



IMPACT OF CLIMATE CHANGE ON GREEN ENTREPRENEURSHIP IN KADUNA NORTH L.G.A. OF KADUNA STATE

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Abstract

This study examines the impact of climate change on green entrepreneurship in Kaduna North Local Government Area (L.G.A.) of Kaduna State, Nigeria. Faced with rising temperatures, erratic rainfall, floods, and droughts, the region highlights the global need for sustainable development, with green entrepreneurship as a key to climate resilience and economic growth. Using a descriptive survey design, the researchers collected primary data from 100 questionnaires and supplemented it with secondary documents. A multiple linear regression model analyzed the relationships between green entrepreneurship and climate change, government incentives, financial support, environmental impact, and community involvement. The findings show a positive and significant correlation between climate change and green entrepreneurship, indicating that entrepreneurs are adopting sustainable practices in response to environmental challenges. However, government incentives negatively and significantly influenced green entrepreneurship, suggesting current policies are ineffective. Furthermore, financial support, environmental impact, and community involvement showed no significant relationships, exposing gaps in funding, public awareness, and stakeholder engagement. The study concludes that while climate change can spur innovation in green entrepreneurship, there's an urgent need for better climate change strategies, revised government incentives, improved financial infrastructure, and expanded environmental education to foster a supportive ecosystem for sustainable development in Kaduna North L.G.A.

Keywords: *Climate Change, Green Entrepreneurship, Sustainable Development, Government Incentives, Kaduna North L.G.A.*

JEL Classification Codes: Q54, Q56, L26, O13, O55

1.0 Introduction

Climate change refers to the long-term warming of the Earth due to increased global temperatures caused mainly by human activities that emit greenhouse gases like CO₂, CH₄, and water vapor. In Nigeria, effects include rising temperatures up to 44°C, irregular rainfall

patterns, flooding, drought, desertification, and more extreme weather events.

Global population growth and increased production have led to resource depletion and environmental damage, resulting in global warming, pollution, flooding, and disease

outbreaks. This spurred global awareness and efforts toward sustainable development, which seeks economic growth with minimal environmental harm while considering future generations.

Climate change stems from both natural and human causes. Human-related activities include emitting greenhouse gases through industrialization, fossil fuel burning, and gas flaring, or reducing carbon sinks through deforestation, land use changes, water pollution, and agriculture (Anabaraonye et al., 2018; Lu, 2016; PAHO, 2013). Adaptation means adjusting to climate impacts, while mitigation refers to reducing climate risks by lowering emissions or enhancing carbon sinks (IPCC, 2007a).

Green entrepreneurship is a key strategy for boosting climate resilience and achieving sustainable development in Nigeria. It can be promoted through education and models like the green office initiative (Omilabu et al., 2023). Eco-innovation supports sustainable practices throughout production and service delivery (Veleva & Ellenbecker, 2001).

Eco-entrepreneurship involves running businesses that prioritize environmental and social responsibility. In Nigeria, common green business areas include:

- Renewable energy (solar panels, wind turbines)
- Sustainable agriculture (organic farming, permaculture)

- Eco-friendly products (reusable bags, biodegradable packaging)
- Green building (energy-efficient structures)

In Kaduna North L.G.A., many residents engage in eco-entrepreneurship for survival. Therefore, this study seeks to investigate the complex relationship between climate change impacts and green entrepreneurship in Kaduna North LGA, Nigeria, to determine if and how eco-businesses can overcome climate-induced challenges, and to identify the critical barriers and necessary support mechanisms for their success in contributing to sustainable development and climate resilience.

2. Literature Review

Concept of Climate Change

Climate change is a critical global issue that must be addressed urgently to avoid severe impacts on humanity and ensure sustainability. It threatens ecosystems, food security, and clean water access, especially for vulnerable populations. Coordinated international action is needed to cut greenhouse gas emissions, support renewable energy, and adapt to climate effects. Prompt action can protect the planet and foster a fairer, more resilient future.

The United Nations Framework Convention on Climate Change (UNFCCC) defines climate change as climate alteration due to human activity, beyond natural variability (UNFCCC, 1992).

This study uses climate change to include adaptation and mitigation. The Intergovernmental Panel on Climate Change (IPCC) defines adaptation as adjusting to new or changing environments to reduce harm or seize opportunities. Mitigation involves actions to reduce or eliminate the risks of climate change by lowering greenhouse gas sources or enhancing their removal (Global Greenhouse Warming, 2018).

Concept of Entrepreneurship

Entrepreneurship simply put, is the process of designing, launching and running a new business, which is often initially a small business. People who create these businesses are called entrepreneurs. An entrepreneur in its unique nature is innovative, possesses ideas that foster development towards achieving a purpose (Anabaraonye, Okafor & Eriobu, 2019).

Concept of Green Entrepreneurship

The earliest attempts aimed at finding a generalized definition for green entrepreneurship appeared around the 1990s. As reported by Hall, “green entrepreneurship” was first mentioned by Gustav Berle (1991) in his book, “The Green Entrepreneur: Business Opportunities That Can Save the Earth and Make You Money” (Hall, 2016). The author provided a poetic definition, explaining green entrepreneurship as the ability and willingness of humans to take up responsibilities of creating the kind of world they dream to live in (Hall, 2016). Nevertheless,

interest on green entrepreneurship is huge, and cuts across all works of life. This can be proved based on the number of green entrepreneurship ideas in extant literature, and the proliferation of the concept (Gibbs, 2006). Green entrepreneurship can also be defined as the activity of consciously addressing an environmental/social problem/need through the realization of entrepreneurial ideas with a high level of risk, which has a net positive effect on the natural environment and at the same time is financially sustainable (Greenproject, 2016).

Theoretical Review

This study is hinged on two theories - Solow’s (1957) neoclassical production function was extended to include ‘knowledge capital’ as a third production factor after economists (e.g., Lucas, 1978; Romer, 1986) acknowledged that economic growth cannot be fully explained by capital and labour input alone. The second is Knight’s (1957) work on Risk, Uncertainty and Profit (Reviewed). He argued that, profit arises from uncertainty rather than risk. Entrepreneurs who are willing to take on uncertainty are rewarded with profit which is a return on their uncertainty bearing.

Subsequently, the knowledge spill over theory identified entrepreneurship as a ‘conduit for knowledge spillovers’, which transforms knowledge capital into innovative business models and economic growth (Audretsch & Keilbach, 2004). With rising awareness of the economic importance of entrepreneurship,

economists began to expand the production function by testing entrepreneurial capital as a fourth production factor or a substitute for knowledge capital (Audretsch & Keilbach, 2004; Urbano et al., 2020; Wong et al., 2005).

Empirical Review

Contemporary empirical studies have employed diverse quantitative methodologies to examine green entrepreneurship dynamics. Econometric approaches have been particularly prominent, with researchers utilizing ordinary least squares (OLS), fixed-effects models, and generalized method of moments (GMM) estimators to analyze relationships between green entrepreneurial activity and development outcomes.

Neumann (2022) conducted a significant cross-country empirical analysis using OLS regression on GEM and Human Development Index datasets to investigate relationships between Green Entrepreneurial Activity (GEA) and economic, social, and environmental indicators. The study's findings revealed positive associations between GEA and economic and social development indicators, but surprisingly non-significant relationships with environmental development measures. These mixed results highlight critical measurement and attribution challenges that pervade the field.

Advanced econometric techniques have also emerged in recent research. Biber et al. (2023) employed multi-level regression models to

examine how national climate adaptation policies influence green venture formation rates in sub-Saharan Africa, while Pacheco et al. (2022) utilized Propensity Score Matching (PSM) to address selection bias in analyzing startup responses to climate-related opportunities. These methodological advances demonstrate increasing sophistication in addressing causal inference challenges inherent in entrepreneurship research.

Kabiamawe et al. (2017) and Anabaraonye et al. (2019) utilized literature review and participant observation methods to explore green entrepreneurship opportunities in Nigeria, emphasizing employment generation, environmental sustainability, and climate mitigation strategies. These studies highlight the importance of contextual understanding in green entrepreneurship research, particularly in developing country settings where informal sector activities and grassroots innovations may not be captured in formal datasets.

Case study methodologies and grounded theory approaches have gained traction in recent research, particularly for understanding grassroots green innovations and informal sector entrepreneurial responses to environmental degradation (George et al., 2021). These approaches offer valuable insights into entrepreneurial processes and innovation dynamics that complement quantitative analyses. George et al. (2021) found that such qualitative methods not only uncover the contextual and socio-cultural drivers of green entrepreneurship

but also reveal the adaptive strategies entrepreneurs employ in resource-constrained environments, highlighting how localized knowledge systems can accelerate sustainable innovation.

Survey methodologies have been employed to examine specific aspects of green entrepreneurship, particularly employment generation and economic impact assessment. Musa et al. (2021) deployed analysis of variance (ANOVA), standard deviation, and mean analysis on structured questionnaires to assess green entrepreneurship's employment potential in Nigeria. Their findings suggested positive employment effects and contribution to Nationally Determined Contributions under international climate agreements.

However, survey-based approaches in green entrepreneurship research face significant methodological challenges including sampling bias, self-reporting limitations, and difficulty in establishing causal relationships. Future research would benefit from more sophisticated survey designs incorporating randomized controlled trial elements and longitudinal tracking mechanisms.

Impacts of Climate Change on Green Entrepreneurship in Nigeria

Climate change has significant impacts on green entrepreneurship in Nigeria. Here are five main effects:

- *Increased Costs and Risks:* Climate change leads to more frequent and intense natural disasters, such as floods and droughts, which can damage green businesses and disrupt supply chains. This increases costs and risks for green entrepreneurs in Nigeria.

- *New Business Opportunities:* On the other hand, climate change creates new business opportunities in areas like renewable energy, sustainable agriculture, and eco-friendly products. Green entrepreneurs in Nigeria can capitalize on these opportunities to create innovative solutions.

- *Impact on Agricultural Production:* Climate change affects agricultural production, which is a critical sector for many green businesses in Nigeria. Changes in temperature and rainfall patterns can alter the suitability of land for different crops, impacting green entrepreneurs who rely on agriculture.

- *Need for Climate-Resilient Infrastructure:* Climate change highlights the need for climate-resilient infrastructure in Nigeria. Green entrepreneurs must invest in infrastructure that can withstand the impacts of climate change, such as flood-resistant buildings and renewable energy systems.

- *Importance of Climate Governance and Policy:* Finally, climate change emphasizes the importance of climate governance and policy in Nigeria. Green entrepreneurs need a supportive policy environment that encourages sustainable practices and provides incentives for climate-friendly innovations.

3. Methodology

The Study Area

The study area is Kaduna North Local Government Area located in the northern part of Kaduna State, within the Kaduna metropolis, Kaduna State, Nigeria. It shares boundaries with Kaduna South Local Government Area, Chikun, and Igabi Local Government Area. Kaduna North is a diverse and urbanized area, serving as the administrative center of Kaduna State. The population comprises various ethnic groups, with a significant presence of Hausa and Muslim communities. The area is also part of the Zazzau Emirate Districts, reflecting its historical and cultural significance. The LGA spans an area of approximately 72.9 square kilometers, resulting in a high population density of about 7,351 people per square kilometer as of 2015 being the most recent projection.

As of the 2022 projection, Kaduna North Local Government Area (LGA) in Kaduna State, Nigeria, has an estimated population of approximately 538,600 people. This reflects a significant increase from the 2006 census figure of 364,575, indicating an annual growth rate of about 2.5%. The gender distribution in Kaduna North LGA is as follows:

- **Male:** 273,985 (51.1%)
- **Female:** 261,954 (48.9%) (CityFacts, Wikipedia)

This suggests a slightly higher male population within the LGA.

Sampling Procedure

The descriptive survey research design was adopted for this research work, as it helps in gaining understanding of the issue surrounding climate change variables that affects green entrepreneurial activities meant to create wealth and protect the environment as well. The descriptive method follows the use of quantitative method of analysis. The quantitative method is generally designed to ensure objectivity, generalizability and reliability. The adoption of purposive sampling technique in selecting the sample of the study is justified by the strong desire to elicit relevant information from respondents that would help in generating data that would explore the salient issues that this study intends to interrogate.

Data collection

Data for this study were obtained from secondary and primary sources. The primary data were sourced through the use of questionnaire, while the secondary data were sourced from relevant documents. Data from one hundred (100) respondents were used for the analysis. This was guided by methodological adequacy and feasibility as sample sizes within this range are generally sufficient to capture representative trends and ensure statistical validity (Creswell, 2014).

Model specification

The model adopted for this research was of the form, green entrepreneurship is a function of climate change and specified as,

$$GE = f(\text{Climate Change}) \quad (3.1)$$

GE = f(climate change, government incentives, financial support, environmental impact and community involvement) (3.2)

$$GE = CC + GI + FS + EI + CI \quad (3.3)$$

$$GE_i = \beta_0 + \beta_1 CC_i + \beta_2 GI_i + \beta_3 FS_i + \beta_4 EI_i + \beta_5 CI_i + \varepsilon_i \quad (3.4)$$

Where:

GE = Green Entrepreneurship (dependent variable)

CC = Climate Change (independent variable)

GI = Government Incentives (control variable)

FS = Financial Support (control variable)

EI = Environmental Impact (control variable)

CI = Community Involvement (control variable)

ε = error term, $\beta_0, \beta_1, \beta_2, \beta_3, \beta_4, \beta_5$, = coefficients to be estimated

4. Results and Discussion

Demographic Characteristics of the Respondents

The demographic characteristics of the respondents are presented in Table 4.1.

Table 4.1 Demographic Characteristics of the Respondents

Gender		Frequency	Percent
Male		65	66.3
Female		33	33.7
Total		98	100.0
Age		Frequency	Percent
18-24 years		16	16.3
25-34 years		23	23.5
35-44 years		26	26.5
45-54 years		22	22.4
55 years and above		11	11.2
Total		98	100.0
Education Level		Frequency	Percent
No formal education		10	10.2
SSCE		19	19.4
NCE/ND		19	19.4
BSC/HND		40	40.8
Maters Degree/PhD		10	10.2
Total		98	100.0

Source: Authors computation (2025)

Table 4.1 shows that the majority of the respondents, 65 (66.3%), are male, while 33 (33.7%) are female. This suggests that there is a higher representation of males in the study, which may be attributed to cultural influences

that have historically favored male participation in entrepreneurial activities, potentially limiting opportunities for women to engage in business ventures. In terms of age, the table shows that the majority of the respondents, 26 (26.5%), are

between the ages of 35-44 years, followed by those between 25-34 years, 23 (23.5%). The age range with the lowest representation is 55 years and above, with 11 (11.2%) respondents. This suggests that the majority of the respondents are in their middle age, which may indicate that they have acquired some level of experience and maturity in their entrepreneurial pursuits.

The table also shows that 19 (19.4%) respondents have a Senior Secondary Certificate Examination (SSCE) or a National Certificate in Education

(NCE)/National Diploma (ND), while 10 (10.2%) respondents have no formal education. This suggests that the majority of the respondents have some level of formal education, which may indicate that they have acquired some level of knowledge and skills that can be applied to their entrepreneurial pursuits.

Respondents' perceptions in terms of Green Entrepreneurship

The respondents' perceptions in terms of green entrepreneurship are presented in Table 4.2.

Table 4.2 Respondents' perceptions in terms of Green Entrepreneurship

What type of green entrepreneurial activity are you involved in?	Frequency	Percent
Renewable energy	33	33.7
Sustainable agriculture	29	29.6
Green manufacturing e.g. flowers & trees nursery	31	31.6
Others	5	5.1
Total	98	100.0
How long have you been involved in green entrepreneurship?	Frequency	Percent
Less than 1 year	14	14.3
1-2 years	26	26.5
2-5 years	23	23.5
More than 5 years	35	35.7
Total	98	100.0
What is your monthly revenue from green entrepreneurial activities?	Frequency	Percent
Less than 50,000 naira	23	23.5
50,000-100,000 naira	44	44.9
100,000-500,000 naira	26	26.5
More than 500,000 naira	5	5.1
Total	98	100.0

Source: Authors computation (2025)

The results in Table 4.2 showed that the majority of the respondents, 33 (33.7%), are involved in renewable energy as their type of green entrepreneurial activity. This is followed by green manufacturing, such as flowers and trees nursery, with 31 (31.6%) respondents, and

sustainable agriculture with 29 (29.6%) respondents. The category "others" has the lowest representation, with 5 (5.1%) respondents. This suggests that renewable energy is a popular area of interest for green entrepreneurs in Kaduna North L.G.A., potentially due to the growing demand for clean

energy solutions. In terms of the duration of involvement in green entrepreneurship, the table shows that, majority of the respondents, 35 (35.7%), have been involved for more than 5 years. This is followed by those who have been involved for 1-2 years, with 26 (26.5%) respondents, and those who have been involved for 2-5 years, with 23 (23.5%) respondents. The category "less than 1 year" has the lowest representation, with 14 (14.3%) respondents. This suggests that many of the respondents have some level of experience in green entrepreneurship, which may indicate that they have developed some level of expertise and knowledge in this area.

The table also shows the monthly revenue from green entrepreneurial activities, with the majority

of the respondents, 44 (44.9%), earning between 50,000-100,000 naira per month. This is followed by those who earn between 100,000-500,000 naira per month, with 26 (26.5%) respondents, and those who earn less than 50,000 naira per month, with 23 (23.5%) respondents. The category "more than 500,000 naira" has the lowest representation, with 5 (5.1%) respondents. This suggests that many of the respondents are earning a moderate income from their green entrepreneurial activities, which may indicate that these activities are viable and sustainable.

Respondents' perceptions in terms of Climate Change

The respondents' perceptions in terms of climate change are presented in Table 4.3.

Table 4.3 Respondents' perceptions in terms of Climate Change

How aware are you of the impacts of climate change on your business?	Frequency	Percent
Not aware at all	10	10.2
Somewhat aware	22	22.4
Aware	40	40.8
Very aware	24	24.5
Extremely aware	2	2.0
Total	98	100.0
How has climate change affected your business operations?	Frequency	Percent
Not affected at all	11	11.2
Somewhat affected	30	30.6
Affected	40	40.8
Very affected	11	11.2
Severely affected	6	6.1
Total	98	100.0
Have you implemented any climate change mitigation or adaptation strategies in your business?	Frequency	Percent
Yes	64	65.3
NO	34	34.7
Total	98	100.0

Source: Authors computation (2025)

The table shows that the majority of the respondents, 40 (40.8%), are aware of the impacts of climate change on their business, followed by those who are somewhat aware, 22 (22.4%), and those who are very aware, 24 (24.5%). The category "not aware at all" has the lowest representation, with 10 (10.2%) respondents, indicating that most respondents have some level of awareness about the impacts of climate change on their business. In terms of how climate change has affected business operations, the table shows that the majority of the respondents, 40 (40.8%), reported being affected, followed by those who are somewhat affected, 30 (30.6%), and those who are very affected, 11 (11.2%). The table also shows that the majority of the respondents, 64 (65.3%), have implemented climate change mitigation or adaptation strategies in their business, indicating

a proactive approach to addressing the impacts of climate change. This suggests that many businesses in the area are taking steps to reduce their vulnerability to climate change and to adapt to its impacts. The remaining 34 (34.7%) respondents who have not implemented any climate change mitigation or adaptation strategies may require support and guidance to help them develop and implement effective strategies to address the impacts of climate change on their businesses.

Correlation Estimate on the impact of Climate Change on Green Entrepreneurship in Kaduna North L.G.A.

The study measured the degree of relationship between the variables and presented results in Table 4.4

Table 4.4 Correlation Estimate

	GE	CC	GI	FS	EI	CI
GE	1					
CC	.317	1				
GI	-.325	-.181	1			
FS	-.412	-.106	.215	1		
EI	.354	.150	.067	.046	1	
CI	.459	.289	.006	.054	.341	1

Source: Authors computation (2025) using SPSS version 22. Where: GE=Green Entrepreneurship (measured by revenue generated from green entrepreneurship), CC=Climate Change, GI = Government Incentives, FS = Financial Support, EI = Environmental Impact, CI = Community Involvement

The correlation analysis reveals a positive and significant relationship between Green Entrepreneurship and Climate Change, with a correlation coefficient of 0.317. This suggests that there is a moderate positive correlation between climate change and green

entrepreneurship, indicating that as climate change increases, green entrepreneurship tends to increase as well. The analysis also reveals a negative and significant relationship between Green Entrepreneurship and Government Incentives, with a correlation coefficient of -

0.325. This suggests that there is a moderate negative correlation between government incentives and green entrepreneurship, indicating that government incentives may not be effectively supporting green entrepreneurship in Kaduna North L.G.A. Furthermore, the analysis shows a positive and significant relationship between Green Entrepreneurship and Environmental Impact, with a correlation coefficient of 0.354. This suggests that there is a moderate positive correlation between green entrepreneurship and environmental impact, indicating that green entrepreneurship is associated with positive environmental outcomes. More so, the analysis reveals a

positive and significant relationship between Green Entrepreneurship and Community Involvement, with a correlation coefficient of 0.459.

Multiple Linear Regression on the impact of Climate Change on Green Entrepreneurship in Kaduna North L.G.A.

Considering that green entrepreneurship in this study is proxied by revenue generated by green entrepreneurs which is a continuous variable, the study applies multiple linear regression to estimate the model and presents the results in Table 4.5.

Table 4.5: Multiple Linear Regression Estimate

DV=GE							
			t.sta	Sig.	Collinearity Statistics		
	Coefficient	Std. Error			Tolerance	VIF	
(Constant)	2.115	.559	3.784	.000			
CC	.262	.097	2.694	.008	.871	1.148	
GI	-.685	.219	-3.124	.002	.921	1.085	
FS	.146	.178	.821	.414	.943	1.060	
EI	.102	.065	1.568	.120	.875	1.143	
CI	.068	.095	.720	.473	.821	1.218	

Diagnostic Test:
 Durbin Watson Test Sta.=2.096, Jarque-Bera Test Sta (p-value) =0.812.R Square=0.532, F sta. (p-value)=0.001

Source: Authors computation (2025) using SPSS version 22. Where: GE=Green Entrepreneurship (measured by revenue generated from green entrepreneurship), CC=Climate Change, GI = Government Incentives, FS = Financial Support, EI = Environmental Impact, CI = Community Involvement

The diagnostic tests indicate that the model is well-specified, with a Durbin-Watson statistic of 2.096, which suggests that there is no autocorrelation in the residuals. The Jarque-Bera test statistic (p-value) of 0.812 also suggests that the residuals are normally distributed. More so,

the collinearity statistics show no significant multicollinearity among independent variables, with tolerance values ranging from 0.821 to 0.943 (all above 0.1) and VIF values from 1.060 to 1.218 (all below 5). The R-squared value of 0.532 indicates that the model explains

approximately 53.2% of the variation in green entrepreneurship. The F-statistic (p-value) of 0.001 suggests that the model is statistically significant, indicating that the independent variables jointly explain the dependent variable.

Regression analysis shows climate change positively and significantly impacts green entrepreneurship, with a coefficient of 0.262 and a p-value of 0.008. Contrary to expectations of a negative effect due to uncertainty and risk, entrepreneurs in Kaduna North L.G.A. appear to embrace sustainable practices in response to climate challenges. This aligns with studies by Anabaraonye et al. (2019) and Kabiamawe et al. (2017), which highlight green entrepreneurship as a response to climate adaptation and economic opportunity.

Conversely, government incentives show a negative and significant effect on green entrepreneurship (coefficient = -0.685, $p = 0.002$), despite expectations of a positive impact. This suggests current policies may be ineffective or counterproductive, supporting Ogbuabor and Egwuchukwu's (2017) findings on unintended policy consequences.

Environmental impact, financial support, and community involvement were not significantly related to green entrepreneurship (p-values: 0.414, 0.120, and 0.473). Though expected to drive sustainability, these factors may be limited by inadequate funding, weak community

engagement, and low environmental awareness among stakeholders.

5. Conclusion and Recommendations

This study examined the impact of climate change on green entrepreneurship in Kaduna North L.G.A. Findings indicate that climate change positively influences green entrepreneurship, suggesting local entrepreneurs are adapting by adopting sustainable practices. This highlights climate change as a potential driver of innovation and sustainability. However, the negative effect of government incentives raises concerns about the effectiveness of current policies. Additionally, the minimal influence of financial support, environmental factors, and community involvement points to gaps in funding, awareness, and engagement.

Recommendations:

- i. Enhance climate change strategies by implementing sustainable practices in response to climate challenges policies that support climate-resilient agriculture, renewable energy, and green infrastructure. Examples include drought-resistant crops, solar-powered irrigation, and energy-efficient building codes.
- ii. Review and revise government incentives to ensure they effectively support green entrepreneurship through stakeholder input and targeted design.
- iii. Improve financial support by offering tailored financial products, simplifying

processes, and providing business and financial training.

- iv. Increase environmental education through awareness programs, workshops, and media campaigns to foster a culture of sustainability.

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