



ASSESSMENT OF GOMBE GOES GREEN (3G): A MITIGATION STRATEGY FOR CLIMATE CHANGE CONTROL IN GOMBE STATE, NIGERIA

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ABSTRACT

The study examined the assessment of the Gombe Goes Green (3G): A mitigation strategy for climate change control in Gombe State, Nigeria. A multi-stage sampling technique was used to select 201 respondents; Data were collected through the administration of structured questionnaires and analyzed using descriptive and inferential statistics. The results revealed that 31.3% of the respondents fell within the age range of 30–39 years, with a mean age of 38 years. Majority (65.7% and 62.7%) were married and male, and 33.8% had attained secondary education. The average household size was 6 members. The results further showed that the respondents had the mean of 11 years in farming experience. The findings further revealed that 58.7% of the respondent belonged to one form of association, and 54.2% had access to extension services while access to credit/funding was relatively low (36.3%). The result revealed that age, farming experience, access to funding and farm size were significant at $P < 0.05$, access to extension services, participation in government programs, use of agroforestry are significant at $P < 0.01$ while educational level and membership in association, were also positive and significant at $P < 0.001$. The major constraints in sustaining the 3G project were destruction of trees, inadequate funding, lack of community participation, poor monitoring and inadequate awarenesses. The study concluded that the Gombe Goes Green initiative has a significant impact on climate change mitigation and community development in the study area. Based on these results, it was recommended that, community participation be encouraged, government and development partners strengthen follow-up mechanisms, increase funding and sensitization campaigns to ensure the sustainability of environmental initiatives.

Keywords: Climate, Change, Control, Mitigation, Strategy

INTRODUCTION

Climate change has emerged as the defining environmental challenge of our era, with profound implications for ecological systems, human health, and socio-economic stability worldwide. The Intergovernmental Panel on Climate Change (IPCC, 2021) underscores that global warming is driven predominantly by anthropogenic activities such as fossil fuel combustion, deforestation, and industrial emissions. These activities have resulted in increased concentrations of greenhouse gases (GHGs) in the atmosphere, leading to rising global temperatures, altered weather patterns, and intensified climate hazards, especially in vulnerable regions. Africa, particularly Nigeria, faces disproportionate impacts of climate change despite contributing minimally to global emissions. Nigeria's climate vulnerability is compounded by high dependence on climate-sensitive sectors like agriculture and natural resource exploitation, which are directly affected by environmental changes (Oluwatayo, 2021).

Gombe State exemplifies the complex interface between environmental degradation and socio-economic challenges. The community livelihoods predominantly revolve around agriculture, forestry, and natural resource use, which are increasingly threatened by climate variability. The region has experienced irregular rainfall patterns, prolonged droughts, and land degradation over recent years, disrupting agricultural productivity and exacerbating poverty (Ibrahim *et al.*, 2020). These environmental stresses threaten to entrench poverty and undermine sustainable development efforts unless effective mitigation and adaptation strategies are employed. The impact assessment of "Gombe Goes Green" thus becomes vital to determine whether the project effectively contributes to climate



change mitigation and community resilience. Such assessment involves evaluating environmental, socio-economic, and health outcomes, providing evidence-based insights for policymakers, stakeholders, and communities. The findings can inform scaling-up strategies, improve project design, and foster sustainable practices that balance ecological integrity with socio-economic development.

One critical concern is the limited awareness and understanding among community members about the direct and indirect impacts of climate change, which hampers their ability to participate actively in mitigation and adaptation efforts. Many residents rely on traditional practices that are increasingly incompatible with changing climatic conditions, leading to reduced crop yields, livestock losses, and compromised water sources (Adebayo et al, 2023). Without adequate knowledge of climate dynamics and the role of community-based mitigation strategies like "Gombe Goes Green," community members are less likely to adopt sustainable practices or support environmental conservation initiatives. Moreover, evaluating the outcomes of the Gombe Goes Green project will provide critical insights into its effectiveness as a mitigation strategy for climate change. This assessment will inform policymakers, environmental agencies, and development partners on best practices, areas needing improvement, and strategies for scaling up successful interventions.

The broad objective of the study is to examine the impact assessment of Gombe Goes Green: a mitigation strategy for climate change control in Gombe State, Nigeria. while the specific objectives were to;

1. describe the socio-economic characteristics of the respondents;
2. determine factors influencing awareness and participation in the 3G project; and
3. identify the constraints faced in the implementation and sustainability of the 3G project.

METHODOLOGY

The Study Area

The study was conducted in Gombe State, located in the Northeastern Region of Nigeria. Gombe State is situated within Latitudes 9°30' N and 11°00' N and Longitudes 10°30' E and 11°45' E. The state shares borders with Bauchi to the north, Adamawa to the east, Taraba to the southeast, and Plateau State to the west. Gombe State covers an area of approximately 18,768 square kilometers, characterized by diverse geographical features including savannah plains, rolling hills, and river valleys. Gombe experiences a tropical climate with distinct wet and dry seasons. The rainy season typically spans from May to October, with annual precipitation averaging between 800 mm and 1,200 mm, supporting agriculture and natural vegetation. The dry season, from November to April, is characterized by high temperatures often exceeding 35°C, which can contribute to desertification and land degradation if not properly managed. The variability in rainfall and temperature patterns poses challenges to local communities, especially those dependent on agriculture and natural resource management.

The topography of Gombe varies from relatively flat plains in the northern parts to hilly and undulating terrain in the southern and eastern regions. The soil types include loamy, sandy, and clayey soils, which influence land use and agricultural productivity across the state. River systems such as the Gongola River and its tributaries provide vital water resources for farming, domestic use, and potential climate mitigation initiatives like afforestation and green belt development. Agriculture is the backbone of Gombe's economy, engaging a significant proportion of the population. The predominant crops include millet, sorghum, maize, groundnuts, and vegetables such as tomatoes, which are vital for local consumption and income generation. In recent years, there has been increased emphasis on environmental sustainability and climate change mitigation, with initiatives such as "Gombe Goes Green" aimed at promoting afforestation, reforestation, and sustainable land management practices.

The population of Gombe is predominantly rural, with many households relying on farming, livestock rearing, and natural resource extraction for their livelihoods. Socioeconomic factors including access to financial resources, education, infrastructure, and market facilities significantly influence community resilience and adaptive capacity to climate change impacts. The increasing threat of climate change, manifested through unpredictable weather patterns, rising temperatures, and land degradation,

underscores the importance of implementing effective mitigation strategies like Gombe Goes Green to enhance environmental sustainability and community resilience.

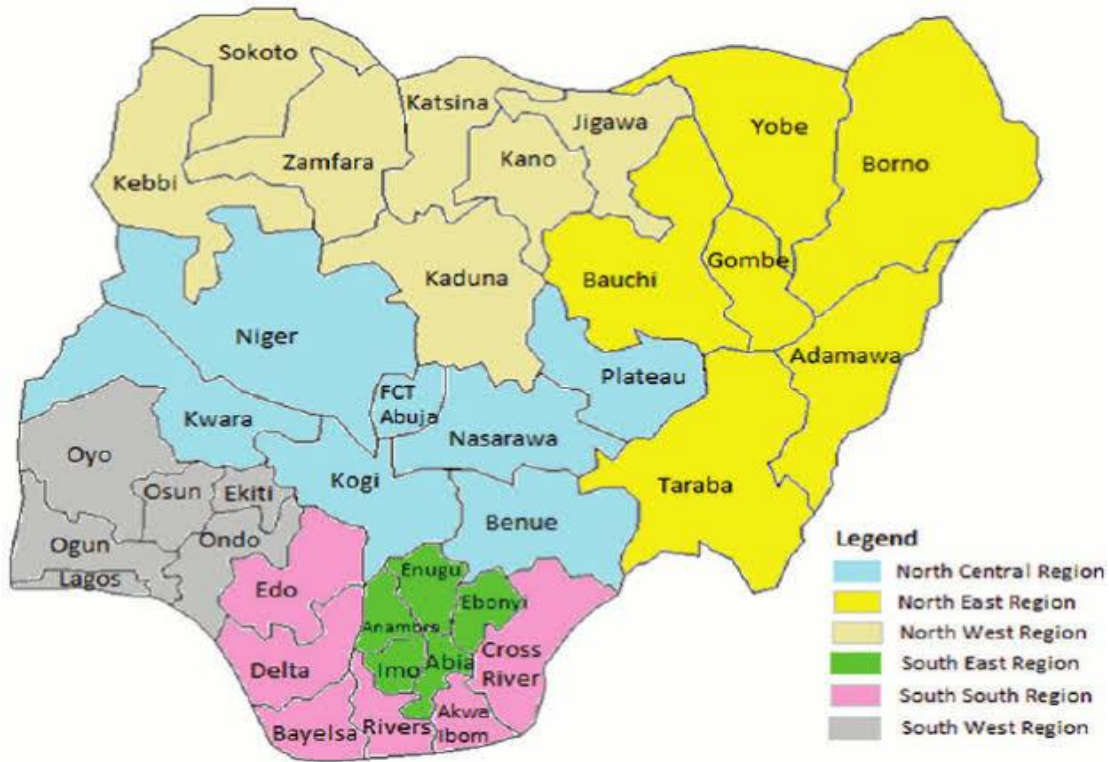


Figure 1 and 2 above are the Maps of Nigeria and Gombe State

Sampling Techniques and Sample Size

This study utilized a multi-stage sampling technique to ensure a representative and inclusive selection of respondents from communities engaged in the *Gombe Goes Green (3G)* initiative. Five Local Government Areas (LGAs) Akko, Yamaltu/Deba, Dukku, Gombe (LGA), and Balanga were purposively selected based on their active involvement in the project. The sample size was determined



using the Taro Yamane (1967) formula, which is appropriate for studies involving finite populations. Given a total estimated population of 750,000 across the selected LGAs and a 93% confidence level (margin of error = 0.07), the sample size was calculated as follows:

The formula is given as:

$$n = \frac{N}{1 + N(e)^2}$$

Where:

- n = required sample size
- N = total population
- e = level of precision (assumed at 5%, or 0.05)

$$n = \frac{750,000}{1 + 750,000(0.07)^2} = \frac{750,000}{3,676} \approx 204$$

A total of 204 respondents were proportionally distributed among the five LGAs based on their population sizes. Within each LGA, a stratified random sampling technique was applied to capture responses from key demographic and stakeholder groups, such as farmers, women, youth, traditional leaders, and community-based organizations. Simple random sampling was then used to select individual participants within each stratum.

Table 1: Sampling Size and Sampling Technique

LGA	Estimated Population	% of Total Pop.	Sample Size (n)
Akko	180,000	24.0	49
Yamaltu/Deba	150,000	20.0	41
Dukku	100,000	13.3	27
Gombe	200,000	26.7	55
Balanga	120,000	16.0	32
Total	750,000	100	204

Source: Gombe State Ministry of Environment

Method of Data Collection

Primary data were collected through the administration of a structured questionnaire designed to align with the study's objectives. The instrument was segmented into sections covering stated objectives. Both closed- and open-ended questions were included to allow for quantitative analysis and qualitative insights. Enumerators received detailed training on ethical conduct, survey objectives, and standardized administration procedures. Ethical standards were strictly upheld; informed consent was obtained, and respondents were assured of confidentiality and voluntary participation. This structured and culturally sensitive approach ensured credible and valid data.

Method of Data Analysis

Descriptive and inferential statistical tools were employed. Descriptive statistics were used to analyze objectives i and iii. Factors influencing community-level participation and awareness of the 3G project was achieved using inferential statistics.

Descriptive Statistics

Descriptive statistics were used to address objectives i and iii of the study. These included an analysis of the demographic and socio-economic characteristics of respondents and the constraints to implementation and sustainability of the project.

Inferential Statistics

To address objective ii on determining the factors influencing awareness and participation in the Gombe Goes Green (3G) project Specifically, a binary logit regression model was applied. This model was used to determine the probability of a respondent being aware of the 3G initiative, based on selected socio-economic and institutional variables.



The logit regression model is specified as follows:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + \beta_{11} X_{11} + \beta_{12} X_{12} + \beta_{13} X_{13} + e$$

Where:

Y = Awareness of the Gombe Goes Green (3G) project (1 = Aware, 0 = Not Aware)

X₁ = Age of respondent (in years)

X₂ = Marital status (1 = Single, 2 = Married)

X₃ = Educational level (1 = No formal education, 2 = Primary, 3 = Secondary, 4 = Tertiary)

X₄ = Household size (number of persons)

X₅ = Years of farming or environmental engagement experience (Years)

X₆ = Membership in environmental or community associations (1 = Yes, 0 = No)

X₇ = Access to extension services or environmental awareness programs (1 = Yes, 0 = No)

X₈ = Land ownership type (1 = Inherited, 2 = Rented, 3 = Allocated)

X₉ = Access to credit or funding (1 = Yes, 0 = No)

X₁₀ = Participation in government/community environmental programs (1 = Yes, 0 = No)

X₁₁ = Farm or land size (in hectares)

X₁₂ = Use of agro-forestry or tree planting practices (1 = Yes, 0 = No)

X₁₃ = Type of labor used (1 = Family labor, 2 = Hired labor)

β_0 = Constant

$\beta_1 - \beta_{13}$ = Regression coefficients

U = Error term

RESULTS AND DISCUSSION

Socioeconomics Characteristics of Respondent

Quantitative socio-economic characteristics of respondents

The result presented in Table 2 provides insight into the socio-economic characteristics of the respondents, which are important determinants of their participation, productivity, and decision-making in farming and environmental activities. The age distribution shows that the respondents were relatively young, with a mean age of 38 years. A majority fell within the active and productive age bracket of 30–39 years (31.3%), followed closely by those less than 30 years (25.9%) and those within 40–49 years (23.4%). Only 19.4% were 50 years and above, which suggests that the majority of respondents were within their economically active years. This finding is consistent with the view of Yusuf *et al.* (2022), who emphasized that the age structure of farmers is critical in determining their willingness to adopt new innovations, as younger individuals are generally more receptive to change compared to older farmers. The household size distribution revealed an average household size of 6 members, with nearly half (45.8%) having 1–5 persons, 37.8% having 6–10 persons, and 16.4% with more than 10 members. This reflects the prevalence of large household sizes common in rural communities, which may serve as both a source of farm labour and a burden on household resources. This supports the argument of Ahmed *et al.* (2024), who noted that larger households provide farm labour but may also increase consumption pressure, reducing disposable income. On farming and environmental experience, the respondents had a mean of 11 years of experience. The distribution shows that 33.8% had between 1–10 years, 26.9% had 11–20 years, 15.9% had more than 20 years, while 23.4% had no experience. This suggests a relatively balanced mix of new entrants and experienced individuals, which could influence both innovation adoption and traditional practice retention. This is in line with the findings of Eze *et al.* (2018), who stated that farming experience is crucial for decision-making, resource management, and resilience in agricultural activities.



Table 2: Distribution of Respondents According to Quantitative Socio-Economic Characteristics (n = 201)

Socio-economic characteristics	Frequency	Percentage	Mean
Age			38
Less than 30 years	52	25.9	
30–39 years	63	31.3	
40–49 years	47	23.4	
50 years and above	39	19.4	
Household Size			6
1–5 persons	92	45.8	
6–10 persons	76	37.8	
Above 10 persons	33	16.4	
Farming/Environmental Experience			11
None	47	23.4	
1–10 years	68	33.8	
11–20 years	54	26.9	
More than 20 years	32	15.9	

Source: field survey, 2025

Quantitative Socioeconomics Characteristics

The result in Table 3 indicates that males dominated the sample, accounting for 62.7%, while females represented 37.3%. This skewed representation may reflect the gendered nature of farming and environmental engagement in northern Nigeria, where men typically control land and major farming decisions, while women often play supportive roles. Gender remains a major socio-economic factor influencing access to agricultural resources, with men often having greater opportunities than women. Regarding marital status, a significant proportion of respondents were married (65.7%), while 23.9% were single and 10.4% were divorced or widowed. The dominance of married individuals implies a higher level of household responsibility, which may influence their involvement in farming as a source of livelihood to sustain family needs. This is supported by the work of Olayemi *et al.* (2023), who observed that married farmers are more likely to invest in farming because of household food security concerns.

In terms of education, the respondents had diverse levels of educational attainment, with secondary education being the most common (33.8%), followed by tertiary education (24.9%), and primary education (20.9%). About 13.9% had no formal education, while 6.5% had only Quranic education. The mean level suggests moderate literacy within the sample, which is advantageous for effective communication and adoption of modern agricultural practices. Similar results were reported by Ibrahim *et al.* (2010), who highlighted that higher educational attainment enhances farmers' ability to process information and apply improved practices, thereby boosting productivity. With respect to membership in associations, more than half of the respondents (58.7%) belonged to one form of association, while 41.3% did not. This indicates a reasonably high level of social participation, which has implications for access to information, cooperative support, and resource pooling. Membership in farmer groups enhances access to extension services, credit facilities, and collective bargaining power.

Access to extension services was reported by 54.2% of the respondents, while 45.8% had no access. Although slightly above average, the result indicates that nearly half of the respondents still lacked contact with extension agents, which could negatively affect the dissemination of improved practices. This agrees with the submission of Okeke and Bello (2020), who noted that limited access to extension services is one of the major challenges hindering agricultural productivity in Nigeria. Finally, access to credit/funding was relatively low, with only 36.3% having access while the majority (63.7%) reported no access. This reflects a significant financial constraint that could hinder productivity, as access to capital is crucial for purchasing farm inputs, adopting new technologies, and expanding production. Lack of credit access is a persistent challenge for smallholder farmers, limiting their ability to improve output and income.



Table 3: Distribution of Respondents According to Qualitative Socio-Economic Characteristics (n = 201)

Socio-economics	frequency	percentage
Sex		
Male	126	62.7
Female	75	37.3
Marital Status		
Single	48	23.9
Married	132	65.7
Divorced/Widowed	21	10.4
Level of Education		
No formal education	28	13.9
Primary	42	20.9
Secondary	68	33.8
Tertiary	50	24.9
Quranic	13	6.5
Membership in Associations		
Yes	118	58.7
No	83	41.3
Access to Extension Services		
Yes	109	54.2
No	92	45.8
Access to Credit/Funding		
Yes	73	36.3
No	128	63.7

Source: Field Survey, 2025

Factors Influencing Awareness and Participation in the Gombe Goes Green Project

The results of the regression in Table 4 indicate that several socio-economic and institutional variables significantly influenced respondents’ awareness and participation in the Gombe Goes Green project. Education level ($\beta = 0.326, p < 0.01$) positively influenced awareness, implying that literate respondents were more likely to recognize and participate in climate mitigation activities. Membership in associations ($\beta = 0.657, p < 0.01$) and access to extension services ($\beta = 0.712, p < 0.01$) were also highly significant, suggesting that social networks and institutional support play pivotal roles in mobilizing awareness. Extension services and community-based organizations serve as vital entry points for environmental campaigns in rural areas.

Table 4: Factors Influencing Awareness of the 3G Project (n = 201)

Variable	Coefficient (β)	Std. Error	Odds Ratio (Exp β)	p-value	Decision
Constant	-2.134	0.742	–	0.003	***
Age	0.018	0.009	1.02	0.047	*
Marital status	-0.106	0.214	0.90	0.617	Ns
Education level	0.326	0.118	1.38	0.006	***
Household size	-0.042	0.028	0.96	0.131	Ns
Farming/environmental experience	0.091	0.037	1.09	0.012	*
Membership in associations	0.657	0.232	1.93	0.004	***
Access to extension services	0.712	0.245	2.04	0.002	**
Land ownership type	0.185	0.139	1.20	0.185	Ns
Access to credit/funding	0.298	0.167	1.35	0.078	*
Participation in govt/community programs	0.829	0.301	2.29	0.007	**
Farm/land size	0.065	0.032	1.07	0.038	*
Use of agroforestry/tree planting	0.913	0.321	2.49	0.004	**
Type of labor used	-0.156	0.201	0.86	0.435	Ns

Model Summary Source: Field Survey, 2025 *($p < 0.01$) **($p < 0.05$) ***($p < 0.001$) Ns. not significant

- Log likelihood = -112.73 ($p < 0.001$)
- Pseudo R^2 (Nagelkerke) = 0.29
- Correct prediction rate = 78.6%

Participation in government/community environmental programs ($\beta = 0.829$, $p < 0.01$) and adoption of agroforestry/tree planting ($\beta = 0.913$, $p < 0.01$) showed strong positive effects, indicating that direct involvement in practical activities and policy-driven programs enhances familiarity with the initiative. Similarly, farming/environmental experience ($\beta = 0.091$, $p < 0.05$) and larger landholdings ($\beta = 0.065$, $p < 0.05$) increased awareness, reflecting that individuals with greater environmental exposure or resources are more responsive to conservation campaigns. Age was significant ($\beta = 0.018$, $p < 0.05$), though the effect was small, suggesting that older respondents were slightly more likely to be aware, possibly due to longer exposure to environmental degradation. Conversely, marital status, household size, land tenure, and type of labor used were not significant, implying that household structure and marital situation did not strongly shape awareness. Overall, the model correctly predicted 78.6% of cases, with a pseudo R^2 of 0.29, indicating moderate explanatory power. These results suggest that educational attainment, institutional engagement, and practical involvement in environmental activities are the most critical drivers of awareness and participation in the Gombe Goes Green initiative.

Constraints in Implementing and Sustaining the 3G Project

The results in Table 5 clearly reveal that several factors significantly constrain the successful amplified as a serious constraint by respondents. It is noted that one of the critical threats to afforestation and reforestation projects in Nigeria is the indiscriminate cutting and destruction of young trees, either for fuelwood, construction purposes, or through uncontrolled grazing. Similarly, tree planting initiatives across Nigerian states often suffer setbacks because of a lack of enforcement measures against intentional destruction, thereby undermining long-term sustainability. Inadequate funding for project activities also emerged as a serious challenge with a mean of 4.01, confirming that financial constraints remain one of the most significant barriers to environmental management initiatives. According to Adeyemi et al. (2022), many government-led environmental interventions fail to achieve their objectives because they are often initiated without sufficient long-term budgetary commitments. This aligns with the findings of Gaidam & Mohammed. (2022), who reported that in Northern Nigeria, most afforestation projects collapse prematurely due to irregular funding and lack of provision for ongoing maintenance. The current study supports these observations, as respondents strongly perceived funding



limitations as a primary barrier to sustaining the 3G project. Poor monitoring and follow-up were also highlighted with a mean of 3.88, indicating that weak institutional frameworks limit effective project execution.

Another major constraint identified was lack of community participation with a mean of 3.62, suggesting that beneficiaries and local residents are not fully involved in the planning and implementation of the project. Community involvement is a key determinant of project ownership and sustainability in environmental initiatives. When local communities are excluded, projects face resistance, neglect, or outright failure. In the case of Gombe State, limited participation may reflect inadequate mobilization and weak collaboration between stakeholders, which restricts the potential of the 3G project to achieve its goals.

Table 5: Constraints in Sustaining the Gombe Goes Green (3G) Project (n = 201)

Constraint	Mean	Decision
Inadequate funding for project activities	4.01	Serious constraint
Lack of community participation	3.62	Serious constraint
Poor monitoring and follow-up	3.88	Serious constraint
Inadequate awareness and education	3.54	Serious constraint
Vandalism/destruction of trees	4.15	Serious constraint

Source: field survey, 2025

Finally, inadequate awareness and education recorded a mean of 3.54, also ranked as a serious constraint, indicating that many community members lack adequate knowledge of the benefits of afforestation. This aligns with the findings of Okeke et al. (2020), who argued that insufficient environmental education remains a major barrier to successful afforestation programs in Nigeria, as many residents still undervalue the ecological benefits of trees.

CONCLUSION AND RECOMMENDATION

The study concludes that education level, membership in associations, access to extension services, participation in government or community programmes, and engagement in agroforestry practices significantly enhanced awareness and participation in the 3G initiative. In addition, while the Gombe Goes Green project has strong potential to enhance environmental sustainability and community resilience to climate change, its impact can only be sustained through improved funding mechanisms, strengthened institutional frameworks, enhanced community engagement, and continuous environmental education.

Based on the findings of the study, the following recommendations are made:

- i. Government agencies and implementing partners should intensify community-based environmental education campaigns using local languages.
- ii. Participatory approaches should be adopted to improve understanding of climate change and the benefits of afforestation initiatives such as the 3G project.
- iii. Sustainable and dedicated funding mechanisms should be established to ensure continuity of project activities
- iv. Community members should be actively involved in the planning, implementation, and monitoring stages of the project.

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