size of 376 farmers from the County. The seven sub-counties that form Busia County, namely Teso north, Teso south, Samia, Nambale, Bunyala, Matayos and Butula were divided into their respective locations. Thereafter, simple random sampling was used to select two locations from each sub-county namely, Teso North (Ang'urai east, Ang'urai south), Teso South (Ang'orom, Chakol north), Samia (Bwiri, Nangina), Bunyala (Bunyala west, Bunyala North), Nambale (Bukhayo north and Bukhayo central), Butula (Elugulu, Marachi central), Matayos (Busibwabo, Mayenje). Subsequently, households from the selected locations were randomly selected proportionate to the sub-county sample size and the questionnaire proportionately administered to household heads in the selected locations.

A five point Likert scale was used (5= strongly agree, 4=agree, 3=neutral, 2=disagree, 1=strongly disagree) to assess the adaptive capacity to climate change effects among the smallholder farmers in the study area. Using the interval scale of 0.50, low adaptive capacity falls within 0.00- 2.49, moderate adaptive capacity ranges from 2.50-3.49 while high adaptive capacity ranges from 3.50-5.00 (Abuja et al, 2015). The average of the six resources represents the adaptive capacity of Busia County.

IV. Results

Findings on adaptive capacity to climate change effects among smallholder farmers' in Busia County in relation to the indicators (financial/economic resource, knowledge and information, technology and innovations, social capital, institutions and informed farming decision making) have been presented in Figure 1.

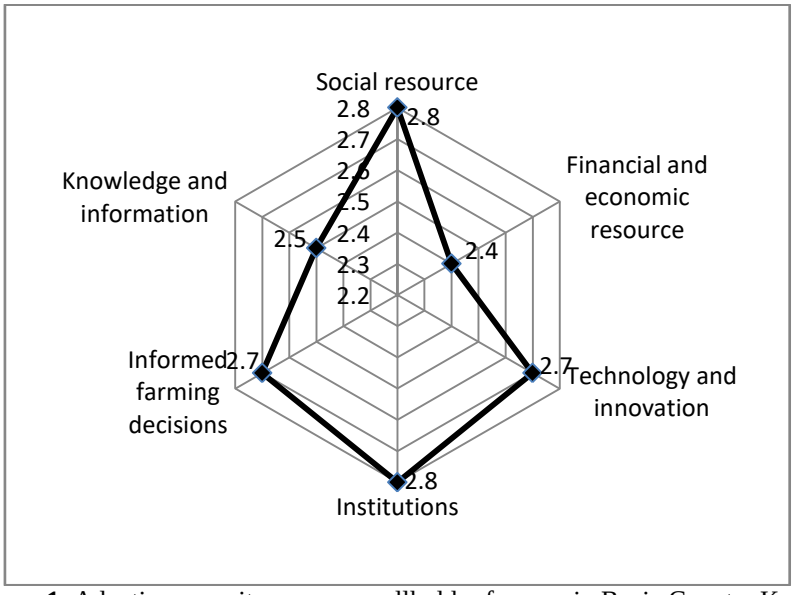

Figure 1: Adaptive capacity among smallholder farmers in Busia County, Kenya

4.1 Social resource

Social resources exist in relationships between and among individuals, groups and organizations within (and without) a community. The importance of social networks during times of stress is well established for both communication and facilitating collective action (Adger, 2003). The study found out that social capital as an indicator of adaptive capacity was moderate (2.8). Being a member of a social group as an indicator of social capital was moderate (3.1) with 51% of the respondents reporting to be members of social groups Social groups that include farming groups such as one acre fund, women and men groups and faith based groups provided benefits to the group members. Group members ability to access information on weather and climate was moderate (2.8), with 42% of the respondents reporting to have accessed information through groups. For example, one acre fund provide information on whether rains would come early or late, and also information on planting time. Local institutions can be effective at aiding knowledge generation that may be important for adaptive capacity (Pelling et al., 2008) and in the diffusion of information and technologies (Isaac, 2012). Group members receiving training on new farming techniques was also moderate (2.9) with 49% of the respondents agreeing to have received training. For example group members in one acre fund were trained on crop pest and disease control, early maturing and drought resistant varieties, soil conservation practices and new crop storage hermetic bags. Other studies have also drawn attention to the critical role that social capital plays in the adoption of sustainable farming practices by landholders (Jacobs et al, 2015).

The role of social groups in helping group members to save and invest was also moderate (2.8). Fourty eight percent of the respondents agreed to have learned how to save and invest. However, this is still low and explains why diversification of livelihoods and income is not yet at par with other counties hence the high poverty rates in Busia County. Most social groups operate through merry go round strategy. This allows members to make savings which they later use to purchase farm inputs or invest in diversifying their income. Therefore, social networks), play an important role in the ability of an individual to manage risk and uncertainty, especially in the absence of help from the state, by facilitating collaboration and coordination among individual actors (Adger, (2003), Ostrom and Ahn (2003). However, accessing farm inputs and loans/credit was low (2.4). Only 38% reported to access farm inputs and loans from groups. Smallholder farmers in Busia County experience challenges in accessing farm inputs due to distance and also low income which limits direct purchase of inputs. Seemingly, farm inputs, loans and credit are pegged on individual savings in groups which was a challenge to most farmers who solely relied on agriculture as a source of income. For example one acre fund provide fertilizer and seeds upon a member having saved with the group. Other groups give loans and credit to group members who are required to pay later. Thus, people who are members of social groups have access to resources that are not available to non-members (Jacobs et al., 2015). For example, savings groups may provide access to financial resources that help an individual pursue costly adaptation strategies (Wood et al., 2014).

Other benefits of social networks include sharing of knowledge, labour, equipment and finances (Pelling and High 2005). Consequently, Hogest, (2005) in Katungi et al., (2007 stated that informal institutions and private social networks play three distinct roles in adoption of agricultural technologies. First, they act as conduits for financial transfers that may relax the farmer's credit constraints. Third, social networks can facilitate cooperation to overcome collective action dilemmas, where the adoption of technologies involves externalities.

4.2 Institutional resource

Institutions are defined as the system of rules, decision-making procedures, and programs that give rise to social practices; assign roles to the participants in these practices and guide interactions among the occupants of the relevant roles (Gupta et al., 2010). Study results indicated that institutional resource was moderate (2.8) in Busia County. Institutional capacity indicators that included presence of climate change institutions, existence of institutions that support farming and access to such institutions were moderate with 2.5, 2.7 and 3.3 respectively. However, only 28% of the respondents reported to have knowledge on available climate change institutions, while 62% reported to have knowledge on institutions that support farming in Busia County, while 29% reported to have access to such institutions. Agriculture Training Center is one of the government institutions under the ministry of agriculture that helps in building capacity among farmers. However, rainfall and temperature data are unreliable due to hindering weather updates. Similarly, such an organisation is located in Busia town with its approach being demand driven where farmers are required to get information from the institution. However, with low extension services to the farmers, inadequate information for weather updates and the distance to the institution limits adaptation among smallholder. Other organisations like One acre fund and Programme for Agriculture and Livelihoods In Western Kenya (PALWECO) have multifaceted roles hence limited focus on climate change, while the County Meteorological services do not provide updates on weather despite that being their mandate. For instance, One Acre Fund focus mainly on improving agricultural production and works through groups, hence the reason why it is widely known in Busia County, while PALWECO concentrated on diversification of livelihoods. However, climate change aspect is not anchored in their objectives.

Climate profile report for Busia County indicated that the County hosts different organisations, with majority of them focusing on farming activities where by climate change information becomes a component in their programmes. Despite having representation on the ground, effectiveness of the key institutions in Busia County is limited by lack of integration and collaboration between non-governmental and governmental organisations (MoALF, (2016). The authors noted that, there are no organisations that have mainstreamed climate change in their programmes and hence their roles in improving livelihoods are limited in the event of climate change. Further, institutions in the study area are hampered by lack of continued support such that an institution becomes less successful with time and is only facilitated when a stressful event occurs (MoALF, 2016). Therefore, the above challenges limit accessibility to such organisations in Busia County with only 29% of the respondents agreeing to have access to the institutions. The role of institutions in determining adaptive capacity for climate change is widely recognized (Willems and Baumert, 2003). They can foster adaptive capacity by creating an environment, which supports actors in both learning from past experiences and developing new insights, enabling them to have flexibility and creativity in managing expected and unexpected situations (Gupta et al., 2010).

4.3 Financial and economic resource

Access to and availability of financial resources and stable income support the development of adaptive capacity (Yohe and Tol, 2002; Armitage, 2005; Engle and Lemos, 2007). Financial and economic capacity was the lowest (2.4) in Busia County. Financial and economic resource is a major component of the asset base. Busia County has poverty rate of 64% with food poverty at 54%. Stable income and savings that can help to cope as indicators of financial/economic capacity were low (2.4 and 2.3) respectively while access to financial resources was moderate (2.5). Agriculture is the main source of livelihood to majority of the households in Busia County and contributes to over 50% of the household income. Busia County is experiencing erratic rainfall, high temperatures, drought and floods which have affected livelihoods that most households depend on. Agriculture that relies on rainfall is greatly affected by climate change leading to low production, while other ecosystem benefits are decreasing. This has greatly limited household income and savings further hampering access to financial resources (loans and credit). These findings are in line with MoALF (2016), that majority of residents in Busia County were of low income.

The authors of this paper noted that stable income and savings in Busia County determined the membership to a social and farmer group and also acted as a security for loans, credit and farm inputs from the groups limiting. This has in turn limited adoption of new farming practices, access to farm inputs, loans, credit and diversification of livelihoods including income. Yohe and Tol (2002) demonstrates how lack of access and direction of financial resources reduces adaptive capacity by limiting the development and implementation of

adaptive strategies, thereby, increasing the physical and social vulnerability of those already at risk. Assets and household wealth are necessary to allow adoption of adaptation strategies that may require access to capital (for example, key inputs such as improved seeds and fertilizer). Therefore, adaptation to climate that requires these investments is less likely to be carried out by the poor, who are often budget constrained (Agarwal, 2010; Vermeulen et al., 2011). Previous studies have shown that increased assets improve the adaptive capacity of groups facing capital constraints (Meinzen- Dick et al., 2002) and with increased potential for adaptation (Wood et al. 2014).

4.4 Knowledge and information resource

Reliable climate information provides farmers with predictive knowledge about environmental risks that helps them overcome prior knowledge constraints (Rosenzweig and Udry, 2013). Knowledge and information on weather and climate in Busia County was moderate (2.5). Indicators such as respondents understanding of climate change and getting updates on weather changes were low (2.4 and 2.1) respectively. However, respondents use local knowledge to cope with weather and climate changes was moderate (3.0). The study revealed that 38% of the respondents understood climate change, while only 19% received updates on weather and climate change. Climate change is not mainstreamed in most agriculture institutions and organisations in the study area, plus much of the weather and climate information and updates are unreliable, coupled with limited extension services at the local level. Limited knowledge and information on weather and climate has contributed to most farmers relying on own experience, local knowledge, and obsolete farming ideas and technologies in their farming decisions. This is despite the changing environmental factors. Lack of updates on weather has affected cropping calendar in terms of land preparation, planting time, crop management and harvesting. This has led to low agricultural productivity, and post harvest losses exacerbating food insecurity and poverty among smallholder farmers in Busia County.

Further, respondents reported to get updates on weather changes through radio (99%) with more men (58%) than women (42%) reporting to have access to radio. However, women often did not receive the forecasts on the radio because they are given at the times of the day (morning and evening) when they are the busiest: in the when they are cooking and doing other chores. This could be limiting adaptation in Busia County where women are more (52%) than men (42%). Availability and accessibility of weather and climate information plays crucial roles before and during the cropping season, and if properly mainstreamed in farm-level decision-making, could enable farmers to mobilize requisite resources and apply them in a timely manner to reap maximum benefits from their investments. At the farm level, agricultural producers require information on a wide range of factors, including weather, soil, water, fertilizers and pesticides that are specific to their farms (AGRA, 2014). To further enhance farming decisions, farmers need additional information regarding the most appropriate types of seed, the crops that are available in the local market, and their respective market prices (AGRA, 2014). However, successful application at the farm level of climate-based agro-advisories largely depends on the existence of relevant smallholder farmer knowledge-sharing mechanisms. Examples of communication channels include: conventional platforms, such as radio, TV, and bulletins; farmer field schools that integrate climate and weather information; farmer-participatory climate workshops; and local climate information centers that together enhance the availability and accessibility of value-added climate information to smallholder farmers (AGRA, 2014). AGRA, (2014) indicated that access to and use of different types and sources of information is highly related to the gender. Women are therefore, less likely than men to be aware of climate smart agricultural practices, but more likely than men to adopt them if they were aware; when individuals have access to weather and agriculture-related information, they are more likely to take up new practices that help them adapt to climate change (AGRA, 2014).

4.5Technology and innovation resource

A key characteristic of adaptive capacity relates to the system's ability to foster innovation and support new practices. Access and incorporation of new technologies into present practices facilitate adaptive capacity for climate change in adaptation (Yohe & Tol, 2002; Engle, 2011). Technology and innovation as determinants of adaptive capacity was moderate (2.7) among farmers in Busia County. Equally, knowledge of new farming ideas as an indicator of technology and innovations was found to be moderate (2.6) with 51% of the respondents being aware of the new technologies. However, accessibility of the new farming ideas seem to be low (2.1) among farmers with only 19% of the respondents reporting to have access to them. Similarly, the search for new ideas among farmers was low (2.3) with 19% of the respondents agreeing to have sought for new farming ideas.

Government organisations and institutions like PALWECO and ATC and non-governmental organisations like one acre fund present in Busia County promote different innovative farming practices through their programmes. These organisations provide certified seeds, fertilizer, improved varieties, appropriate planting techniques, best storage infrastructure to minimize post harvest losses and better land management

ideas among others depending on their objective. However, these benefits and new ideas are accessed by group members only especially from one acre fund and PALWECO, while ATC requires farmers and groups to seek extension services from the institution, rather than being supplied with the extension services. Besides, these new farming technologies and innovations are unaffordable to most households in Busia County due to limited financial and economic resources which are the lowest (2.4). In addition, some farming practices like drought resistant varieties that included cassava and sweet potatoes were not largely adopted due to the preference of maize in the community, while early maturing varieties are said to have different taste from the normal varieties. The authors also noted that research institutions have not developed varieties attuned for specific areas and therefore, farmers choose from what is available in the market. Similarly, organisations working at the local level to improve livelihoods also present varieties for the farmers to make choices without their recommendation on what is suitable. This has been worsened by lack of soil tests and also limited weather updates that are necessary for farming decision making. Similar observation was made by Adesina and Chianu, (2002), that adoption is determined by socio-cultural and economic factors at all levels, and these could either motivate or hinder smallholder farmers from adopting CSA practices. These factors include: regional and national agricultural policies; economic conditions; levels of education and the availability of information; land tenure systems; and the preferences of individual farmers, which are conditioned by societal and community-based norms (Adesina and Chianu, 2002).

Thus, adoption of new technologies and practices will depend on the extent to which the new approaches deviate from current practices and how compatible they are with existing production systems (Lybbert and Sumner (2012) cited in AGRA, 2014). In this instance, compatibility refers to how well suited new technologies and practices are perceived to be, relative to the farmers' local context, including: geographical location and agro-ecologies; farmers' resources and capabilities; and individual farm characteristics, such as soil types, terrain, potential for erosion, and the prevalence of various biotic and abiotic threats to production. Where such factors have not been addressed, farmers have declined to adopt new practices (Daniel, Myers and Dixon (2012) as cited in AGRA, 2014). In addition, farmers have through planned initiatives or trial and error, adopted agricultural practices on which they can rely and with which they are comfortable, and are reluctant to adopt new practices that are unproven within their context.

4.6 Informed farming decision making

Decision making is anchored on appropriate information so that households do not just make decisions, but informed-decisions. Individual decisions are influenced by the availability of technical information and the appropriate technology necessary to implement sustainable approaches (Andersson and D'Souza, 2013). Informed farming decision making as an adaptive capacity was moderate (2.7) among farmers in Busia County. Similarly, influence of farming decisions by other fellow farmers (3.0), or by own understanding (3.0) were moderate, while use of extension information was low (2.2). Findings indicate that farmers' decisions are majorly (54%) influenced by other farmers, 46% make farming decisions based on own understanding while only 22% use extension information in making farming decisions. The authors found out that, only farmers who belong to social groups majorly farmer based benefit from extension services, while government institutions like ATC through government policy on demand driven approach to extension, requires that individual farmers or farmer groups seek extension services from the institution. This disadvantages majority of the smallholder farmers especially those who cannot be able to sustain group or institution conditions for them to benefit from extension services. Therefore, majority of the farmers learn from their peer or fellow farmers who might not be equally well informed. Other farmers farming decisions are based on their own trial and error. Similarly, other findings indicated that some farmers in Busia County receive extension information through different organisations like One Acre Fund, but do not use the information in making farming decisions. This was because farmers find extension information too technical for them to understand and apply.

Similar findings were reported by Klopper et al., (2006), that while seasonal weather forecasts are developed and disseminated, very few farmers use them in making farm-level decisions. Weather services have always fallen short of meeting user needs in agriculture and allied sectors. Major barriers to their use in decision-making include their perceived low reliability, and their coarse spatial resolution in relation to the needs of individual farmers. Besides, the forecasts are often disseminated in an untimely manner, do not regularly reach smallholders, and are in forms that are not readily understood (AGRA, 2014). Further, one of the major handicaps of farmers and other intermediaries along the agricultural information chain has been the limited capacity to incorporate weather and climate information – and related early warnings – into farm-level decision-making (AGRA, 2014). However, Busia County has several government and non-governmental organizations involved in climate change adaptation at the local level. Despite this, effectiveness of the key institutions is limited by lack of integration and collaboration between non-governmental and governmental organisations limiting their effectiveness at the local level. Often in Busia County, organisations work in the same areas and duplicate programs (MoALF, 2016).

Nevertheless, Busia County has several government and non-governmental organizations involved in climate change adaptation at the local level, but the effectiveness of the key institutions is limited by lack of integration and collaboration between non-governmental and governmental organisations. This limits their usefulness to the recipient farmer at the local level. Often in Busia County, organisations work in the same areas and duplicate programs, limiting the stretch of extension service (MoALF, 2016).

V. Conclusion And Recommendation

The capacity of a household or individual to adapt to climate change impacts is reflective of the available resources and processes that assist in adaptation. The mean adaptive capacity shows that smallholder farmers in Busia County have low (2.4) financial/economic adaptive capacity, and moderate social (2.8), institutional (2.8), knowledge and information (2.5), technological/innovative (2.7),and informed farming decision making (2.7) adaptive capacities. The low financial and economic resource may be due to overreliance on climate sensitive rain- fed agriculture that is largely affected by erratic rainfall in Busia County. Therefore, the low financial and economic capacity among the smallholder farmers in Busia County reflects their limited ability to deal with and adapt to climate change effects. This affects smallholder farmers' ability to plan, prepare for, facilitate and implement adaptation measures. The study recommends that development and climate change efforts should focus on creating awareness on climate change and also diversification of on-farm and non-farm livelihood activities. This will help to diversify household livelihood sources, thus increase their income, and reduce poverty and food insecurity, lessening their vulnerability to climate change.

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