



## Livelihood Activities in Sub-Saharan Africa: Applying Entrepreneurship and Innovation for Climate Change Adaptation

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### **Abstract**

In Sub-Saharan Africa and other developing regions of the world, rural communities have relied on diverse activities to earn income for their households to survive. These activities which are mostly informal, have provided casual and seasonal employment and livelihood opportunities for rural communities to cope during times of hunger and deprivation. Livelihoods activities comprises of capabilities, assets and activities required for a means of living. Some of the common rural livelihood's activities include but are not limited to, cropping and livestock rearing, gardening, street vending and home construction. Unfortunately, in recent times, climate change has emerged as a challenge for not only the socio-economic setting of the poor communities, but for the whole sphere of living, particularly in rural areas. Climate change is comprised of long-term shifts in temperatures and weather patterns leading to unprecedented high levels of temperature, extreme episodes of flooding, heat waves, and drought, just to mention but few. Consequently, the complex nature within which the rural income earning activities and livelihoods are found, and how such activities are dependent on the environmental characteristics and the climatic conditions of a given area, makes it more difficult to pursue. The purpose of this paper is to discuss the role of entrepreneurship and innovation in climate change adaptation and its implications for rural development planning. This theoretical paper discusses how livelihoods activities can form a base for innovation and entrepreneurship development in rural areas. Case studies from few sub-Saharan countries are used to demonstrate the application of this. The paper argues that rural livelihoods activities in Sub-Saharan Africa can be developed through innovation towards entrepreneurial success. Entrepreneurship as a strategy for rural development planning and climate change adaptation can intensify potential of absorbing a growing rural labour force, slowing rural-urban migration; contribute to national income growth, and promoting a more equitable distribution of income (Crick, Gannon, Diop and Sow, 2017). The paper concludes that, for rural livelihoods to become economically viable, innovation need to be applied which can be built towards entrepreneurship development and contributes to climate change adaptation and rural development planning. Furthermore, the paper recommends planning and policy directives towards rural development planning in sub-Saharan Africa.

**Keywords:** *Livelihoods; Climate Change Adaptation; Innovation; Entrepreneurship; Rural Development Planning; Sub-Saharan Africa*

## ***Introduction***

Humanitarian crises associated with environmental conditions on the African continent, such as serious and sustained droughts, flooding and heat waves has added to the extreme vulnerability of people and communities in rural developing economies (United Nations, 2008; Nagler and Naude, 2014; Osabutey, Williams, and Debrah, 2014; Seline, Meijer, Catacutan, Ajayi, Sileshi & Nieuwenhuis, 2014; Connolly-Boutin and Smit, 2016; Gontareva, Chorna, Pawliszcz, Barna, Dorokhov and Osinska, 2018). Climate change is one of the most devastating crises which does not only affect the social, economic, and environmental spheres of rural communities but the entire ecosystems particularly in rural areas of the Sub-Saharan Countries. Devastating shocks associated with climate change act on communities whose vulnerability is affected in part by poverty and weak institutional support and can have devastating consequences for people's food security and livelihoods. Ironically, the adaptation innovations and abilities to climate change are concentrated in limited countries whose impact of climate change are not as severe as SSA countries. These industrialised countries such as China, Germany, Japan, the Republic of Korea, and the United States possesses stronger technological capacities whilst they face lower adaptation needs yet have the most access to adaptation innovation (Glachant, 2020). In developing countries, the impact of climate change may include direct damage to infrastructure and disruption to production processes, and indirect through disruption to supply chains, and changes in regulation and disruptions of livelihoods markets (Abegunde, Sibanda and Obi, 2019; Oluwatayo, 2019; Dosso, 2022; Glachant, 2020; Kuyah, Sileshi, Nkurunziza, Chirinda, Ndayisaba, Dimobe and Öborn, 2021). Much of the literature generated over the last few decades suggests that there is a strong link between technology, innovation, and economic development. Innovation is central to the challenges facing SSA and there is a need for public policies to lead innovation in a rural context if rural development is to be facilitated and adaptation to climate change was to be achieved. This will assist rural communities to unlock the potential of livelihood activities to develop towards innovative entrepreneurial adventures (Stathopoulos, Psaltopoulos and Skuras, 2004; Owusu, 2007). The purpose of this article is to discuss the role of entrepreneurship and innovation in climate change adaptation and its implications for rural development planning. In presenting the argument for this paper, the discussion begins looking at the overview of Rural Livelihood activities and Climate Change Challenges in SSA. This is followed by a presentation of Entrepreneurship and Innovation activities for Rural Development and Climate Change Adaptation. Case Studies in Sub-Saharan Africa are then discussed as evidence of some exemplary innovation activities in the region, followed by an argued conclusion and way forward.

## **Overview of Rural Livelihood Activities and Climate Change Challenges**

In most Sub-Saharan African countries, agriculture remains the way of life and continues to be the focal source of livelihood and employment for most people. According to IFAD (2011), smallholder agriculture and subsistence farming predominate the sector with limited involvement in other household enterprises. Accordingly, more than 80 per cent of households are dependent on farming employment, thus farming contributes significantly to household income and livelihood (Alemu and Adesina, 2017). In other words, most farmers in rural Sub-Saharan Africa are small holder and subsistence farmers who rely on these activities for not only food security but also income. These small-scale farmers carry out their agricultural production on fragmented portions of land, which are in most cases degraded and susceptible to erosion (Alagidede, Adu, and Frimpong, 2016; Oluwatayo, 2019; Dosso, 2022; Glachant, 2020; Kuyah et al. 2021). Poor farming practices and other climate variables have resulted in poor soil fertility, thus giving rise to low productivity. Furthermore, Seline et al. (2014) highlight that, farmers depending on subsistence agriculture are most vulnerable to the effects of environmental degradation and climate change since their lack of economic resources restricts access to alternative livelihoods. It has been difficult for rural farmers to increase their agricultural yield because they lack provision of inputs, technology, and extension services which are more accessible to commercial farmers. To make matters worse, these rural small scale and subsistence farmers rely on rainfed farming practices which are

dependent on climatic conditions. It is estimated that the livelihoods of 70% of Africans are dependent on rain-fed agriculture (Connolly-Boutin and Smit, 2016; Gontareva et al. 2018; Abegunde et al. 2019). Consequently, climate change has shortened and disrupted growing seasons, reduced areas suitable for agriculture, and contributed to decline in agricultural yields in many regions of sub-Saharan Africa. Climate change manifestation through extreme episodes of droughts and flooding has disrupted the ability of households to grow crops and rear livestock. These two are the most common livelihoods that most people depend on in these areas. Interruptions in livelihood development are having a far-reaching impact on food security in these areas. Whereas households were able to grow their own food and sometimes trade surplus, climate change has disrupted these processes and exposed communities to food insecurities. Climate change is a problem that all countries are faced with, the costs and benefits of rising global temperatures tend to vary across countries and regions (Madzivhandila and Niyimbanira, 2020). However, most studies indicate that poor countries, particularly those in SSA bear the brunt of climate change. Climate change is an emerging stressor that is experienced over longer time frames via changes in climatic norms and over shorter periods via changes in the frequency and severity of extreme weather events (Osabutey et al. 2014; Seline et al. 2014; Connolly-Boutin and Smit, 2016; Gontareva et al. 2018). Connolly-Boutin and Smit (2016) argue that in SSA, the impact of climate change are severe because of multiple biophysical, political, and socioeconomic stresses. In KwaZulu Natal, South Africa for example, the impact of the recent flooding disaster was exacerbated by weak organizational support and limited adaptation capacity (Madzivhandila and Maserumule, 2022). The overwhelming reliance on agriculture and other climate-sensitive sectors for production as well as the limited capacity to respond appropriately to climate-related shocks tends to expose SSA to the extreme impact of Climate Change. To remedy the situation, it is important that the relationship between climate, food, and livelihoods is well understood. Comprehension of this will assist to devise practical initiative and solutions which are policy guided and can be implemented with limited challenges. This paper proposes the adoption of innovation and entrepreneurship as a strategy for livelihood, rural development, and climate change adaptation in Sub-Saharan Africa.

### **Entrepreneurship and Innovation for Rural Development and Climate Change Adaptation**

When proposing new approaches to rural development in Sub-Saharan Africa, there are multiple obstacles and challenges one is faced with. The situation is even worse now that there are complexities associated with the emergence of climate change. Already, most SSA countries are struggling with the triple threat of poverty, unemployment, and inequality. Government systems and policy initiatives are also found to be weak in these countries. Unfortunately, SSA's still faces challenges of human development and technology transfer (Osabutey et al., 2014) which are required to create conditions necessary to promote rural development. Other challenges include lack of skilled labor and basic infrastructure; the predominance of low value-added activities; the informality; and the highly volatile markets and socio-political conditions (Adhikari, Bonney, Woods, Clark, Coates, Harwood and Miles, 2018). Agriculture sector for example which has a lot of potential to grow sustainable livelihoods is also found to remain at minimal levels in SSA. IFAD (2011) highlighted that the increase in agricultural yield does not sustain in SSA due to weak entrepreneurship and innovation in terms of market value addition and expansion of agribusiness and linkages to global chains. In other words, rural transformation remains slow owing to weak market orientation and entrepreneurship development in this region. Knowledge constraint, especially lack of information on technology, and poor infrastructure also contribute as major barriers to innovation and knowledge search for SSA (Amankwah-Amoaha, Osabutey and Egbetokun, 2018). To address some of these challenges it is important to establish determining factors to create a conducive environment for innovation and entrepreneurship for growth and development.

One of the most important determinants for innovation to succeed is the attributes of the place of implementation. The characteristics of places shape the success or lack thereof innovative activities and have consequences for productivity growth. It is important to build place-based innovation capabilities if development is to be achieved and productivity growth is to be sustained. Support in terms of incentives,

resources, knowledge, and skills are also imperative to the process of rural development and climate change adaptation. UN (2008) argue that, in SSA, local innovations can have positive regional-wide impacts if there are effective communication and information-sharing channels to spread knowledge widely. This is seldom happening across SSA and sometimes even within countries in SSA. The required entrepreneurial capacity building and business development skills for policy support is minimal (Nagler and Naud, 2014a). It is thus important that building of social capital such as networking, trust, and networks among individuals with several market actors are enhanced to contribute towards innovation and entrepreneurship development (Stathopoulou et al., 2004). For instance, communities should be assisted to secure adaptation measures such as installation of flood protection measures and investing in infrastructure to protect farming assets and processes. For agriculture prone communities, building of networks such as farmer associations, cooperative formation and marketing contracts is also important to transform their activities into entrepreneurial opportunities and ventures. Most importantly, considerations need to be made to embrace technology into rural development activities. Technology plays a vital role in fostering innovative opportunities and entrepreneurship growth in developing countries. Growing body of knowledge suggests that technology has potential to unlock the potential of African industries and foster entrepreneurial development (Amankwah-Amoaha, et al. 2018). In other words, the extent to which technologies are developed and made globally available significantly shape the “new normal” of life beyond agriculture in rural areas of SSA. It is undeniable that most of technological innovations and endeavours are developed in global north, which is ironic as majority of the communities affected by climate change, and who desperately require adaptation are found in developing countries particularly those in SSA. Consequently, Cross-border transfers of innovations and inventions for climate change adaptation predominantly occur between the small group of countries whose impact of climate change stressors is not as severe as the ones in SSA (Glachant, 2020).

SSA requires technologies that increase resilience to climate risks and extremes, such as new irrigation systems, advanced weather forecasting tools, and more-resilient crop varieties. Particularly those who rely on agriculture related livelihoods. The concept of smart agriculture is also applicable for this purpose. Abegunde et al. (2019) argue that climate-smart agriculture (CSA) is a great and credible alternative to tackle food insecurity under the changing climate. The activity of this strategy focuses on three main goals, that is, sustainable increase in agricultural productivity to enhance income levels, food security, and development; climate change adaptation and resilience from the micro to the macro level; and a reduction or total removal of greenhouse emissions where possible. This is done by applying modern activities which ranges from soil and water management, crop production, urban agriculture, rangeland management and agro-processing. Other modern climate smart agriculture initiatives include agroforestry, cereal-legume intercropping, conservation agriculture, doubled-up legume cropping, fertilizer micro-dosing, planting basins, and push-pull technology. Madzivhandila and Niyimbanira, (2020) however argues that for rural development to succeed and to diversify activities beyond agriculture in SSA, other non-farm activities need to be considered. Rural non-farm enterprises are non-agricultural activities which generate income to rural households through self-employment (Davis and Bezemer, 2004). These activities serve as income diversifying strategies for the household in rural areas. Most rural innovations and entrepreneurial ventures are derived from these activities. Thus, rural entrepreneurship ventures are praised for transforming and revitalizing the rural economy in that they improve value creation, create employment opportunities and fosters market linkages. The facilitation of these activities and other rural innovation ventures could play an essential role in this process of achieving long term rural and sustainable development. The next section provides few case studies to demonstrate the extent within which rural innovation and entrepreneurship development could play a major role in rural development and climate change adaptation.

## **Case Studies in Sub-Saharan Africa**

Many countries across the globe are engaged on research and development to devise measures to not only tackle poverty but to adapt to the impact of climate change. In these countries, one of the most

common endeavors is development of modern contemporary innovations to deal with these challenges. In most cases, local sustainable development initiatives and innovation processes have engendered learning processes that go well beyond these activities, pointing the way to solutions of national or regional significance. UN (2008) defines innovation as the “embodiment, combination or synthesis of knowledge in original, relevant, valued new products, processes or services”. In modern economies this can include the way business is done, production organized, a supply chain structured, financial resources distributed, or essential services provided. At community level it involves households, utilizing locally owned knowledge to create activities which can then be disseminated to other communities and transferred to other initiatives (UN, 2008). For instance, many farmers in SSA, especially those in areas with lower rainfall, have substituted crops requiring a high level of water with those requiring less water for cultivation. Farmers in areas with frequent flooding have shifted to short-cycle crops, applied crop diversification, and changing plant days (Abegunde et al. 2019). Because of investment in R&D some farmers in South Africa are creating and adopting drought resistant crop varieties of staple food such as rice, maize, and legumes (Kuyah et al. 2021). In addition, a new variety of maize has been developed at the University of Cape Town that is resistant to the maize-streak virus, an insect-borne disease (UN, 2008). Below is few case studies of innovation and local community based entrepreneurial activities to promote rural development and climate change adaptation in SSA.

### **Adoption of Zai Technology in Ghana, Burkina Faso, and Niger**

Zai technology is one of the most prominent applications for land restoration in agriculture practices (UN, 2008). The technology which is also known as ‘tassa’ by the communities of Tahoua region of Niger is an example of local practices which has replaced the traditional ‘flat planting’, in Burkina Faso, Niger and Ghana (Ehiakpor, Danso-Abbeama, Dagungaa, and Ayambila, 2019). Introduced by local farmers in Burkina Faso in the early 1960’s, this traditional rehabilitation technology has assisted communities in recovering their degraded land, cope with drought and conserve soil moisture. Some of the English terms of the technology include the “planting pockets,” “planting basins,” and “micro pits,” . This technology is applied to enhance water and nutrient use efficiency, resulting in increased agricultural production. For example, the increase in millet yield in Burkina Faso and Niger was around 4 and 6 times, respectively, compared to the control (UN, 2008). Zai also rehabilitates degraded farmlands and restores soil fertility to the benefit of farmers dwelling mostly on drylands. Furthermore, the technology helps to combat the adverse effects of soil moisture stress, collect, and concentrate water at the plant base and create a micro-environment that helps increase drought resistance, and improve microbial activities. Ehiakpor, et al. (2019) posits that, the application of this innovative technology, leads to significant gains in consumption expenditure, consumption expenditure per capita, and household income. In Burkina-Faso, Ehiakpor, et al. (2019) revealed that the practice of the technology led to significant improvement in yield, the food security situation, and welfare of farm households. Whist in Ghana, the technology is regarded as a strategic tool to promote food security, thus contributing to the achievement of the Sustainable Development Goal of curbing hunger and poverty in developing countries. The world Bank reported that, if well managed, the application of the technology could increase output by 500% in SSA.

### **Community-run Marine Protected Area (MPA) in Madagascar**

The impact of climate change on livelihood activities of rural communities in SSA cannot be overstated. In Madagascar, climate change and the associated El Nino phenomenon have resulted in severe coral bleaching events representing the single greatest natural threat to reef systems (Harris, 2007). Due to this phenomenon, local fishers have reported observing marked declines in catches over the last few decades. To respond to this, community devised ways to rescue their livelihood activities through application of innovative activities (UN, 2008). Witnessing the growing threats to the region’s coastal ecosystems, the village of Andavadoaka decided to take control of its marine resources. This community understood that that the livelihoods and economic security of community members are inextricably linked



to the health of local marine ecosystems. Thus, they developed and launched community managed marine zones. The network of community run marine and coastal protected areas are aimed at benefiting more than 10,000 people and protect coral reefs, mangroves, seagrass beds and other threatened habitats along Madagascar's southwest coast (Harris, 2007). UN (2008) posits that, in fisheries, the activities in the village of Andavadoaka in Madagascar one of the greatest examples of innovative local efforts to sustain livelihoods and promote rural development. These innovative activities have ensured that octopus, the region's most vital commodity, would remain a viable resource for years to come. The activities of the MPA's is to protect marine and coastal biodiversity while improving livelihood sustainability in the region. Fishing is the primary economic activity for 71% of villagers in Andavadoaka, thus it was important to be innovative to secure sustainability of this process (UN, 2008).

The communities of Andavadoaka and surrounding villages have also understood that the livelihoods and economic security of community members are inextricably linked to the health of local marine systems. Some of the applied activities include short - term closures of reef flats to octopus fishing to increase in the number of octopuses fished once a closed area is reopened (UN, 2008). To do this, village elders and local fishers combined traditional knowledge with fisheries science to implement seasonal fishing bans and allow octopus to grow in size and number. The strategy ensures long-term survival of octopus and greater yields for local fishers when the bans are lifted. The results of this, is the significant increase in octopus fishing yield and mean size (both factors helped increased earnings of fishers) (UN, 2008). The observed increase in mean weight brought about by the closures means that fishers, who are paid by the kilogram of wet weight of octopus, increased their earnings, thus growing their small businesses. This has also assisted in terms of introduction of commercial markets for fresh fish, as opposed to the traditional dried and salted fish market. The increase in the value and exploitation rates of target species such as the reef octopus has been accompanied by a change in recent years from a largely barter and subsistence economy to a fisheries-driven cash-based economy. This has also increased several local entrepreneurs who are now trading beyond their localities.

Other examples of innovation which sustains the livelihoods of rural communities include the bee keeping initiatives in Kenya, Turning Waste into Energy and Fertiliser in Nigeria and innovative tourism development in South Africa, Tanzania, and Sierra Leone just to mention but few. To accelerate the benefits of these efforts it is important that rural development planning and policy development in SSA should be refocused.

## ***Conclusions and Way Forward***

It is evident with the few examples above that efforts to bring about change and development through innovation in SSA exist. It even more appealing that the whole continent of Africa has significant growth prospects as it is host to the world's youngest population and has tremendous resources. What is important for these countries is putting efforts to establish innovation ecosystem comprises of two distinctive features, research development and market prospects for goods and services. Local startup ecosystems have never been so blooming and interconnected, thanks to a rapid adoption of information and communication technologies (ICTs) (De Jager, Mthembu, Ngowi and Chipunza, 2017). Technology is playing a huge role to not only provide for systems to facilitate development, but also to provide connections and online markets for business start-ups and entrepreneurs. This is also linked to establishments of innovation hubs which are increasingly attracting funding for the implementation of entrepreneur and business support-oriented programs. Innovation hubs also provide for onsite and online value-adding services, including incubation and scaling-up support, coaching and mentoring sessions, financial literacy and networking, and financing facilitation just to mention but few. Governments in SSA countries such as South Africa, Kenya and Rwanda have been investing in enhancing technology options to facilitate societal involvement and improving educational infrastructures for innovation. Furthermore, important ingredients such as material resources (funds, equipment, facilities, etc.) and human capital

(students, staff, associate researchers, etc.) that make up the institutional entities participating in the ecosystem of innovation are also visible in these areas. What is important is that these initiatives should not only be developed in urban spaces of these countries but extended towards rural areas which more affected by poverty and require consolidated efforts to respond to the impact of climate change.

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