



# Climatepreneurship: Adaptation Strategy for Climate Change Impacts on Rural Women Entrepreneurship Development in Nigeria

C. A. O. Akinbami

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## Abstract

Adequate and proper adaptation strategies to climate change depend largely on activities in the rural sector, which drives national economy through exploitation

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of natural resources. Consequently, actions in rural areas are essential to successful climate change adaptation. Rural communities are highly dependent upon natural resources that are affected by climate change, thus affecting their food security, livelihoods, health, and physical infrastructure. Women and their livelihood practices are thereby affected negatively, leading to increased poverty level and low income, because they find it difficult to respond adequately to climate change effects. This study examines the past and existing interventions on climate change adaptation strategies in two rural communities in Oyo State, introduces climatepreneurship strategy, and assesses its effectiveness. This is an explorative study, employing qualitative approach to gather information through in-depth interview (IDIs) from 50 farmers, before and after the interventions. Data collected were analyzed using Atlas ti. This is a powerful workbench for qualitative data analysis using coding and annotating activities to generate different thematic issues for discussions and interpretations with networks. Study revealed that communities had previously experienced some interventions. Such had no impact on livelihood practices because steps to successful intervention were not followed. Socio-cultural practices hinder women development. The newly introduced climatepreneurship strategy improved livelihood practices. Study outcomes will expectedly be integrated into policy framework for sustainable rural women entrepreneurship development and also replicated in other rural areas in Nigeria.

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**Keywords**

Climatepreneurship · Adaptation strategies · Climate change · Rural women · Entrepreneurship development · Nigeria

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**Introduction**

In recent years, the terms viable adaptation strategies and climate resilience have become important concepts for both scholars and practitioners working on climate change. This progress reflects a growing interest from various disciplines in a holistic understanding of complex systems, including how societies interact with their environment and adapt to the increasing effects of climate change. This new lens offers an opportunity to focus on communities' ability to prepare for and adapt to the challenges posed by natural hazards and the mechanisms/strategies that have been developed to cope and adapt to threats. This is important because repeated stresses and shocks still cause serious damages to communities across the world, despite efforts to better prepare for disasters. This is especially relevant to the rural communities that are highly dependent upon natural resources which are affected by climate change, thereby affecting their economic activities, food security, livelihoods, health, and physical infrastructure.

Women in particular and their livelihood practices have become highly vulnerable. They face various challenges from effects of climate change such as drought,

delayed rainfall pattern, heat wave, flood, etc. According to Howden et al. (2007), agriculture as a major economic, social, and cultural activity of most women, particularly in the rural areas, provides a wide range of ecosystem services. The sector is saddled with the responsibility of meeting the projected growth in human population and per capita food demand. Unfortunately, this sector remains highly sensitive to and affected by climate variations. The economic activities are therefore affected negatively, leading to increased poverty level and low income, because the rural women find it difficult to respond adequately to climate change effects.

Many studies have argued that climate change and its effects are clear, escalating and will continue to be a contending issue around the world, because enormous quantities of greenhouse gases (GHGs) have been released into the atmosphere over the past decades through anthropogenic activities (UNDP 2010; Adesina and Odekunle 2011; IPCC 2014, 2015; Salami 2010). According to Dube and Phiri (2013), climate change is now a well-accepted reality with emerging evidence that climate change poses a massive threat for development especially in poor countries. Also, Sadashivam (2010) reported that climate change is a global and regional environmental problem faced by humanity and livelihoods with strong implications for rural populations, particularly women. Kumar and Sharma (2013) analyzed the impact of climate change on agricultural productivity and submitted that variation in climate affects food grain and non-food grain productivity and other livelihood practices. This is due to the fact that climate change often alters the physical geography of an area leading to a disappearance or reduction of natural habitats that constitute the livelihoods of the women. Declining precipitation and rising temperatures are making farming increasingly more difficult with declining productivity, and thus aggravating food insecurity.

In Nigeria, Nwokeoma et al. (2017), Ikehi et al. (2014), Akinbami et al. (2015, 2019), and Ali (2011), have reported on the effects and social consequences of climate change on the farming families, livelihood practices, farmlands, economic activities, food security, health, and physical infrastructure in various communities in the country. These studies reveal that global warming which is as a result of climate change has serious impacts on the communities and their livelihood practices, and these effects will spiral out of control, if the current trend of increasing greenhouse gas emissions is not curbed. This will bring about more natural disasters, increased declining livelihood practices, worsened global food supply, and also threaten the existence of millions of people, with a disproportionately high impact on the impoverished and indigenous populations, particularly, the women. Therefore, there is a need to continue to pursue climate change mitigation and adaptation strategies with vigor (IPCC 2014).

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## **Climate Adaptation Strategies Among Rural Women in Nigeria**

Some studies have documented various adaptation strategies geared toward economic development of women in Nigeria (Ikehi et al. 2014; Abid et al. 2015; Etim and Etim 2019) such as planting date adjustment, crop diversification, conservation

agriculture, and crop and livestock integration. However, according to Yilmaz (2014) and Etim and Etim (2019), many interventions have failed due to low awareness level and lack of proper involvement of stakeholders, inappropriate non-local technologies to the areas affected, and improper communication of interventions and implementation as the top-down approach was adopted, without the participation of community members. Howden et al. (2007) also alluded that there are many potential adaptation options available with substantial benefits only under moderate climate change for some cropping systems and are therefore not very effective under more severe climate change. In addition, most interventions lack long-term plan for monitoring and sustainability.

In order to build the resilience and sustainable development of women across the whole disaster cycle, involvement of communities in identifying problems (community communication) and involving them in addressing the identified problems become key factors to be considered in determining information-based adaptation strategies that are borne out of earlier sensitization programs. This is more of a bottom-up rather than top-down approach. It is believed that this approach will reduce the impacts of climate change as well as disaster-related losses and lead to faster recovery and the ability to “build back better” (Cutter et al. 2008).

Joo et al. (2011) further expatiated on steps that will aid sustainable development through implementation of interventions as (a) identifying key performance measure for the intervention by creating a plan to know the community to have an idea of their problem, attitude, and behavior; (b) measuring own’s internal performance level by how you have to be knowledgeable about the identified intervention and able to gather a team of experts to handle the identified problem and work on the actual and appropriate intervention; (c) identifying intervention advantages and disadvantages, process, and training models and materials; and (d) implementing intervention to close a performance gap by holding meetings and executing all the planning that have been done and importantly, follow through to achieve successful implementation which is monitored thereafter.

Therefore, in responding to the need of implementing appropriate measures to address the severity of climate-related hazards among Nigerian rural women, adequate and effective adaptation strategies are necessary to handle the effects of climate change. Such strategies will integrate the findings of climate change risk assessments into planning processes for disaster risk reduction and management and embrace methods that are climate smart and able to turn climate change challenges to entrepreneurship opportunities, thereby reducing poverty among the rural women, in particular, hence, the introduction of climatepreneurship.

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## **Climatepreneurship and Other Smart Strategies**

In literature, scholars had conducted studies on smart strategies and termed differently, such as agri-preneurship, ecopreneurship, etc. Agri-preneurship, according to Ashe (2019), is a new measure taken by developing economies utilizing various forms of technological tools and methods to tackle farm yield, which is sometimes

referred to as smart farming. Pai, Shah, and Bohara (2020) also stated that, as the effects of climate change and population growth resulted in high food demand, smart farming is now being adopted. Agri-preneurship comprises of some farming methods such as geo-mapping, greenhouse farming, hydroponics, nutrient cycling, and soil analysis that could address the issue of low farm yield in developing economies (Ariani et al. 2018).

Ecopreneurship was seen as an answer to market breakdown in dealing with negative environmental impacts caused by the industries by focusing on underlying green values and solving the problems in the society caused by these businesses (Kirkwood and Walton 2010). That is, business activities should be geared toward providing values across three dimensions: economic, social, and environmental. Priority is given to addressing the effect of the negative externalities of firms' economic activities on these firms' immediate surroundings (Doman'ska et al. 2018). The goal is, therefore, to build a business model that is sustainable in the long run which ecopreneurship contributes to achieving this goal by seeking simultaneously for both profit and environmental sustainability (Rekik and Bergeron 2017). The concept of ecopreneurship is based on three pillars: innovation, caring for the environment, and long-term sustainability (Hultman et al. 2016).

Climatepreneurship is an adaptation strategy to climate change effects which consists of activities that are climate smart and make use of locally available resources for economic empowerment and enhancement of the social status of rural women. It also helps to turn climate change challenges into opportunities, and thereby emphasizes livelihoods' diversification. This concept entails climate change, adaptation strategies, and entrepreneurship, while according to Omodanisi et al. (2020), smart agri-preneurship entails smart agribusiness, smart technology, and entrepreneurship. Entrepreneurship in agri-preneurship is defined as the means to create and develop a profitable agribusiness, while in climatepreneurship, it is a means of turning climate change challenges into business ventures in all livelihood practices, as well as developing profitable agribusiness by adopting adaptation strategies. That is, agri-preneurship deals with ways of increasing farm yield, while climatepreneurship deals with climate-related issues as they affect the livelihood practices and more importantly, turning the challenges of climate change to various business ventures. On the other hand, ecopreneurship deals with the means of carrying out entrepreneurial activities in order not to affect the environment negatively.

Though, the concepts are geared toward achieving sustainable development and reducing starvation among the populace, climatepreneurship goes a step higher by introducing livelihood diversification, exposure to the use of natural resources in the local environment, and turning climate change-related challenges into business opportunities as a major adaptation strategy (Rehman and Shaikh 2014; FAO 2011). Agri-preneurship can therefore be seen as a subset of climatepreneurship aimed at increasing farm yield and enhancing food security in an eco-friendly manner (FAO 2018; Lin et al. 2015; Omodanisi et al. 2020; Ponisio and Ehrlich 2018; Adebisi et al. 2018). Succinctly put, climatepreneurship is an adaptation strategy to climate change effects which consists of activities that are climate

smart, eco-friendly process, and making use of locally available resources for economic empowerment and enhancement of the social status of rural women. It also helps to turn climate change challenges into opportunities.

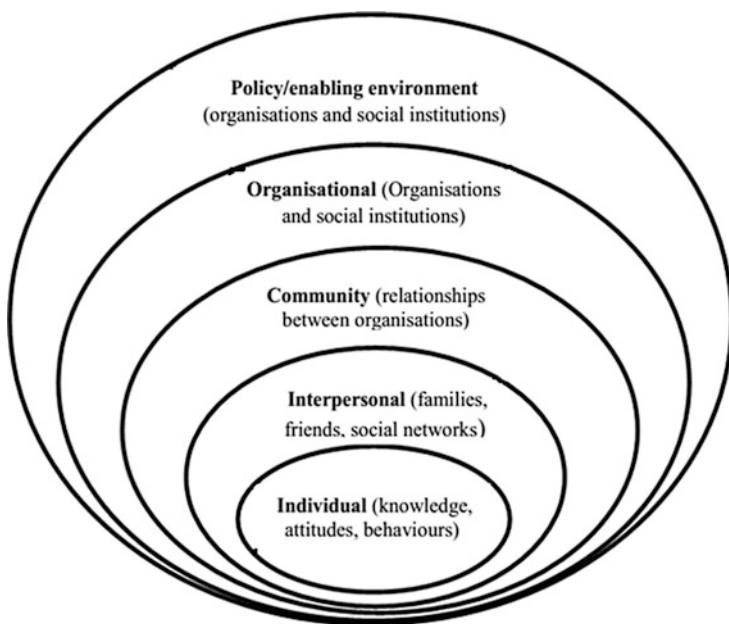
Thus, climatepreneurship can be regarded as a viable and significant option to safeguard rural livelihoods and ensure rural sustainable development. Hence, this study on climatepreneurship, which presents viable adaptation strategy for addressing climate change, impacts women entrepreneurship development in Nigeria. It aims to examine the past and existing interventions and assess the effectiveness of implemented climatepreneurship strategy introduced by this study among rural women in selected communities in Oyo State.

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## Theoretical and Conceptual Framework

### Theoretical Framework

This study is anchored on socio-ecological system approach which sees a community as a coherent system of biophysical and social factors that regularly interact in a resilient, sustained manner and are linked systems of people and nature, emphasizing that humans must be seen as a part of, not apart from, nature (Berkes and Folke 1998; Redman et al. 2004). The socio-ecological model (SEM), therefore, provides the framework for understanding the interactions between the multiple levels of a social



**Fig. 1** Socio-ecological theory. (Adapted from Bronfenbrenner (1989))

system and how behavior and attitude are thereby affected. The multiple levels according to SEM are individual, interpersonal, community, organizational, and enabling environment (Fig. 1). The main tenant of this theory is based on cooperation between individuals and environment within the system with emphasis on the model of communication for development (C4D), how to incorporate social norms and needs into program planning and partnerships to finally achieve capacity strengthening (CDC 2014).

Consequently, in this regard, adaptation strategies have been acknowledged as useful measurement to understand to what extent the intervention measures address the needs of people as end-users, to what conditions people are still vulnerable, whether the potential outcomes are expected or unwanted (MOVE D.5 2011; Yilmaz 2014). In this sense, it is important to monitor the effects of implemented strategies, especially in terms of observing how the affected communities adapt economically and socially.

### Conceptual Framework

The conceptual framework (Fig. 2) further explains the operationalization of the concepts in order to achieve positive results in the rural areas. The individual (rural woman) is the victim of climate change impacts, norms, and socio-cultural activities,

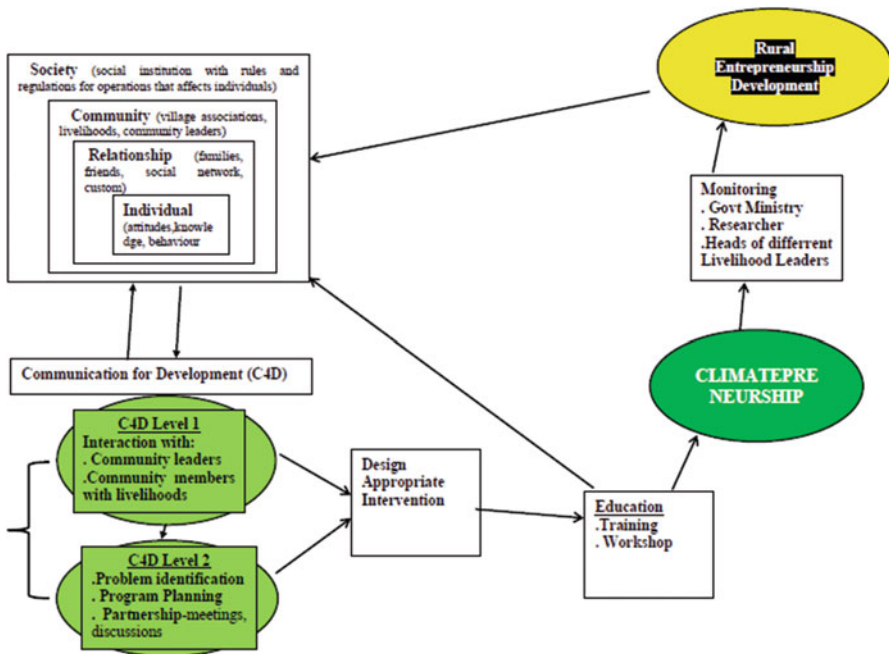


Fig. 2 Conceptual framework. (Source: Author)

and with low livelihood practice, who equally needs to change her own personal attitudes and beliefs toward climate change. Though, aware of the effects of climate change on her livelihoods but yet helpless because of the major and drastic changes in weather being experienced and leading to low farm yields and sales. Even though currently taking steps of engaging in moderate activities in order not to be idle, the poverty level is still on the increase. Having awaited help from government circle for so long, and now frustrated, the victim of the climate change impacts seeks for solution to the economic challenges. The community houses the relationships among institutions and informational networks within defined boundaries, which comprises of the total environment (social, economic, norms, and various association groups) as they affect the individuals reflecting gender specifics. The society at large dictates the enabling environment at the local, state, and national levels including policies that affect and regulate the choices the individual makes.

This framework underscores communication as a vital instrument for development, with the argument that livelihoods have been left to suffer as a result of non-involvement of the community members (i.e., partnership) in most of the interventions/programs that have at various times been designed for rural development. Consequently, the approach to the implementation of such programs had been top-bottom approach, and this has led to the failure of most of the interventions. If interactions through stakeholders meetings take place in order to identify actual problem and gain better understanding before planning a program, clarify limiting socio-cultural issues, designing appropriate training on handling and management of intervention, and establishing a monitoring team (as part of the monitoring and evaluation mechanism), then the designed program will definitely be successful, and the livelihoods of individuals will improve with poverty level reduced and eventually leading to sustainable development in the rural areas.

In essence, in order to reduce disaster and build resilient communities, the socio-ecological model should be an effective learning and assessment tool for the development of rural livelihoods. As the increasing new information and training on how to improve livelihood practices amidst impacts of climate change are gained, the employment of both bottom-top approach and partnership method will stir up a strong will among the rural dwellers to follow through with the new intervention (s) designed. The society and communities will directly be affected positively since both are collections of individuals.

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## Methodology

This study was carried out to determine the extent to which adopted adaptation strategies to climate change have impacted on the rural women entrepreneurship development in Nigeria. An assessment study (Akinbami 2015) had been carried out to determine the impact of climate change on the livelihood practices of women in the rural areas of some southwest States of Nigeria. Due to limited fund available for the interventions in this study, Oyo State and some of the communities in the State were purposively chosen based on the assessment report on vegetation zone and



availability of needed resources (Akinbami 2015) to pilot the implementation of the climatepreneurship strategy. This is an explorative study, employing qualitative approach to gather information through in-depth interview (IDIs) and questionnaire administration from 50 farmers, both male and female, before and after the interventions. This study adopted descriptive research design to examine the past and existing interventions in the last few years before the introduction of climatepreneurship strategy. The study area is in Oyo State which is in the southwest region of Nigeria.

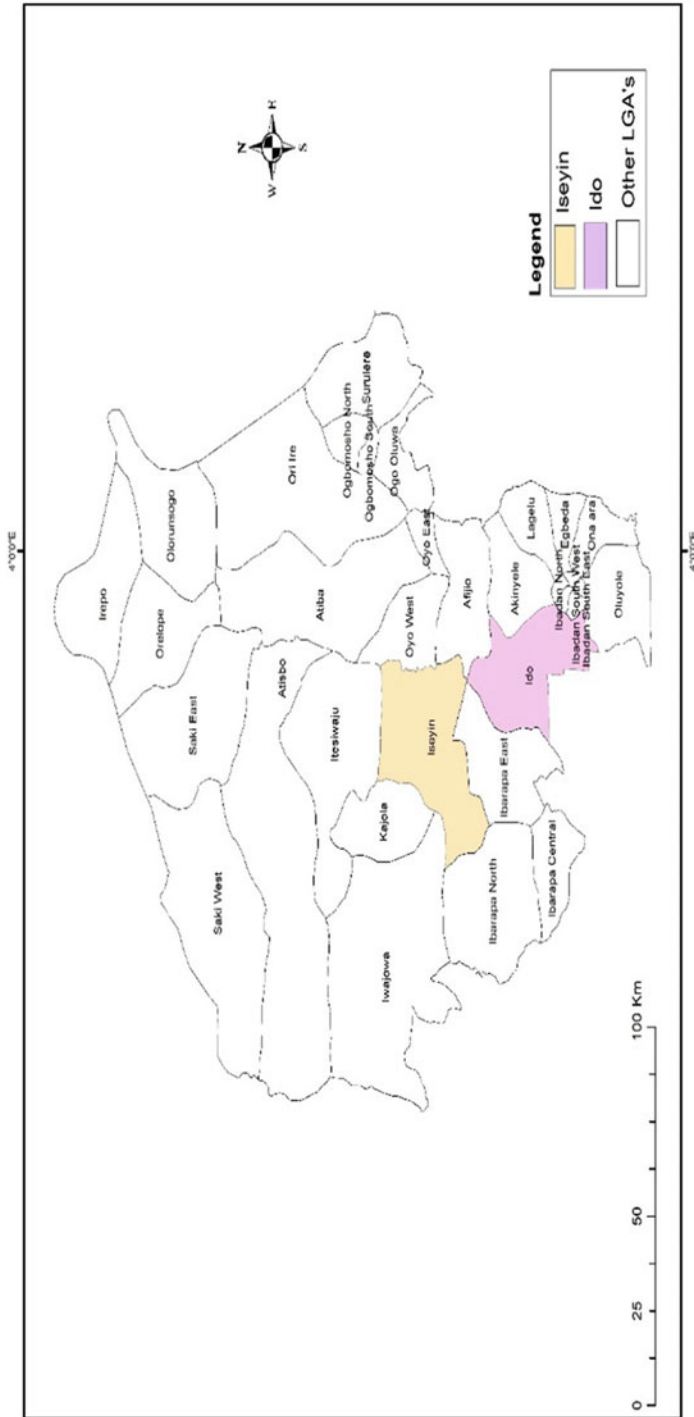
The study was carried out in two purposively selected communities – Araromi Idowu and Abokede Communities at Ido LGA, Ibadan, Oyo State, Nigeria (Fig. 3). The communities are made up of men and women whose different livelihood practices have been affected negatively by climate change. The target populations for this study are mostly women and few men involved in crop farming activities (cassava, maize, oil palm) and who were able to supply land space for planting. Pre-intervention interview was conducted only to participants who were able to supply up to an acre of land each. This was to capture necessary immediate situational experiences of the women and be able to compare with post-intervention interview.

Some men were also added for them not to view the project as just solely pro-women activity and a means of empowering the women against the men. This became useful in order to address the existing socio-cultural issues. The instrument for primary data collection was structured interview questions developed from literature reviewed for the study with inputs from the pre-intervention stakeholders meetings. The use of in-depth interview was to harvest the views and experiences of the respondents on the nature of perceived climate change impacts on their livelihood practices and previous interventions in their communities. The IDIs targeted participants who could provide up to an acre of land to accommodate intervention varieties, more for the purpose of monitoring and evaluation while the questionnaire was distributed among the other participants who showed interest in the intervention.

The project targeted 50 participants who had portions of land available and who were interested in participating.

The employed methodology involved some activities, such as:

- Community visitation and sensitization program.
- Meetings with different stakeholders in the communities to identify challenges.
- Distribution of improved drought-tolerant maize varieties and beta-carotene fortified cassava for planting.
- Distribution of hybrid oil palm trees (those who were able to supply up to an acre of land each) for planting,
- Training of women on entrepreneurship businesses in the oil palm tree products.
- Meetings with government parastatals saddled with women affairs, climate change, and agriculture in the State to intimate them with the objectives of the study and solicit their partnership and collaboration for its success.
- Facts finding workshop for all stakeholders involved in the study.



**Fig. 3** Map of Oyo State showing the Ido Local Government Area where the study areas are located

- Agricultural extension officers from the State Government were also part of the training exercise and workshop for effective monitoring of the intervention.

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## Data Analysis

Data collected were analyzed using Atlas ti. This is a powerful workbench for qualitative data analysis using coding and annotating activities to generate different thematic issues for discussions and interpretations with networks.

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## Result and Discussion

### Socio-Demographic Characteristics of Respondents

This section provides descriptive summary of the characteristics of the rural women and men entrepreneurs (18) gathered during IDIs, who were able to supply up to an acre of land each for the intervention in Table 1. However, the other 32 participants who showed interest in the exercise and with less than an acre of land were also accommodated by the intervention. The 18 participants reported in Table 1 were given drought-resistant maize, vitamin A-enhanced cassava, and hybrid oil palm trees. In addition, the intervention provided drought-resistant maize and vitamin A-enhanced cassava to the 32 participants (those with less than 1 acre of land) for planting on their farming space.

All the 18 participants were in the age range of 40–65 years (Table 1). Participants were mainly into crop farming involving planting of maize grains, cassava, and palm tree. All of the women were found to be involved in another occupation, such as food processing of garri (cassava-based Nigerian staple food); cassava and palm oil ventures; and sales of cloths, beverages, and other food items. While all the men had crop farming as their major economic activity, about 67% were not involved in any other economic activity. The table further revealed that about 20% of the men were into additional occupation of commercial transportation using their motor cycles, and it was observed that these are of the younger generation. About 10% of the men were involved in food processing as an additional economic activity.

Table 1 also showed their educational status; about 72% of the participants were not with formal education, 22% had only primary school education, and 6% were with secondary school education. About 96% of the participants had spent more than 15 years in crop farming business.

The age range of the other 32 participants is between 38 and 65 years, with 80% being women involved mostly in food processing, while the men (20%) were mainly into crop farming. It was observed that the educational status, awareness of climate change, and involvement in other occupational activities are the same as those respondents in IDI. The opinions of the respondents in both instruments are presented in the analysis.

**Table 1** Socio-demographic factors of participants during IDIs

Respondent	Age	Sex	Educational status	Occupation	Community	Years of farming engagement	Second occupation
Respondent 1	40	Female	Secondary	Crop farming	Abokede	5	Sales of provision
Respondent 2	60	Female	No formal education	Crop farming	Abokede	30	Sales of cloth
Respondent 3	50	Female	No formal education	Crop farming	Abokede	25+	Food processing (palm oil)
Respondent 4	40	Female	No formal education	Crop farming	Abokede	20	Food processing (palm oil, cassava)
Respondent 5	65	Female	No formal education	Crop farming	Abokede	30+	Food processing (palm oil)
Respondent 6	50	Female	Primary education	Crop farming	Abokede	20+	Sales of yam flour
Respondent 7	40	Male	Primary education	Crop farming	Araromi-Idowu	15	Commercial motor cycling
Respondent 8	52	Male	Primary education	Crop farming	Abokede	30+	None
Respondent 9	60+	Male	No formal education	Crop farming	Abokede	30+	None

Respondent 10	62	Male	No formal education	Crop farming	Abokede	30+	None
Respondent 11	55	Female	No formal education	Crop farming	Abokede	20	Food processing (palm oil)
Respondent 12	62	Female	No formal education	Crop farming	Araromi-Idowu	30+	Food processing (palm oil)
Respondent 13	42	Male	No formal education	Crop farming	Araromi-Idowu	30+	Commercial motor cycling
Respondent 14	57	Male	No formal education	Crop farming	Abokede	30+	None
Respondent 15	60	Female	No formal education	Crop farming	Araromi-Idowu	30+	Sales of dry maize
Respondent 16	50	Male	No formal education	Crop farming	Abokede	30+	None
Respondent 17	56	Male	No formal education	Crop farming	Abokede	30+	Food processing (palm oil)
Respondent 18	48	Male	Primary education	Crop farming	Araromi-Idowu	30+	None

Source: Study Survey

## Awareness of Climate Change and Impacts on the Business Activities

All the respondents (from IDIs and questionnaire) reported that they are aware of the changes in the weather recently. The participants stated that the changes had been observed through personal experiences and comments from colleagues as far back as 30 years' ago, and this has been confirmed by information from the radio programs they listened to on climate change. Their awareness cut across the elements of weather vagaries such as distortion of rainfall pattern, drought, sea level rise, temperature rise, and increase in humidity. They reported "as farmers, we have experienced hard times as a result of the changes, which ranges from delayed rainfall to increase in temperature and drought." Consequently, the communities have suffered some economic hardship and social consequences from impacts of climate change. Some of the responses of the respondents are:

There is too much heat, as a result, our crops, vegetables and other things planted do not do well. Sometimes, the farm products harvested are both too few in quantity and small in size that we do not have good quality crops to sell. This has increased poverty level in this community, especially among the women. **Female Participant, Abokede Community, 40 years old**

The weather has become so unfriendly, we as farmers do not have rains as at when due, the sun is too much, our crops therefore produce low yield. Ultimately, we have little to sell and are having poverty increasing in this community. **Male Participant, Araromi-Idowu Community, 42 years old**

This study outcome supports the work of Suleiman (2014) which stated that farmers had crops uprooted prematurely and destroyed due to harsh weather condition; as such, crops could not be taken to the market. They lost money that should have been gained.

This could be the reason why the younger-generation men in this study subscribed to another business (commercial transportation) because the pangs of impacts of climate change were being felt. The income generated from only farming activity was no longer enough to cater for their needs. These impacts had led to the increase of poverty level in the communities and particularly, among the women. It has further shown the relationship between climate change, livelihood practices, and community empowerment.

Also, due to the low level of education of the rural communities, participants could not process the information received into finding out the causes of climate change and what adjustments are needed to be made to improve the livelihood practices. Participants knew nothing about crop diversification strategy which could have helped to improve the livelihood practices. This study revealed the communication gap that exists between the rural areas and research outcomes. This submission is in line with FMENV (2010) which stated that programs, policies, and activities of the Ministry on climate change do not seem to have specifically targeted and involved farmers. Consequently, the farmers are exposed to hardship. In affirmation, participants from both communities stated:

We are hoping that help will come one day. Our community leaders know about our plight since we are in it together, unfortunately, they don't know what to do. **Female Participant, Araromi-Idowu Community, 62 years old**

We don't even know the cause of the change nor do we know the solution. **Male Participant, Abokede Community, 57 years old**

Participants could not produce any observed weather pattern based on the reported climate change, to help them know when and what to plant, that is, adjusting the planting calendar in order to adapt to the change in rainfall pattern, as stated by Ikehi et al. (2014) that "planting date adjustment" is one of the strategies that can be employed by the rural communities to cope with impacts of climate change. The study is also of the opinion that the low level of education of the participants may be a major factor responsible for this inability.

Participants declared that they have been coping through prayers. They perceived climate change as an act of God and not induced by the activities of man. They also said God has decided to punish man as a result of sin which is on the increase daily. This has affected their readiness and preparedness for mitigation and adaptation strategies. A participant said:

Sacrifices were done by our forefathers with animals and now are being done with human beings, so, why will God not be angry. **Male Participant, Araromi-Idowu Community, 62 years old**

The participants' lack of understanding therefore calls for urgent and proper training at the rural areas by the agriculture extension officers, so that rural dwellers especially will not continue waiting for the government to handle what they can quickly put right by themselves. This study sees this step as important because an enlightened community will be able to contribute to the process of developing adequate adaptation strategies which the community will own and preserve. Consequently, intensive and extensive sensitization and education programs mounted by both public and private sectors including the faith and community-based organizations as well as climate-based NGOs are essential since effective adaptation requires a holistic approach that incorporates both policy, people, and investment issues into the planning and decision-making processes. This is of great importance as no one solution will adequately address effective adaptation in all communities (UNDP 2010). Effective adaptation will require long-term planning approaches at the national, regional, and also, local level, which is responsible for the national food supply. However, at all the levels, their associated impacts in the rural communities may not succeed if the end users are not carried along due to the lack of understanding of subject matter.

## **Experiences of Participants and Their Livelihood Practices on the Effects of Climate Change**

The study revealed some of the experiences of participants from the effects of climate change as it affects their livelihood practices. According to the participants,

the climatic change ranges from delayed rainfall, strong wind, increase in temperature, and heavy rainfall leading to flooding, thereby affecting the roads and also resulting in overflowed rivers. It was observed that participants from the two communities have similar experiences as they commented on the effects of different aspects of climate change. It was reported that there has been delayed occurrence of rainfall, and when it occurs, the intensity was unusually heavy and had an adverse effect on their farm products. This was reported by participants during the in-depth interview sessions and questionnaire administration conducted in the two communities. The reported effects of climate change on the participants' crop farming business are presented in Fig. 4. According to Akinbami et al. (2019) and Slater et al. (2007), these negative impacts have implications on food security of the nation. As a nation, researchers, civil society, and policy makers should be in quest for innovative approaches to food security and not depleting the available quantity, especially with population increase which may expose people to the risk of hunger and its associated social vices.

## Previous Intervention in the Two Communities

According to some of the participants from Araromi-Idowu and Abokede communities, it was reported that they have never been part of any intervention either from the government, NGO, or a researcher. The community leader at Araromi-Idowu reported that there has not been specific intervention from the government except for a borehole that was dug for the community about 3 years ago. The borehole has ceased functioning due to lack of electricity to pump constantly. However, he further stated that some researchers in the last 2 years had visited the communities with some interventions. He retorted:

About two different times, some people (researchers) visited our community and distributed cassava stem (they said it is fortified with vitamin A) and maize grains to few male farmers. We were not taught the importance of the seedling and grains. As a result, most of us did not plant them. I kept the grains in my house and I know that my colleagues did same. **Youth Community Leader, Araromi-Idowu Community**

From the submission of the respondents, it was observed that interventions did not succeed because the measures that lead to successful implementation of interventions were not taken into consideration. Measures such as communication and partnership with the communities' members, as well as monitoring, were missing (Joo et al. 2011; CDC 2014; Yilmaz 2014; Etim and Etim 2019). Apart from the ineffectiveness of the previous interventions, the women reported special challenge they are facing as a result of socio-cultural practices which are still very strong in the rural areas.

About three years ago, some people came to train us women on how to manage our businesses, the men did not allow us to participate fully. They felt threatened and it is also against the rules/practices of this community to gather only the women. The cause of their



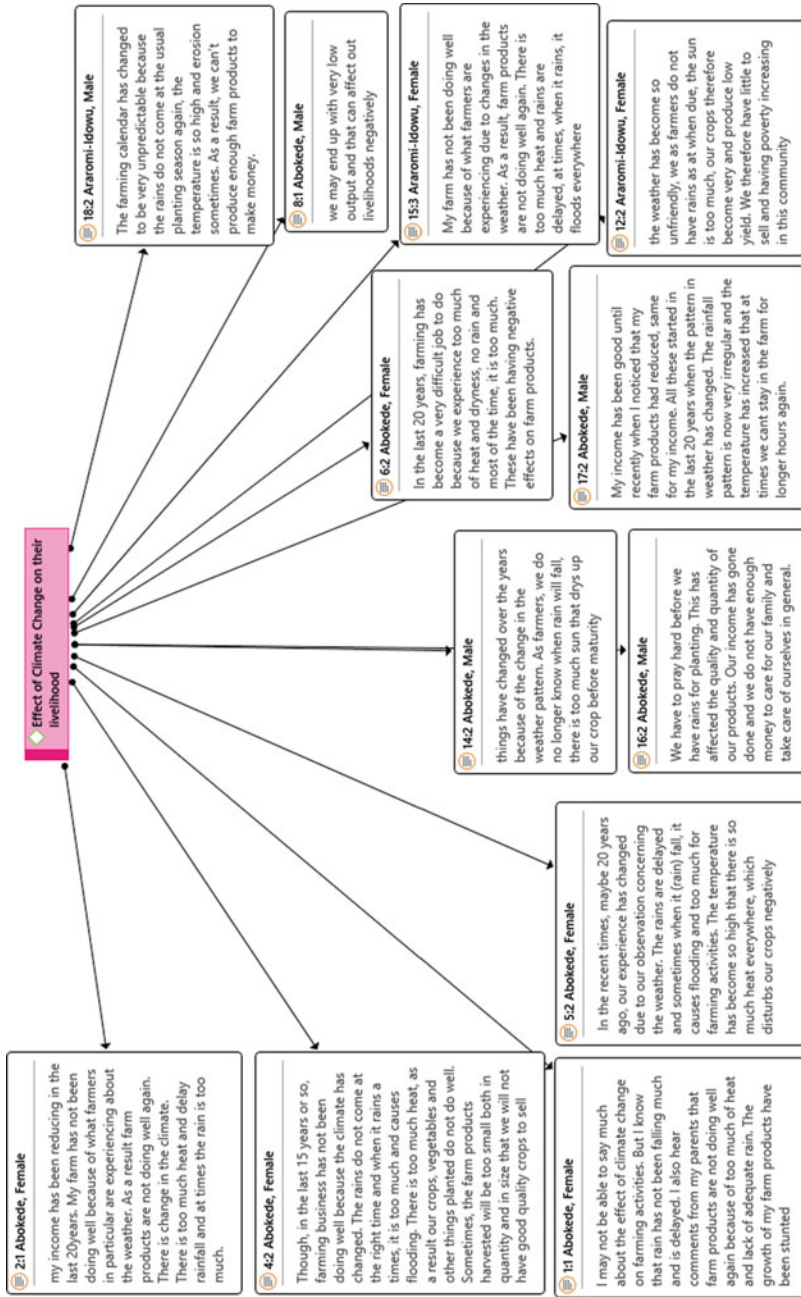


Fig. 4 Effects of climate change on participants' livelihood

anxiety is that they thought we would be exposed to things that will make us rebel against them, especially, when we are financially liberated. **General response from women in the two communities**

This study is of the opinion that these unattended to changes in weather patterns through various appropriate and effective adaptation and mitigation measures will result in increasing series of devastating natural disasters and low economic activities and poverty level in the rural areas. Consequently, more people will continue to abandon rural areas that are strongly affected by climate change and migrate to cities. Furthermore, extreme weather events such as floods and heat waves can also pose significant health threats such as diarrheal disease, dehydration, or cardiac complications, and mean temperature changes can alter the range and transmission potential of diseases such as malaria (Akinbami and Momodu 2013, GIZ and MoEF 2009).

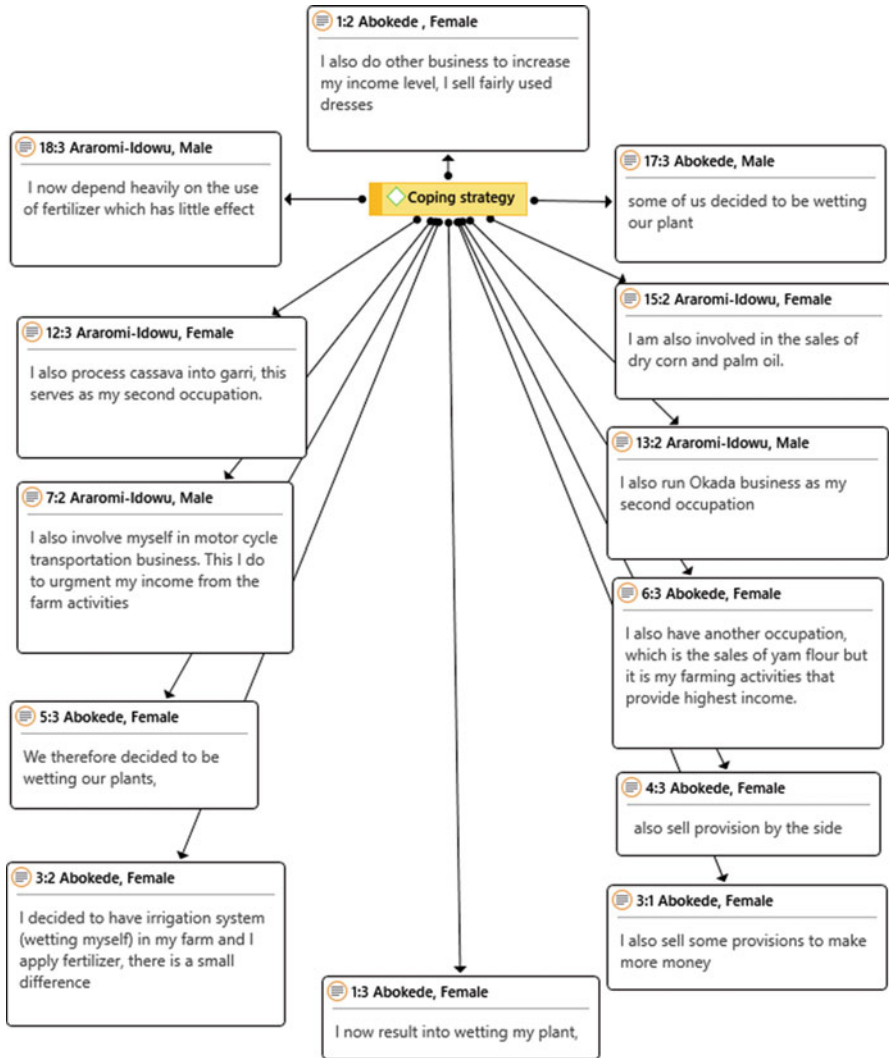
### **Coping Strategies from Communities**

During the interview conducted, participants revealed that they have employed some strategies such as diversifying into other business line, use of fertilizer, and wetting of plants from nearby river. It was observed that all of the women and just a few of the men were involved in business diversification. This finding agrees with WEDO (2007) that stated that women have developed specific adaptive strategies to cope with climate change-induced problems in livelihood, health, shelter, energy sectors, etc. in some countries. This suggests that women, if exposed to the right training, can employ their initiatives to develop strategies that will help handle immediate and long-term strategies that will gradually reduce the impacts of climate change in the rural areas. Figure 5 presents various coping strategies the women and some men in the communities visited adopted to alleviate the sufferings associated with effects of climate change. The figure depicts the readiness and willingness of the rural women.

However, the women reported that the socio-cultural climate of their communities hinders their ability to cope. Firstly, the practice around land tenure which prevents women from owning land hinders their ability to diversify. This was well experienced in Araromi-Idowu where the community missed out of oil palm intervention due to lack of land and strong existence of patriarchal system in place.

### **Climatepreneurship Intervention**

The climatepreneurship intervention provided a template which would improve the coping strategies of the participants. Climatepreneurship intervention also exposed participants to the use of natural resources in their community that can be turned to various business activities, such as clay work. This became necessary, in order to create avenues to increase their income generation activities. Also, they were trained on entrepreneurship businesses in the oil palm tree products, such as basket weaving. This was with the aim of introducing them to business diversification concepts.



**Fig. 5** Coping strategies employed by participants in both Araromi-Idowu and Abokede communities

In order to strengthen participants’ coping strategies through proper monitoring, the researcher held series of meetings with the government parastatals in charge of women, community development, and extension officers. This was to enable them get proper understanding of climatepreneurship concept and see to the success and continuity of the intervention through its replication in other communities.

## Effectiveness of Climatepreneurship Intervention

Climatepreneurship was designed by the researcher as an adaptation strategy intervention by employing the opportunities that climate change present to enhance entrepreneurship growth and development for the economic empowerment of the rural men and women. It provided some climate smart grains and seedlings to participants of Araromi-Idowu and Abokede communities in order to empower the women in the communities by helping them to have their livelihood practices improved. This intervention employed some methods that led to its success. Some outcomes were observed as a result of the activities employed by climatepreneurship intervention to demonstrate community communication, partnerships, and bottom-up approach, in order to strengthen their economic capacity and increase entrepreneurship development. These outcomes include:

- The actual needs of participants were known such as lack of monitoring from agricultural extension officers.
- Actual impacts of climate change on their livelihood were stated.
- The drought-resistant maize grains, hybrid oil palm seedlings, and vitamin A-enhanced cassava stems were identified to improve their livelihood practices, thereby enhancing entrepreneurship development and economic empowerment.

The basic and fundamental step was to enlist their interest that led to the acceptance of intervention by community leaders and members. Training sessions were organized in the two communities to educate participants on the handling and management of grains and seedlings. Thereafter, drought-tolerant maize grain varieties, beta-carotene fortified cassava stems, and hybrid oil palm seedlings were distributed to participants and were planted as revealed in Fig. 6. Monitoring tool was employed via periodic visitation to communities and the involvement of the government parastatal attached to agriculture services in the state.

Participants retorted that they have never planted such improved and enhanced seedling varieties before climatepreneurship intervention, though, most of the participants claimed that they have heard of their existence through friends and neighboring communities.

Post-intervention interview was conducted when the drought-tolerant maize grain varieties and beta-carotene cassava stems planted were matured for harvesting, and the participants were able to express their experiences. All the farmers attested to the effectiveness of this intervention over the local maize grains they were used to. Some of the participants from the two communities reported their experiences with climatepreneurship as evidence to its effectiveness and said:

We have not seen this before. It seems we are going back to those days when farming was rewarding. The maize harvested is quite different from the local grains we normally planted. This one got matured before it was normal 3 months, which means we farmers will have more to sell and thereby have more money to cater for ourselves. It is also sweeter in taste than the one we were used to. What really gladdens my heart is that we will have more trips to the market from the look of things. I will distribute the grains to other people in this



Female and male farmers planting drought tolerant maize grains and beta-carotene fortified cassava seedlings



Group of male and female farmers with hybrid oil palm Female farmer planting hybrid oil palm



Distribution of Beta-carotene fortified cassava Both farmers planting drought tolerant maize

**Fig. 6** Participants with climate-smart grains and seedlings

community, so that we can all have access to this new grain. **Male Participant, Araromi-Idowu Community, 48 years old**

I never knew the outcome will be this fantastic. We were mocked by some of our colleagues in this community because there was not enough rains. They were so sure that we were wasting our time, despite the training we had before the grains were handed over to us. Maybe, if the researcher had handed the grains over to us without staying on the farm with us to plant every grain, I would have just gone to keep the grains also. But now, I thank God that I participated. Our people that mocked us then are now asking for the grains. I am preparing for good sales this season. **Female Participant, Abokede Community, 50 years old**

The cassava stem planted yielded so well. Apart from the fact that the tubers are big, I now have cassava that can also improve our health. In this community, we eat a lot of cassava and we process it to fufu (staple food made from cassava) which we take to the city



to sell. So apart from having more quantities to sell for money, we are also contributing to the well being of people. I know that we will always have this in this community now by replanting the stem. **Female Participant, Araromi-Idowu Community, 62 years old**

From Fig. 7, it is evident that the rural areas are ready for innovative adaptation strategies, if the right investment is made.

To further enhance the effectiveness of this intervention and strengthen the capacity of participants, it was observed during the pre-intervention activities that the communities lack good clean water supply for the processing of the harvested cassava into fufu (a Nigerian staple food), a well was also dug in the communities to improve their economic activities and their health status because this well water will be used for drinking purposes as well by the communities (see Fig. 8). Unlike the previous intervention of a borehole that was dug by the government which ceased functioning due to the lack of electricity to pump water constantly, the well was made people-friendly which even a young boy or girl would constantly be able to operate manually at any time.

However, in spite of the success of the various aspects of the climatepreneurship intervention measures, the hybrid oil palm aspect was not as successful as others. This is mainly due to the existing land tenure and strong patriarchal system in place in the communities. Since the condition for eligibility for the hybrid oil palm was access to at least 1 acre of land so that the quantity to be harvested would have a positive impact on economic status of the women, most of the women jointly contributed land to be eligible. Also, unfortunately, the community experienced clash between herdsmen and farmers. It was later observed in between the periodical monitoring of the project that cattle rearers had led cattle to the oil palm farm, which was not close to farmers' dwelling places and devastated some of the seedling planted, thereby defeating the objective of this part of the project.

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## Conclusion

Adapting to climate change represents a new challenge particularly in the rural areas. Already, linkages exist between business-as-usual development strategies and adaptation to climate change impacts. Therefore, development strategies that will generate benefits for managing climate change risks are highly essential. Such will result in poverty reduction, improved nutrition, enhanced education, expanded infrastructure, and improved health which will also reduce vulnerability to climate change and enhance wellness.

This study presented available adaptation strategies suggested by various authors for testing of conformity with rural farmers, following the view that environmental knowledge and resilience to climate change lay within societies and cultures. Farmers in these communities of study have experienced hard times as a result of climate change effects ranging from delayed rainfall, heavy rainfall which lead to flooding, increase in temperature, and drought. Consequently, the communities have suffered some economic hardship and social consequences from impacts of climate



**Fig. 7** Post-intervention measure pictures showing harvested maize and cassava in the two communities



**Fig. 8** A dug well for improved economic activities by the intervention

change. This necessitates the rural dwellers diversification and integration of other livelihood practices in addition to crop farming. Observations made in the communities of study agreed with previous studies such as Suleiman (2014) and Yusuf et al. (2017).

Due to the low level of education of the rural communities, participants could not process the information received into finding out the causes of climate change and what steps to take to abate the climate change impacts and improve their livelihood practices. It is therefore essential that intensive and extensive sensitization and comprehensive education programs mounted by both public and private sectors including the faith and community-based organizations as well as climate-based NGOs be incorporated into the development intervention strategies in the rural communities in their various local languages for effective and benefitting communication. For example, such sensitization and education programs may include the production of facts sheet and radio interactive programs specifically tailored to address rural farmers' challenges.

Innovative adaptation strategies such as climatepreneurship which consists of activities that are climate smart and make use of locally available resources for economic empowerment and enhancement of the social status of rural women and also help to turn climate change challenges into opportunities have been assessed as effective intervention measures in rural communities. It therefore reveals that successful climatepreneurship intervention measure entails a bottom-up approach that requires a situational report of rural communities for a good understanding of the peculiarities of their climate and environmental assessment based on vegetation zones in each geopolitical zone in the country, as well as locally available raw materials that can be turned to sustainable economic empowerment ventures. These



will help to forestall the increasing rural-urban migration with its attendant food insecurity and social vices and further help in developing the rural dwellers especially the womenfolk through sustainable economic empowerment and also enhancing their socio-political status in the society. Ultimately, many more micro-, small-, and medium-sized enterprises (MSME) can begin springing up and thereby enhancing environmentally sustainable industrial rural development and increasing economic value additions to both sub-national and national economic growth and development.

The paper concludes that the purpose of undertaking adaptation strategy is to effectively manage potential climate risks over the coming decades as the effects of climate change continue to increase because such can help inform decisions by farmers (both women and men), agribusiness owners, policy makers, and development partners of implications over a range of timeframes from short-term tactical to long-term strategic options. This is because inadequate consideration of and in-appropriate actions to adaptation options could result in increased vulnerability to climate change generally in the rural areas and particularly by women and children, and thereby giving rise to more severe mitigation targets and costs.

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