

EXAMINING THE ROLE OF COMMUNITY ENGAGEMENT AND CAPACITY BUILDING IN THE ACCEPTANCE OF RENEWABLE ENERGY PROJECTS: THE MEDIATING ROLE OF TRUST

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Abstract

Global climate change threats demand urgent renewable energy transitions, yet public scepticism rooted in unfamiliarity and lack of trust poses barriers to widespread adoption. This issue persists in Nigeria despite supportive policies as scepticism erodes cooperation needed for success of community-based projects. Accordingly, this study investigated how targeted community engagement strategies and capacity building interventions shape public trust evaluations to influence citizens' willingness to participate in local renewable energy initiatives. Quantitative survey data from 876 Nigerian residents were analyzed using PLS-SEM methodology. Results revealed participatory engagement platforms and education demonstrations exerted significant positive effects on public trust in proposed projects. Moreover, trust mediated the relationships between engagement, education and willingness to participate - substantiating its pivotal role fostering cooperative behaviours. Findings contribute empirical evidence regarding comparative influence mechanisms driving sociotechnical transitions in the understudied Nigerian context. Practical implications centre on building early-stage community partnerships and competence signalling to shift scepticism. Without renewing public trust, well-intended incentives and persuasion attempts falter. Accordingly, facilitating transparent interactions, conveying reliability and matching communications to localized priorities constitutes imperative starting points for transition strategies seeking participatory momentum. This supports decentralizing policy efforts for more resilient locally attuned renewable energy futures.

Keywords: green energy; collaboration; capacity building; community engagement; public trust; technology

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1. Introduction

Global climate change poses an urgent crisis necessitating rapid societal transitions from fossil fuel-based energy systems towards renewable alternatives like solar, wind and hydropower. Yet achieving widespread adoption faces complex social barriers rooted in public scepticism and lack of community participation (Walter & Gutscher, 2010). This underscores the need for context-specific evidence on factors driving acceptance of renewables across diverse populations. Though Nigeria maintains immense potential for clean energy given extensive natural resources, adoption efforts continue encountering public distrust, doubts regarding feasibility, and unwillingness from citizens to back projects (Ogunjuyigbe et al., 2016). As such, this study investigates how locally focused community engagement initiatives alongside public education programs can intervene to build trust, shape positive technology perceptions, and ultimately enhance Nigerians' willingness to participate in adaptive renewable energy projects.

While technology advancements have expanded renewable energy systems' efficiency and affordability, diffusion lags due to social acceptance issues rather than strictly technical or economic limitations in contexts like Nigeria (Riahi et al., 2021). Here, cultural unfamiliarity and emphasis on risks over benefits fuels public wariness, despite national incentives supporting renewables (Emodi & Ebele, 2016). Crucially, citizens lack information and opportunities to voice concerns early when opposition tendencies solidify (Ogunjuyigbe et al., 2016). Hence community-based platforms for engagement and learning represent potential pathways for addressing distrust rooted in knowledge gaps and procedural justice worries (Walker & Devine-Wright, 2008). However, few empirical evaluations enlighten optimal strategies for enabling public trust or spurring active participation tailored to community needs that accelerator diffuse renewables adoption (Brunie, 2009). While case studies highlight promising examples of engagement forums and capacity building programs cultivating acceptance, systematic comparisons assessing influence mechanisms across tactics remain scarce, especially within the understudied Nigerian context (Walter & Gutscher, 2010; Willis et al., 2007). This constrains evidence-based policy and practice. Accordingly, guided by social capital and diffusion of innovation theories, the current study asks: How can community-based engagement versus education programs enhance public trust and willingness to participate in renewable energy adoption in Nigeria?

This study posits that community-led engagement and capacity building can foster renewable energy acceptance by improving project transparency, attitudes and

trust. Grassroots participatory forums enabling citizens to gain trusted information and voice opinions facilitate solution-focused dialogue, convey respect, and build support (Kerr et al., 2017). Meanwhile experiential learning interventions demonstrate feasibility and compatibility - unlocking interest (Claudy et al., 2013). Comparing the influence of strategies on knowledge, technological perceptions, trust and willingness constitutes a novel contribution with practical and policy implications. Findings can guide contextually attuned interventions to accelerate Nigeria's renewable transition by spotlighting community-driven levers for overcoming barriers rooted in scepticism and unfamiliarity.

Grounded in relevant theory, the study puts forth a conceptual model situating the independent variables of community engagement strategies and public education programs as drivers that can shape key cognitive, emotional and behavioral outcomes related to public trust, technology perceptions, and citizens' willingness to participate in proposed local renewable energy projects. Here, grassroots participatory platforms and capacity building offer complementary routes to building acceptance via transparency, attitude and trust transformations.

As the threats of climate change grow increasingly dire, the need for smooth sociotechnical energy transitions also heightens (Sovacool et al., 2020). This study's focus on building acceptability and participation surrounding renewables adoption in Nigeria via context-specific engagement and capacity building addresses key barriers constraining clean energy transitions across the developing world. Findings will enable targeted, evidence-based policy and practical strategies for practitioners aiming to foster public trust, positive perceptions, and involvement by starting local through community-centered education and dialogue platforms. Ultimately Navarrete (2021) contends renewable energy transitions demand collaborative multi-stakeholder efforts merging technological innovations with social change. By illuminating influencers and mechanisms integral for citizen participation, this research contributes to the social dimension enabling Nigeria's adaptive transition to sustainable energy systems.

2. Literature Review and Hypothesis Formation

2.1. Community Engagement

Community engagement refers to the process of involving community members and fostering participation in initiatives or decisions that impact the community (CDC, 2011). Within renewable energy contexts, prior studies reveal a growing focus on

engagement strategies to build acceptance of new projects. Effective community engagement enables residents to gain trusted information while voicing concerns, spurring dialogue, building procedural justice perceptions, and enhancing buy-in (Kerr et al., 2017; Trutnevyte et al., 2021; Walker et al., 2010). However, challenges still remain surrounding optimizing community participation mechanisms.

Several case studies highlight the utility of public forums and deliberative meetings as key community engagement tactics. For instance, facilitated small group community meetings have been found to offer residents valuable opportunities to learn about planned renewable energy facilities, while also feeling genuinely listened to regarding worries - helping build acceptance perceptions even amidst continued scepticism (Brunie, 2009). Similarly, Kerr et al., (2017) revealed that consistent community roundtable listening sessions helped establish positive reciprocity dynamics between renewable developers and residents in Scotland, encouraging embrace of the projects. Here, community steering groups and more informal social gatherings provided both information sharing and relationship building opportunities credited with mitigating opposition (Kerr et al., 2017). These examples showcase the value of iterative in-person forums for bridging divides and nurturing trust.

Complementarily, Hunter and Valentine (2017) showcase online townhalls and social media forums as lower-cost community engagement tactics that also surface concerns and facilitate problem-solving. Accordingly, multi-modal informational hearings, interested group meetings, and sustained online feedback avenues may provide optimal community participation opportunities (Hunter & Valentine, 2017). Still, challenges related to marginalization and ensuring broad demographically representative engagement persist (Trutnevyte et al., 2021). More so, prior qualitative evaluations reveal community engagement processes help enhance clarity, participation opportunities, trust-building, and collective navigation of renewable energy tensions - spotlighting their value for research and adoption efforts.

H1: Community Engagement Influences citizens willingness to participate in green energy programmes

H2: Community Engagement Influences public trust to participate in green energy programmes

2.2. Capacity Building

Capacity building refers to enhancing the knowledge, skills, resources and organizational structures needed to effectively advance adoption of innovations like renewable energy technologies (Willis et al., 2007). Education and training focused on improving technical knowledge, positive attitude formation, and overcoming barriers have been identified as key capacity building pathways to drive climate action among individuals and communities (Fazey et al., 2018). However, questions remain regarding optimal educational formats and content for renewable energy.

Prior literature reveals multiple beneficial outcomes stemming from renewable energy education campaigns and training programs. For instance, classroom sustainability workshops have been found to shift youth opinions, trust and emotional connectivity to climate change issues—building engagement capacity (Lombardi et al., 2019). Similarly, townhall presentations on renewable technologies increased knowledge and positively influenced attitudes among community residents (Hayden et al., 2018). These examples showcase cognitive impacts, yet capacity advances also depend on skill-building. Here, hands-on solar panel installation training enabled tribes to independently adopt and maintain projects, underscoring applied learning for capacity retention (Leonard et al., 2019). Accordingly, multifaceted education initiatives spanning awareness raising to technical skills development provide interconnected channels for capacity building.

However, gaps persist surrounding what formats are optimal across contexts. While in-person trainings show promise for rural regions, virtual workshops have enabled diffuse global knowledge exchange as well (Willis et al., 2007). Structured curriculums also appear more impactful than basic information provision, yet development requires extensive input (Fazey et al., 2018). Importantly, capacity building programs rooted in community participation in planning and implementation better respond to localized needs and cultural norms as well (Hayden & Deng, 2016). Hence sufficient adaptability and partnership appear integral. Synthesizing insights, an interdisciplinary perspective conceptualizes capacity building as “an endogenous, multilevel, and multidimensional process” demanding coordinated efforts across institutional, organizational, and individual community elements (Hayden & Deng, 2016, p.233).

H3: Capacity Building Influences citizens willingness to participate in green energy programmes

H4: Capacity Building Influences public trust to participate in green energy programmes

2.3. Public Trust in Green Energy Programmes

Trust constitutes a key precursor enabling community acceptance and adoption of renewable energy projects, yet barriers surrounding public scepticism persist. At the interpersonal level, emotional trust in developers' intentions and competence as well as democratic trust in participatory justice shape project perceptions (Wüstenhagen et al., 2007). At a broader level, institutional trust aligned with consistent policy and regulatory structures also influences willingness to accept community renewables (McCauley et al., 2019). This review synthesizes key determinants and outcomes of public trust uncovered across prior renewable energy research.

Emotional trust grounded in feelings of transparency, care, and reliability toward specific developers appears foundational. Developer communication patterns and responsiveness signal intent and drive emotional trust appraisals (Fast, 2021). For instance, case studies reveal consistent interactive meetings enable emotional trust-building, whereas prolonged unresponsiveness to community requests or absent updates erode confidence in intentions (Brunie, 2009; Cowell et al., 2012). Complementarily, perceptions of fairness and justice tied to opportunities for information and participation cultivate crucial public trust by conveying respect (Walter & Gutscher, 2010). Here, democratic trust forms when people believe processes give equal voice to all stakeholders (Fast, 2013). As such, emotional, competence and democratic trust constitute critical intermediaries.

At a higher order, these individual and relational assessments feed into institutional trust judgments. Citizens gauge institutional support for renewables via coherence of policies and goal setting, visible political commitments and insurance of non-exploitation (Wüstenhagen et al., 2007). For example, stable incentive schemes and community benefit structures reinforce institutional reliability over time - building public trust in the supportive context needed for project success (Kerr et al., 2017). Without institutional signals enabling trust, even well-intentioned developers struggle converting local goodwill into project acceptance (Cowell et al., 2012).

Synthesizing insights, public trust accrues via emotional appraisals of intentions and competence, visible participatory justice cues, as well as clear institutional structures that align with community needs and priorities (Walter & Gutscher, 2010; Wüstenhagen et al., 2007). This multilayered trust proves foundational for collaborative community renewable energy projects. However, public scepticism rooted in focus on risks over benefits persists as a barrier (Shamsuzzaman & Young, 2020). Here, community-based education and engagement emerge as potential trust-

building pathways that remain underexplored across contexts. More inquiry examining locally attuned strategies for enabling public trust represents an imperative opportunity to accelerate renewable energy deployment.

H5: Public Trust Influences citizens willingness to participate in green energy programmes

H6: Public trust mediates the relationship between community engagement and citizens willingness to participate in green energy programmes

H7: Public trust mediates the relationship between capacity building and citizens willingness to participate in green energy programmes

2.4. Willingness to Participate in Renewable Projects

Willingness to adopt or actively participate in renewable energy initiatives constitutes a pivotal precursor for technology diffusion, yet adoption rates continue to vary greatly across communities (Carattini et al., 2021). While awareness and positivity towards renewables has expanded globally, most climate action models necessitate far broader societal involvement (Sovacool et al., 2020). This underscores public willingness to participate as imperative - though factors shaping embrace or opposition remain underexplored across cultural contexts.

Prior quantitative surveys reveal perceived personal and community benefits act as key drivers of willingness to participate in green energy programs (Koirala et al., 2016). Similarly, community energy studies underscore altruism towards climate change mitigation and collective civic participation norms as motivators for involvement in local renewables initiatives (Kalkbrenner & Roosen, 2016). Younger generations exhibit consistently higher willingness, pointing to potential target demographics (Carattini et al., 2021). Still, intentions often exceed behaviors, as structural constraints beyond motivations related to inconsistent policy support, high costs or financing barriers inhibit actual adoptions (Sovacool et al., 2020).

Qualitative case studies provide additional context, unveiling psychosocial, political and demographic predictors. Across municipalities, trust in providers and local government process fairness enhance participation likelihood (Yliskylä-Peuralahti et al., 2021). Comparatively, perceptions of exclusion from decisions or top-down politically forced policies spur reactions limiting willingness and derailing projects (Brunie, 2009). Hence both emotional and functional barriers warrant consideration alongside motivations. Importantly, community-focused education, dialogue forums and participatory planning processes appear to increase openness by spurring local connections (Dóci & Vasileiadou, 2015). Still few empirical

evaluations exist examining comparative effectiveness of specific citizen participation pathways (Carattini et al., 2021).

3. Theoretical Review

To conceptualize the mechanisms by which community engagement and capacity building may influence acceptance of innovative renewable energy systems, this study draws on two complementary theories - social capital theory and diffusion of innovations theory. These perspectives inform assumptions and predictions around trust-building, participation dynamics, and technology adoption within communities.

3.1. Social Capital Theory

Social capital refers to the “features of social life networks that enable participants to act together more effectively to pursue shared objectives” (Putnam, 1995, p.664). This overarching concept includes elements related to trust, norms of reciprocity, civic participation, and the networks that underpin such aspects (Helliwell & Putnam, 2004). Accordingly, social capital is theorized to function as a resource for communal action and collective efficacy. Applying this concept to renewable energy adoption suggests that willingness to embrace innovative renewable technologies may in part be shaped by the stocks of trust, shared expectations, and channels of civic participation and information exchange within a community. By connecting residents through information and engagement platforms, feelings of procedural justice, and reciprocal support norms, social capital can grow - enabling the coordination needed for renewables diffusion (Walker & Devine-Wright, 2008). As such, social capital theory centered on civic participation and trust-building mediating information exchange will guide one key theoretical framework underpinning this study.

In relation to social capital, dense networks of interactions and connections within a community can promote trust and norms of mutual support by enhancing information flows and perceptions of transparency (Butler et al., 2015; Dale & Newman, 2010). As applied to this study, approaches that tap into existing community ties and relationships to foster open communication around renewable projects may thus help improve understanding and attitudes while building further social capital reservoirs of trust. For instance, grassroots initiatives leveraging influential community groups as champions for participatory town halls or meetings may enable constructive dialogue and convey a sense of procedural justice - building

support for projects (Brunie, 2009; Gross, 2007). Furthermore, consistent grassroots engagements have been found to cultivate feelings of reciprocity between residents and renewable developers - encouraging willingness to accept projects via residents' sense of obligation from sustained listening and information exchange (Kerr et al., 2017). Accordingly, the study will draw on social capital tenets around dense networks and reciprocal norms to explore how targeted community participation platforms shape both cognitive and emotional aspects of trust-building to influence acceptance.

Trust provides the basic foundation enabling citizens to accept advice, join collective causes, and cooperate across community renewable energy projects (Walker et al., 2010). Complementarily, social capital accrued through networks of mutual support and expectations of reciprocity help residents manage vulnerabilities interdependently - providing an alternate basis for communal trust (Abada, 2018). As such, social capital accrued through consistent community engagement and grassroots information exchange provides a key pathway for building various forms of public trust theorized to shape willingness to participate in community-based renewables initiatives (Brunie, 2009; Abada, 2018). Accordingly, grounded in social capital theory, a key premise of this study is that community-centered engagement and education platforms may influence acceptance by fostering trust.

3.2. Diffusion of Innovations Theory

Diffusion research seeks "to explain how innovations are taken up in a population" (Straub, 2009, p. 626). Relevant to this study, perceived attributes of renewable energy technologies themselves as well as change agent efforts are posited as central drivers shaping adoption decisions (Claudy et al., 2013; Rogers, 2003). Key aspects of this theory will be applied to conceptualize how education and engagement platforms operate as change agents to positively shape public perceptions and willingness to adopt community renewable energy systems.

Central to renewable energy adoption decisions are citizen assessments of the feasibility, utility, complexity, compatibility, trialability, observability and relative advantage of technologies (Claudy et al., 2013; Karakaya et al., 2015). Here, concrete ability to demonstrate and trialability are especially critical, as hands-on interaction can shape early perceptions and trust (Rogers, 2003). As such, the theory suggests that targeted demonstrations and trainings meant to showcase renewables' utility and compatibility may be particularly impactful change agent drivers of acceptance compared to strictly persuasive communication efforts (Claudy et al., 2013). This further aligns with social capital postulations around information channels building

knowledge. Accordingly, grounded in diffusion of innovation premises, the study will assess demonstrations and experiential learning as key educational platforms theorized to positively shape technology perceptions and adoption decisions.

Diffusion also depends on how change agents interface with communities as external information sources. When change agent efforts employ communication matching the backgrounds, education levels, and relational proximity of adopters, diffusion accelerates (Rogers, 2003). As opinion leaders closely embedded in grassroots community networks, local champions and leaders may thus act as optimally heterophilic change agents to diffuse renewables information (Shakya & Shrestha, 1985).

4. Conceptual Framework

Expanding renewable energy adoption faces public scepticism barriers in many Nigerian communities. However, community-centered initiatives may present solutions for overcoming this. The study investigates how tailored community engagement strategies and capacity building programs can shape public trust and willingness to accept renewable technologies. Specifically, the independent variables of interest are methods of enabling citizen participation through avenues such as town halls and focus groups, as well as building knowledge capacity via awareness campaigns, trainings and technology demonstrations. These initiatives are expected to influence mediating processes related to project transparency, residents' knowledge, and attitudinal shifts. Enhanced clarity around plans, opportunities to provide input, and improved understanding of feasibility may subsequently cultivate process-based and cognitive-based trust. As such, the key outcome variable will be public trust in proposed community renewable energy projects and technologies. This trust is then hypothesized to encourage willingness to adopt or actively participate in renewable energy - the final outcome measure capturing acceptance. The overarching assumption is that establishing community trust and buy-in are crucial precursors enabling the success of any local renewable energy transitions. Assessing how tailored engagement and education shape Nigerian community members' trust and acceptance will offer practical insights into this. The conceptual model outlines variables and mechanisms of interest to empirically examine these assumptions.

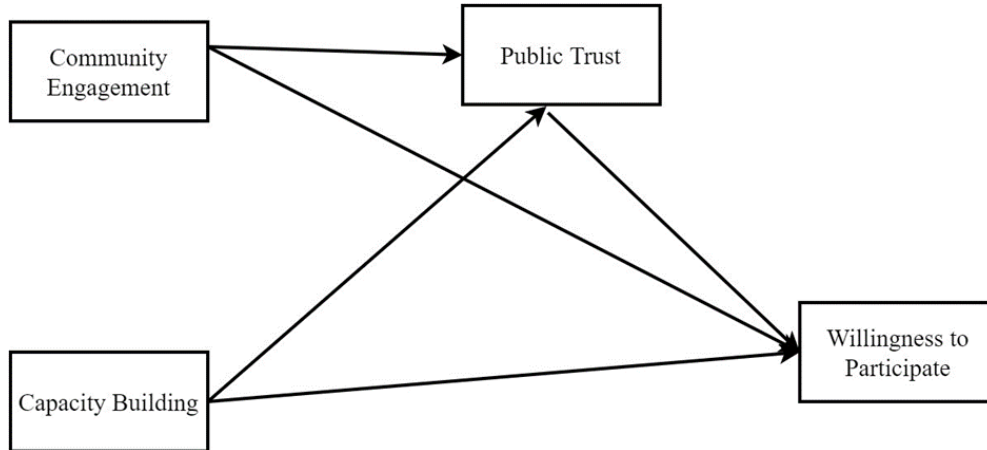


Figure 1. Conceptual Model

5. Methodology

This study utilizes a quantitative approach to examine the research objectives related to community engagement, capacity building, public trust and willingness to participate in renewable energy. Quantitative methods allow for statistical analysis of measured variables to test the directionality and significance of hypothesized relationships (Creswell & Creswell, 2018). Accordingly, survey questionnaire data were analyzed using partial least square structural equation modeling. The population of interest is Nigerian citizens given the localized focus on community renewable energy adoption. A target sample size of 1,700 is determined based on power analyses conducted using G*Power software to enable detection of small effect sizes with 95% confidence and 5% margin of error. Due to population accessibility constraints, non-probability snowball sampling was used, beginning with convenience sampled seed participants who then recruit additional respondents from their networks to achieve the target sample size. The self-administered questionnaire was hosted online for ease of distribution across the sample. Links were shared with seed participants from various regions of Nigeria, who then share the survey with their contacts. Unique single-use links prevented duplicate responses. Completed responses were downloaded from the host platform for analysis. The questionnaire comprises multiple previously validated multi-item scales related to key variables including community engagement strategies, capacity building, public trust, and willingness to adopt renewable energy. Content validity was confirmed by a panel of 5 subject matter experts. A pilot test with 11 Nigerian citizens established item clarity and internal reliability. Common method bias from

self-reported data were statistically examined by including validated marker variables in analyses (Podsakoff et al., 2003).

5.1. Measurement of Variables

The community engagement measures were adapted from scales used in prior studies on public participation in renewable energy projects, such as the work of Kerr et al. (2017) and Walker et al. (2010). These studies have developed and validated instruments to assess the quality and effectiveness of community engagement platforms, including items related to transparency, information sharing, and opportunities for voice and collaboration. The capacity building constructs were measured using items from educational evaluation frameworks applied in renewable energy and sustainability contexts. Specifically, the study drew on validated scales from Fazey et al. (2018) and Leonard et al. (2019), which have assessed the impacts of renewable energy training programs and hands-on technical workshops on improving community knowledge, skills, and competencies. Public trust measures were synthesized from established trust scales in the renewable energy literature. This includes emotional trust items adapted from Wüstenhagen et al. (2007) and Brunie (2009), as well as institutional trust items based on the work of Kerr et al. (2017) and McCauley et al. (2019). These prior studies have rigorously developed and tested instruments to capture the cognitive, affective, and structural dimensions of trust relevant to renewable energy project acceptance. The willingness to participate construct was measured using scale items from studies such as Kalkbrenner and Roosen (2016).

6. Analysis

The online survey collected 876 usable responses out of the 1,700 sent out. This reflects a strong interest in the topics explored related to community renewable energy engagement and education. Gaining citizen insights is crucial, and the demographic profile as shown in Table 1 indicates coverage of key groups needed to inform policy decisions across age, place of residence, education levels and employment status. Specifically, about twice as many men as women completed the survey. In terms of age, the bulk of responses came from citizens in their prime working years between 31 and 50 years old. However, both youth under 20 years old and elderly participants over 50 also voiced their equally valuable perspectives, despite small numbers. Capturing concerns of those just entering or approaching retirement age matters when implementing community renewable projects intended

to benefit all groups long-term. Additionally, the data includes insights from both urban city-dwellers as well as rural small-town residents, in reasonable proportion to Nigeria's urban-rural population distribution. Education levels varied greatly as well, spanning from only primary schooling to advanced postgraduate degrees. Occupational diversity was also strong, incorporating unemployed citizens and students alongside public, private and self-employed professionals. This range aids investigating what barriers around trust or participation may uniquely exist for different education or employment categories.

Table 1. Demographic Profile of the Respondents

		%	Freq
Age	Less than 20	6	53
	20-30	17	149
	31-40	30	263
	41-50	27	237
	Above 50	20	175
Gender	Male	67	587
	Female	33	289
Residence	Rural	26	228
	Urban	74	648
Educational Qualification	Primary Only	4	35
	Post Primary	6	53
	Secondary Only	9	79
	Post Secondary	11	96
	OND/NCE	15	131
	Bachelor/HND	35	307
	Post Graduate	20	175
	Self-Employed	19	166
	Government Employed	17	149
Occupation	Private Sector Employed	27	237
	Student	18	158
	Unemployed	19	166

6.1. Measurement model

The constructs demonstrate good internal consistency reliability, with Cronbach's alpha values above the recommended 0.7 threshold (Community Engagement = 0.762, Public Trust = 0.785, Willingness to Participate = 0.722, Capacity Building = 0.753). The composite reliability values also exceed 0.7 across constructs. The average variance extracted (AVE) values are acceptable ranging from 0.514 to 0.564. The outer loadings for most indicators are above the recommended 0.7 threshold, indicating they satisfactorily represent their respective constructs. A few items have slightly lower loadings around 0.68-0.69 (CEG6, CEG7), but are still acceptable. The

HTMT values between constructs are below the conservative 0.85 cutoff, suggesting discriminant validity is established. Therefore, as presented in Table 2, the measurement model demonstrates reasonable reliability and validity properties based on the PLS-SEM analysis results.

Table 2. Measurement Model Result

Constructs	Items	Outer loadings	CA	CR (rho_c)	AVE
Community Engagement	CEG1	0.765	0.762	0.76	0.564
	CEG2	0.716			
	CEG3	0.729			
	CEG4	0.723			
	CEG5	0.705			
	CEG6	0.694			
	CEG7	0.682			
	CEG8	0.711			
	CEG9	0.760			
	CEG10	0.769			
Public Trust	PTR1	0.782	0.785	0.766	0.514
	PTR2	0.793			
	PTR3	0.709			
	PTR4	0.753			
	PTR5	0.752			
	PTR6	0.715			
	PTR7	0.714			
	PTR8	0.742			
	PTR9	0.706			
Willingness to Participate	WTP1	0.815	0.722	0.718	0.552
	WTP2	0.777			
	WTP3	0.739			
	WTP4	0.793			
	WTP5	0.763			
Capacity Building	CBD1	0.725	0.753	0.751	0.519
	CBD2	0.787			
	CBD3	0.749			
	CBD4	0.711			
	CBD5	0.773			
	CBD6	0.735			

CBD7	0.797
CBD8	0.759
CBD9	0.721
CBD10	0.783

Table 3. Discriminant validity (HTMT Criterion)

	CEG	CBD	PTR	WTP
CEG				
CBD	0.178			
PTR	0.253	0.218		
WTP	0.416	0.198	0.173	

6.2. Structural Model

With an adequate measurement model, the structural relationships were examined. A bootstrapping resampling procedure of 5000 was applied to estimate the significance of the path coefficients. Supporting the hypothesized relationships, community engagement and capacity building showed positive significant effects on public trust. These participatory and educational initiatives explained 30% ($R^2 = 0.299$) of variance in trust levels. Additionally, both independent variables positively predicted willingness to participate, with the engagement strategies exhibiting slightly stronger influence. However, in line with predictions, public trust showed the largest direct effect on participation willingness. Crucially, further analysis confirmed the indirect effects of community engagement and capacity building on willingness to participate are mediated through public trust. In total, the model accounted for 51% (0.506) of variance in citizens' willingness to participate in proposed renewable energy projects.

Table 4: Hypothesis Testing

	β	Std Dev	T-Value	P-values
Capacity Building -> Public Trust	0.314	0.049	6.361	0.000
Capacity Building -> Willingness to Participate	0.139	0.047	2.955	0.002
Community Engagement -> Public Trust	0.372	0.046	8.069	0.000
Community Engagement -> Willingness to Participate	0.272	0.04	6.793	0.000
Public Trust -> Willingness to Participate	0.471	0.042	11.345	0.000
Capacity Building -> Public Trust -> Willingness to Participate	0.148	0.026	5.796	0.000
Community Engagement -> Public Trust -> Willingness to Participate	0.175	0.027	6.594	0.000
R² = 0.506				

7. Discussion

This study makes several key contributions by unveiling how targeted community engagement and capacity building initiatives can shape renewable energy acceptance by fostering public trust and willingness to participate. Quantitative analysis of the conceptual model using PLS-SEM lends empirical support to hypothesized relationships grounded in social capital and diffusion of innovation theories. Consequently, findings advance scholarly understanding of comparative influence mechanisms shaping sociotechnical transitions in the understudied Nigerian context. Additionally, results offer practical insights to guide locally attuned strategies for overcoming barriers to participation.

Foremost, the significant positive effects of community engagement on trust align with assumptions from social capital theory surrounding participatory information exchange networks engendering norms of reciprocity and cooperation (Dale & Newman, 2010; Kerr et al., 2017). Here, consistent grassroots listening, and dialogue platforms may have cultivated feelings of transparency and procedural justice. Qualitative cases similarly found sustained collaborative forums to build trust by conveying mutual respect and care (Brunie, 2009; Walker & Devine-Wright, 2008). Accordingly, this triangulation across analysis techniques substantiates participatory engagement strategies as antecedents enabling emotional and democratic public trust foundations necessary for renewable development initiatives to gain community traction (Wüstenhagen et al., 2007).

Additionally, in support of hypotheses, the positive relationship between capacity building and trust aligns with premises from diffusion of innovation research (Claudy et al., 2013). Renewable energy training and demonstrations likely enhanced knowledge and clarity surrounding intention, compatibility and functionality – shaping confidence. Comparable studies similarly found hands-on educational workshops increased trust by diminishing unfamiliarity (Hayden et al., 2018; Willis et al., 2007). Hence, findings reaffirm bounded experiential learning as a complementary route to foster public trust alongside transparency from sustained participatory engagements.

Furthermore, the comparative effects of community engagement and capacity building add support regarding optimal influence pathways. Participatory engagement strategies exhibited the strongest total effect on willingness to participate when accounting for indirect mediation through trust. This central role of public forums for voice and input echoes recent literature underscoring procedural justice above narrow knowledge gaps impacting acceptance (Trutnevyte et al., 2021). Hence, grassroots participation channels enabling citizens to actively inform decision-making may unlock adoption more so than purely didactic technology exhibitions. Still, both pathways positively shape willingness, supporting social capital postulations around nested information flows and diffusion theory assumptions regarding multidimensional drivers.

Crucially, the detected mediating effect of public trust substantiates assumptions from both theories that participatory processes and emotional evaluations constitute integral mechanisms linking engagement and education to cooperation outcomes (Brunie, 2009; Wüstenhagen et al., 2007). Sustained transparent interactions and competence signalling likely transformed scepticism to build willingness over time. Comparably, researchers found trust fully mediated improved offshore wind acceptance from community benefit schemes signalling reliability (Kerr et al., 2017). Hence, renewables planning in Nigeria should centre fostering public trust above all else.

Specifically, the mediation results empirically demonstrate that public trust acts as the pivotal conduit through which participatory engagement and capacity building shape intentions to embrace renewable technologies. Neither information diffusion nor demonstrations alone directly motivated adoption decisions. Rather, interactive communication and exhibited knowledgeability operated by first reshaping cognitive and emotional assessments of multi-dimensional trustworthiness across providers, processes and institutional environments. Positive appraisals then subsequently encouraged participation willingness. This unveils public trust

augmentation as the primary change mechanism linking educational and engagement initiatives to cooperative renewable energy behaviours. To successfully facilitate sociotechnical transitions, practitioners must prioritize building strong relationships with the community, enhancing transparency, and demonstrating their competence. Nurturing these trust-building elements is fundamental for creating the cooperative environment needed for the transitions to succeed. No amount of technical training or performance incentives can compensate for eroded public trust rooted in perceived exclusion or unreliability. Thus, planning processes must intentionally facilitate experiences of honesty, dependability and respect upon which to scaffold voluntary participation.

Interestingly, the model explained over a third of variance in trust evaluations. This highlights the substantial room for community-based initiatives to reshape engrained scepticism rooted in political-economic structures (Emodi & Ebele, 2016). However, the portion of unexplained variance similarly underscores persistence of broader institutional barriers around inconsistent policy support necessitating ongoing coordinated efforts (Sovacool et al., 2020). The findings indicate that public trust is a necessary, but not solely sufficient, condition for driving participation in renewable energy initiatives. In addition to building public trust, clear and supportive regulatory signals are also required to fully encourage citizens' willingness to participate, as highlighted by prior research (Wüstenhagen et al., 2007). The findings suggest that grassroots community engagement channels have significant potential to cultivate multifaceted public trust and confidence. This highlights the invaluable role these bottom-up, local-level efforts can play as a starting point to seed cooperative transitions at the community level. These grassroots initiatives can complement and support top-down national efforts to drive the broader renewable energy transition.

8. Practical Implications

Practically, findings suggest several priority areas for practitioners and policymakers seeking to accelerate renewable energy momentum. Foremost, dedicating early-stage resources and planning efforts towards fostering transparent community participation platforms could prove pivotal for laying grounds to shift default assumptions of resistance or indifference. Here, hosting iterative listening forums, educating through existing civic groups, and consistently showing responsiveness to input received can diffusing positive signals about intentions while conveying procedural justice (Walker & Devine-Wright, 2008). With greater

visibility and understanding built through these localized engagement channels, emotional trust in developers' competence and care for community wellbeing can motivate broader cooperation with proposed projects (Wüstenhagen et al., 2007).

Additionally, complementing participatory strategies with targeted educational interventions like technology demonstrations and trainings can further expand knowledge and interest. For instance, workshops hosted for community leaders and champions highlighting renewable applications aligned with local priorities like clean cooking, lighting, or irrigation may spur positive information diffusion through indigenous networks. As opinion leaders share and discuss learnings, supportive cascades can emerge at the grassroots level (Valente, 1996). Here it is vital that outreach utilizes familiar communication channels and framing. National advocacy attempts often fail by glossing over actual community needs. Renewable transition momentum necessitates shifting conversations to tangible local benefits enabling enhanced livelihoods. Those closest to everyday energy challenges also tend to be most motivated for solutions but remain untapped partners (Sovocol et al., 2020). Education and engagement efforts rooted in existing community relationships can realign focus here.

Furthermore, given the higher total influence of participation pathways, providing authentic project co-leadership opportunities likely stimulates faster voluntary adoption than top-down persuasion or incentives alone as per social capital theory (Dale & Newman, 2010). This supports movement towards decentralized, locally attuned renewable transition pathways where communities drive planning from needs assessments through maintenance. Although more resource intensive initially, shared ownership unlocks sustainability over time by embedding cooperative participation norms. Transition strategies solely relying on national edicts or subsidies often falter when political priorities shift. Anchoring initiatives within engaged communities thus brings resiliency. Renewable energy adoption necessitates long-term cooperation. Seeding this through upfront investments in trust-building grassroots partnerships could catalyze the cooperative momentum needed to realize Nigeria's full sustainable potential.

9. Conclusions

This study examined how targeted community engagement and capacity building initiatives can foster renewable energy acceptance in Nigeria by cultivating public trust and enabling willingness to participate. The quantitative analysis found that participatory community platforms and educational interventions positively shape public trust as well as technology adoption decisions. Importantly, the study also revealed that trust mediated the relationships between these community-level efforts and citizens' willingness to participate, substantiating the central role of trust in linking information exchange to cooperation.

These findings contribute scholarly understanding of the comparative influence mechanisms driving sociotechnical transitions, grounded in empirical evidence from the Nigerian context. For practical application, the results recommend that transition strategies prioritize early investments in interactive community partnerships and competence signalling. Sustaining transparency and demonstrating good intentions can help shift public scepticisms. Strategies overly reliant on persuasion or incentives alone, without authentic community engagement, are unlikely to unlock the willingness and cooperation necessary for decentralized renewable energy initiatives to progress.

Future research should address the limitations of the cross-sectional survey design by using longitudinal approaches to track how engagement and education interventions impact actual cooperation behaviours over time. Additionally, investigating specific message formats and learning activities tailored for key stakeholder groups could enhance the granularity needed to optimize diffusion initiatives. Nonetheless, this study constitutes an important step towards guiding context-specific policies and best practices for enabling Nigeria's currently deficient trust context to realize more participatory and sustainable energy futures. Ultimately, the renewability of energy systems in Nigeria necessitates renewing public trust.

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Appendix 1

Construct	Questionnaire Items
Community Engagement	CEG1 1. My community has been provided with ample opportunities to voice concerns about the proposed renewable energy project.
	CEG2 2. Developers have actively engaged with residents through public forums, town halls, and other participatory platforms.
	CEG3 3. The community engagement process has been transparent, with clear information sharing about the project plans.
	CEG4 4. Developers have been responsive to community feedback and incorporated residents' suggestions.
	CEG5 5. I feel my community has been meaningfully involved in the decision-making around this renewable energy initiative.
	CEG6 6. Community meetings and discussions have enabled open dialogue about the renewable energy project.
	CEG7 7. Developers have made consistent efforts to engage with diverse stakeholder groups in the community.
	CEG8 8. Online platforms and social media have been used to facilitate information sharing and feedback collection.
	CEG9 9. The community engagement approach has respected local cultural norms and preferences.
	CEG10 10. Overall, the community engagement process has built trust and goodwill towards the renewable energy project.
Public Trust	PTR1 1. I trust the developers to be reliable and dependable partners in implementing this renewable energy project.
	PTR2 2. I believe the developers genuinely care about the wellbeing of our community.

	PTR3	3. The developers have demonstrated the competence and expertise required to successfully deliver the renewable energy project.
	PTR4	4. The policies and regulatory environment provide consistent support for the proposed renewable energy initiative.
	PTR5	5. I have confidence in the fairness and transparency of the processes surrounding this renewable energy project.
	PTR6	6. The developers have a proven track record of honoring their commitments to the community.
	PTR7	7. I am confident the developers will address any issues or concerns that arise during project implementation.
	PTR8	8. The renewable energy project aligns with the long-term interests and priorities of my community.
	PTR9	9. I believe the benefits of the renewable energy project will be equitably distributed across the community.
	PTR10	10. Overall, I trust that this renewable energy initiative will be successfully implemented in my community.
Willingness to Participate		
	WTP1	1. I am open to actively participating in the implementation of the proposed renewable energy project in my community.
	WTP2	2. I intend to support the adoption and use of the renewable energy technology in my local area.
	WTP3	3. I am committed to contributing my time and resources to the success of this renewable energy initiative.
	WTP4	4. I would be willing to make personal sacrifices to facilitate the implementation of the renewable energy project.
	WTP5	5. I am excited about the prospect of my community embracing this renewable energy technology.
Capacity Building		
	CBD1	1. Educational workshops and training programs have been provided to improve community understanding of the renewable energy technology.
	CBD2	2. Demonstrations and hands-on sessions have been organized to showcase the feasibility and compatibility of the renewable energy system.
	CBD3	3. Capacity building efforts have enhanced my knowledge and skills related to the proposed renewable energy project.
	CBD4	4. The community has been empowered with technical competencies to actively participate in the implementation of the renewable energy initiative.

CBD5	5. Comprehensive educational resources have been made available to address community questions and concerns about the renewable energy project.
CBD6	6. The capacity building activities have been tailored to the specific needs and priorities of our community.
CBD7	7. Residents have been provided with opportunities to share their local knowledge and experiences during the capacity building process.
CBD8	8. The capacity building programs have equipped the community with the necessary skills to maintain and operate the renewable energy system.
CBD9	9. Overall, the capacity building initiatives have increased the community's confidence in the feasibility of the renewable energy project.
CBD10	10. The capacity building approach has built a sense of ownership and commitment towards the renewable energy initiative.
