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A DIFFERENTIATED RURAL SETTLEMENT FRAMEWORK FOR LOCAL ECONOMIC DEVELOPMENT RESILIENCE IN RURAL GHANA

Joshua Babachuwekem VORODAM, Mohamad Fadhli RASHID, Siti Hajar MISNAN

Universiti Teknologi Malaysia, 81310 Joh, Johor Bahru, Malaysia, E-mails: babachuwekem@graduate.utm.my, m.fadhli@utm.my, shajar@utm.my

Corresponding author: babachuwekem@graduate.utm.my

Abstract

Globally, one in every ten rural village indicates a low level of economic growth. The condition is no different in Ghana, which continues to face significant developmental challenges, particularly regarding low socio-economic status of rural community. Local Economic Development (LED) is crucial for promoting sustainable growth, improving livelihoods and reducing poverty in rural Ghana. This paper examines the determinants of LED resilience across agricultural, mining, fishing and forest-based settlements, proposing an integrated framework tailored to each settlement type. Drawing on multiple theoretical perspectives, this study identifies key factors influencing LED resilience: Social, Human, Economic, Cultural, and Environmental resilience. A mixed-methods approach involving surveys, interviews, and focus groups discussions (FGDs) was utilized to gather data from diverse rural Ghanaian communities. Findings indicate that social cohesion, human capital development, and cultural preservation are essential for LED resilience, with distinctive dynamics specific to each settlement type. This study advances existing literature by offering a differentiated framework specific to agricultural, mining, fishing, and forest-based rural settlements in Ghana and presents practical recommendations for implementing localized strategies to foster inclusive economic growth.

Key words**:** *local economic development, rural planning, rural economy, rural development*

INTRODUCTION

Local Economic Development (LED) fosters sustainable growth, improves livelihoods, and reduces poverty in rural Ghana. Rural settlements in Ghana, which include agricultural, mining, fishing, and forest-based communities, face unique challenges and opportunities [1, 25, 26]. These communities are constrained by limited infrastructure, inadequate access to markets, and insufficient social services, all of which hinder resilient economic growth [2, 10, 23, 28]. Despite extensive research into individual determinants of LED, an integrated, context-specific approach tailored to distinct rural settlement types remains underexplored. Addressing this gap, this paper aim to examine key determinants of LED resilience across different settlement types namely agricultural, mining, fishing and forest-based settlements and proposing an integrated framework tailored to each settlement type for promoting sustainable economic development. This study provides a unique framework for assessing Local Economic Development (LED) resilience across different rural settlement types in Ghana, filling a gap by focusing on the specific needs of each type. It combines multiple theoretical perspectives and a mixed-methods approach to offer practical, locally relevant strategies for enhancing economic resilience in Ghana.

Literature review

Theoretical Perspectives on Local Economic Development Resilience

Local Economic Development (LED) resilience in rural Ghana is influenced by a complex interplay of factors that vary by settlement type. The theoretical basis for understanding LED resilience includes Endogenous Growth Theory, the Resource-Based View (RBV), the Livelihood Concept, and Institutional Theory. These theories provide a comprehensive framework for analysing the factors that contribute to LED resilience and have been extensively applied in studies across different geographical contexts.

Endogenous Growth Theory emphasizes the importance of human capital, infrastructure, and innovation as primary drivers of economic growth. Investments in education, skills

development, and infrastructure are crucial for fostering economic resilience, particularly in rural settlements [1, 4, 5, 8, 23, 27]. For instance, targeted investment in rural education and infrastructure in China significantly enhanced the adaptive capacity of local economies, underscoring the universal applicability of this theory [28]. This paper builds on Zhou's findings by applying similar concepts to rural Ghana and adapting them to different types of rural economies, such as agricultural, mining, and fishing settlements [28].

The Resource-Based View (RBV) highlights the role of local resources in building a sustainable competitive advantage. In the context of rural Ghana, natural, social, cultural, and environmental assets are essential to LED resilience. Previous studies in Malaysia [14, 15, 16, 18, 19] and Romania [10] have emphasized leveraging these local resources for sustainable growth. That rural communities that leveraged their natural and cultural assets experienced improved economic resilience [13, 23]. This paper extends RBV to the Ghanaian context, examining how agricultural communities utilize fertile land, mining settlements extract mineral resources, and fishing communities capitalize on marine assets for LED resilience.

The Livelihood Concept by Ian Scoones (1998) takes a holistic approach to rural development, recognizing the interconnection of different types of capital—human, social, natural, financial, and physical—that support livelihoods [12]. Scoones (1998) highlighted the need for diversified livelihood strategies to enhance resilience against economic shocks [21]. Recent studies in sub-Saharan Africa [1, 17, 25, 26] have shown that integrating multiple forms of capital such as human and social capital enhances livelihood resilience in rural communities. In this study, we apply Scoones' framework to rural Ghana, focusing on how diverse livelihood strategies can strengthen the resilience of different types of rural settlements.

Institutional Theory emphasizes the importance of governance structures, community participation, and supportive policy frameworks in fostering LED. Institutions play a crucial role in shaping economic performance by defining the rules that govern local economies [9, 11, 25]. This theory has been applied in several studies, such as [8], who highlighted the role of local institutions in building community resilience in rural Sweden. This paper expands on these ideas by examining how effective governance and community participation in Ghanaian rural settlements contribute to LED resilience, ensuring equitable benefits from economic activities and fostering community trust [25].

In comparing rural economic resilience across different regions, studies such as China [28], Malaysia [18, 19], Ghana [1], Romania [10], and Sweden [8] highlight that LED resilience is significantly influenced by local contexts, including resource availability, governance, and socio-cultural factors. By comparing these international contexts with Ghana, this paper seeks to provide a broader understanding of how various determinants shape LED resilience in different settings. This comparative analysis helps to illustrate the generalizability of the findings and emphasizes the importance of contextualizing resilience strategies to fit local conditions. The similarities, such as the importance of community participation and resource leveraging, provide a strong argument for adapting successful strategies from other regions to the Ghanaian context. Conversely, the differences underscore the need for localized solutions that account for specific socio-economic and cultural factors inherent in rural Ghana.

Determinants of Local Economic Development Resilience in Differentiated Rural Settlements

Rural communities in Ghana face persistent challenges in achieving economic resilience and socio-economic sustainability. These challenges significantly affect the ability of rural households to adapt and thrive amidst changing environmental, economic, and social conditions. Understanding the determinants that contribute to enhancing Local Economic Development (LED) resilience is essential for developing effective policies that can foster growth, reduce poverty, and improve livelihoods in rural areas [12, 22, 27]. The

determinants that influence LED resilience are multifaceted and span across social, human, economic, cultural, and environmental domains [6, 20, 24].

Each determinant plays a vital role in shaping the overall resilience and capacity of rural communities to withstand and recover from adversities.

In this context, LED resilience is conceptualized as the ability of rural communities to cope with economic shocks, adapt to changes, and seize new opportunities to ensure sustainable economic development [3, 6, 25].

The concept of resilience in rural Ghana is not just limited to economic growth but also encompasses the capacity to maintain social cohesion, preserve cultural heritage, and sustainably manage natural resources [1, 17, 25, 26]. Therefore, an integrated approach that considers the interaction of multiple resilience factors is crucial for understanding the complexities of rural development. This approach aligns with existing theories, such as the Territorial Innovation Model, which emphasizes the interplay between internal and external factors in shaping rural economic performance [18, 19].

Over the past decade, there has been increasing interest in understanding the disparities in resilience across rural communities. The literature has shown that the capacity of rural communities to respond to economic challenges is not uniform, and it varies significantly depending on local context and resources [2, 7, 10, 18, 23]. This differentiation underscores the importance of identifying key resilience determinants that can enhance LED and contribute to reducing vulnerability in rural Ghana [25, 26].

Table 1 presents the determinants of LED resilience identified in this study, including social, human, economic, cultural, and environmental factors. These determinants and their respective indicators serve as the foundation for assessing the factors that influence LED resilience in rural Ghana.

The identification of these determinants is essential for developing effective interventions to strengthen the resilience of rural communities. By understanding how each determinant contributes to the adaptive capacity of rural households, policymakers can design targeted programs that address specific needs, ultimately promoting sustainable economic development in rural Ghana [1, 25, 26].

Table 1. LED resilience determinants in rural Ghana based on the studied literature

Resilience Determinant	Indicators	References
Social Resilience	Collective Action	[11][19][24]
	Community Membership	[15][18][23]
	Trust & Norms	[2][19][28]
	Social Networks	[10][11][19]
	Partnerships	[11][18]
Human Resilience	Health	[2][13][19]
	Education	[2][18][26]
	Skills	[2][18]
	Leadership	[11][18][28]
	Technological Application	[11][12][19]
Economic Resilience	Occupation & Income	[8][10][18]
	Entrepreneurship	[9][14][19]
	Economic Diversification	[3][5][8][10][15][18]
	Household Employment	[16][18]
	Agriculture Dependency	[7][19][20][22]
	Access to Market	[10][18]
	Government Assistance	[6][18][26]
	Family Remittance	[13][14][18][25]
	Innovation	[11][12][19]
	Asset & Property Ownership	[8][13][18]
	Financial Management	[8][10][15][18]
Cultural Resilience	Attitudes	[14][17][18]
	Religion	[1][14][17][19][23]
	Culture	[1][14][17][18][23]
	Heritage	[17][18][23]
Environmental Resilience	Natural Environment	[4][13][19]
	Climate Change	[4][13][19]
	Soil Fertility	[3][18][20][22]
	Environmental Quality	[4][18][27]
	Accessibility to Facilities	[9][18]
	Location	[18][25]

Source: Own structured ideas based on the studied literature.

Rural Settlement Types in Ghana

Agricultural-based settlements rely primarily on farming and livestock, with resilience driven by sustainable farming practices, market integration, and education on modern agricultural techniques. Collective action through cooperatives and sustainable land use practices plays crucial roles in enhancing social and environmental resilience [11, 19].

Mining-based settlements depend on mineral extraction, facing vulnerabilities related to resource depletion and market fluctuations. Economic resilience in these settlements is shaped by income derived from mining, while human resilience focuses on health interventions and skills development for alternative livelihoods [3, 10].

Environmental resilience is also critical, requiring effective reclamation and sustainable management of the mining areas [4, 13].

Fishing-based settlements rely on fishing and related activities, with resilience influenced by sustainable fishing practices, market access, infrastructure like cold storage, and education on modern fishing techniques [2]. Strong community networks enhance social resilience, while environmental resilience focuses on tackling overfishing and pollution challenges [10, 24].

Forest-based and historical settlements are characterized by their cultural heritage and reliance on forest resources.

Cultural resilience in these communities supports eco-tourism and traditional crafts, while economic resilience is promoted through non-timber forest products, such as handicrafts and beekeeping [14]. Environmental and social resilience are strengthened through sustainable forest use and community participation in conservation efforts [13].

Table 2. Resilience determinants across settlement types

Resilience Determinant	Analysis	Type of Settlement			
		Agricultural	Mining	Fishing	Forest-Based
Social Resilience	Mean	4.1	3.5	4.0	4.3
	SD*	0.7	0.9	0.8	0.6
Economic Resilience	Mean	3.8	3.2	3.6	3.9
	SD*	0.8	1.1	0.9	0.7
Environmental Resilience	Mean	3.9	2.8	3.5	4.2
	SD*	0.6	1.2	0.8	0.5
Cultural Resilience	Mean	3.5	3.1	3.7	4.5
	SD*	1.0	0.8	0.9	0.4
Human Resilience	Mean	3.9	3.4	3.8	4.1
	SD*	0.7	0.9	0.8	0.7

Note: SD (Standard Deviation).
Source: Authors' analysis of primary survey data.

Table 2 shows that forest-based settlements consistently demonstrate higher resilience scores across social, economic, environmental, cultural, and human dimensions compared to other settlement types, with particularly strong performance in cultural and environmental resilience.

Mining settlements, on the other hand, generally have the lowest mean scores for resilience determinants and higher variability, indicating significant challenges in social cohesion, economic diversification, and environmental sustainability.

Agricultural and fishing settlements fall between these two extremes, with relatively balanced scores, though agricultural settlements slightly outperform in areas such as social and economic resilience.

These findings highlight the distinct strengths and weaknesses of each settlement type, emphasizing the need for targeted interventions to address specific challenges in mining and other lower-scoring communities.

MATERIALS AND METHODS

This study employed a mixed-methods research design, combining both quantitative and qualitative approaches to investigate the factors influencing Local Economic Development (LED) resilience in rural communities in Ghana.

The mixed-methods approach was selected to provide a comprehensive understanding of LED resilience by integrating numerical data with in-depth insights from community members, thereby enhancing the depth and reliability of the findings.

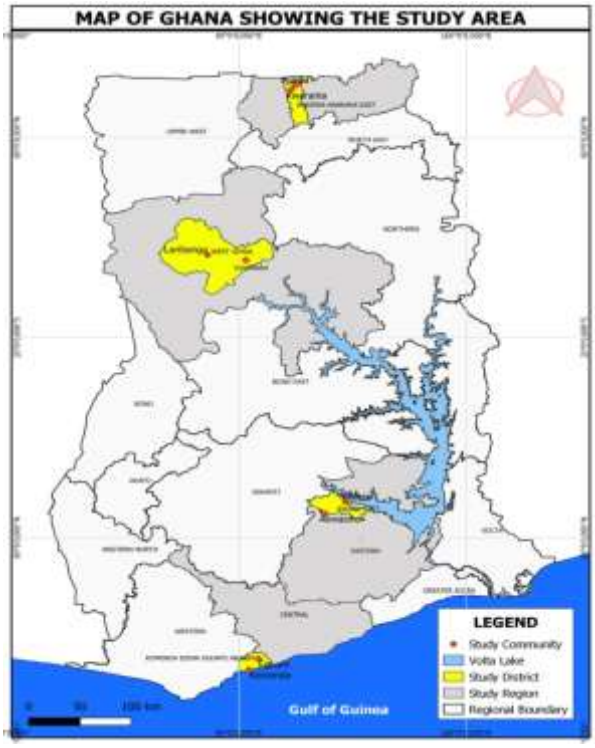

Fig. 1. Location of eight rural settlements in four different regions in Ghana
Source: [25].

The study was conducted across four regions (Figure 1): Upper East (Kassena Nankana Municipality), Eastern (Kwahu East District), Central (Komenda-Edina-Eguafo-Abirem Municipality), and Savannah (West Gonja Municipality).

These regions were chosen to ensure comprehensive representation of diverse rural settlement types, encompassing a variety of geographical, cultural, and economic characteristics. This diversity allows for a broader generalization of the findings to rural settlements across Ghana.

A stratified random sampling method was used to select two communities from each region, resulting in the inclusion of eight communities: Komenda, Eguafo, Pungu, Korania, Akwasiho, Kotoso, Busunu, and Laribanga. Stratified random sampling was chosen to ensure that the sample represented different settlement types (agricultural, mining, fishing, and forest-based) and to minimize bias by ensuring that all subgroups within the population were adequately represented.

This method provides a more precise estimate of the population parameters compared to simple random sampling, especially when dealing with heterogeneous populations.

The research sample consisted of 377 participants, calculated using Cochran's formula for sample size determination to ensure statistical power and representativeness. The stratification helped achieve a balanced representation of demographic and economic characteristics across the selected communities, enhancing the credibility of the findings.

Data were collected using structured surveys, interviews, and FGDs. The structured questionnaire gathered data on household income, education, market access, credit availability, and other factors. The questionnaire was pretested with a small group similar to the target population to ensure clarity, reliability, and relevance. Cronbach's alpha was calculated to assess the internal consistency of the questionnaire items, with a value of 0.80 indicating good reliability. Revisions were made based on the pretesting feedback to improve the quality of the data collection instrument.

Qualitative data were gathered through in-depth interviews with key stakeholders, including local government officials, community leaders, and business owners. A semi-structured interview guide was used to ensure consistency while allowing participants to elaborate on their experiences and perspectives. To validate the qualitative findings, member checking was conducted, where participants reviewed and confirmed the accuracy of the interview transcripts. FGDs were also conducted to explore community dynamics affecting LED resilience, with participants selected to ensure diversity in age, gender, and economic activities. The discussions were facilitated by experienced moderators, and ethical considerations, such as informed consent and confidentiality, were strictly observed. Quantitative data were analysed using both descriptive and inferential statistical methods. Descriptive statistics summarized demographic characteristics, while inferential methods, including regression analysis and chi-square tests, were used to assess the relationships between LED resilience and various independent variables. Factor analysis was employed to identify underlying determinants contributing to LED resilience across rural communities. The hypotheses formulated for this study were tested using ordinal logistic regression, with a significance level of 0.05 set as the threshold for hypothesis acceptance or rejection. This approach allowed for an assessment of the impact of multiple resilience factors (social, human, economic, cultural, and environmental) on LED outcomes. For qualitative data, thematic analysis was conducted to identify patterns and themes emerging from interviews and FGDs. Thematic coding was carried out independently by two researchers to ensure inter-coder reliability, and discrepancies were discussed and resolved to reach consensus. This analysis provided a nuanced understanding of LED resilience, offering insights into the contextual realities of the communities studied. The mixed-methods approach facilitated triangulation, enhancing the validity and reliability of the findings by cross-verifying data from multiple sources.

The reliability and validity of the data collection methods were ensured through several measures. For the quantitative component, Cronbach's alpha was used to assess the reliability of the questionnaire items, with a value above 0.70 indicating acceptable internal consistency. Construct validity was addressed by aligning the questionnaire items with established theoretical constructs related to LED resilience. For qualitative data, validity was ensured through member checking and peer debriefing, where another researcher reviewed the analysis process and findings to ensure they accurately represented the data.

Demographic Characteristics of Study Participants

Table 3 presents the demographic characteristics of the study participants, including age, gender, education level, average farm income, and household size. The age group with the highest representation was 41-50 years, followed by 31-40 years. Participants were predominantly male (74.8%), with educational attainment ranging from no formal education to undergraduate degrees. Most participants (60.4%) had household sizes of five or fewer members, and the majority reported an average farm income between GHS10,001 and GHS15,000.

Table 3. Demographic information

Characteristics	N	Percentage (%)
Age (years)		
26-30	42	11.1
31-40	87	23.1
41-50	184	48.8
Above 50	64	17.0
Gender		
Female	95	25.2
Male	282	74.8
Education Level		
None	102	27.1
Primary	98	26.0
Junior High School	107	28.4
Senior High School	41	10.9
Diploma	12	3.2
Undergraduate Degree	17	4.5
Average Annual Income (GHS)		
1,001-5,000	18	4.8
5,001-10,000	61	16.2
10,001-15,000	143	38.0
More than 15,000	154	41.0
Household Size (Number of people)		
<5	228	60.4
5-10	119	31.5
11-15	30	7.9

Source: Primary survey data collected during the study.

Understanding these demographic characteristics is crucial for interpreting the factors influencing LED resilience in rural Ghana. The classification of communities by settlement type provides insights into their economic characteristics, which is essential for understanding the unique LED dynamics within each community.

RESULTS AND DISCUSSIONS

Factor Analysis

Factor analysis was conducted to determine the underlying dimensions among variables related to Local Economic Development (LED) resilience. This analysis aimed to identify key latent constructs namely Social Resilience, Human Resilience, Economic Resilience, Cultural Resilience, and Environmental Resilience that contribute to LED resilience. The results, summarized in Table 4, provide insights into the relationships and variances explained by each factor.

Table 4. Results of factor analysis

Factor Name	Variables	Factor Loading	% of Variance Explained	Cronbach's Alpha
Local Economic Development	LED1 LED2 LED3	0.791-0.871	67.576%	0.757
Social Resilience	SR1 SR2 SR3 SR4	0.731-0.914	78.215%	0.833
Human Resilience	HR1 HR2 HR3 HR4	0.816-0.939	75.473%	0.836
Economic Resilience	ER1 ER2 ER3	0.744-0.971	81.601%	0.885
Cultural Resilience	CR1 CR2 CR3	0.791-0.972	81.722%	0.886
Environmental Resilience	ENR1 ENR2 ENR3	0.526-0.914	63.552%	0.883

Source: Factor analysis results computed from the survey data.

Each determinant showed distinct loadings, indicating that the variables were grouped well into meaningful factors. Cronbach's alpha values, ranging from 0.757 to 0.886, indicated an adequate level of internal consistency for each factor. Specifically, all factors exceeded the commonly accepted threshold of 0.7, demonstrating high reliability. The Kaiser-

Meyer-Olkin (KMO) values ranged from 0.667 to 0.746, suggesting adequate sampling adequacy, while Bartlett's test of sphericity was significant ($p < 0.001$), confirming that the dataset was suitable for factor analysis.

The factor analysis identified five resilience dimensions that account for a substantial proportion of variance in LED resilience: Social, Human, Economic, Cultural, and Environmental. This comprehensive approach ensures that the constructs used in the study are representative and suitable for regression analysis.

Regression Analysis and Robustness Checks

To assess the impact of the identified resilience factors on LED, an ordinal logistic regression model was employed. The ordinal nature of the dependent variable (LED) made this model appropriate for examining the relationship between LED and independent variables such as Social Resilience, Human Resilience, Economic Resilience, Cultural Resilience, and Environmental Resilience.The ordinal logistic regression model used is represented as follows:

$$logit(P(LED \leq k)=\alpha k+\beta 1SR+\beta 2HR+\beta 3ER+\beta 4CR+\beta 5ENR+\varepsilon\alpha k+\beta 1SR+\beta 2HR+\beta 3ER+\beta 4CR+\beta 5ENR+\varepsilon \quad (1)$$

where:

-logit(P(LED≤k) represents the log odds of LED being less than or equal to the threshold category k.

-αk represents the threshold-specific intercept, capturing differences in the baseline log odds between the threshold categories.

-β1,β2,β3,β4,β5 are the coefficients that indicate the effects of Social Resilience (SR), Human Resilience (HR), Economic Resilience (ER), Cultural Resilience (CR), and Environmental Resilience (ENR) on LED.

-ε represents the error term.

Assumptions and Diagnostic Checks

To ensure the validity of the regression model, several diagnostic checks were conducted (Table 5, 6, 7):

(1)*Multicollinearity:* Variance Inflation Factors (VIF) were calculated for each independent variable, with all VIF values being below 5, suggesting that multicollinearity was not an issue.

(2)*Normality:* Residuals were evaluated for normality using the Shapiro-Wilk test and Q-Q plots, which confirmed that deviations from normality were within acceptable limits.

(3)*Homoscedasticity*: The Breusch-Pagan test was used to check for homoscedasticity of residuals, and the results indicated no significant heteroscedasticity, validating the model's consistency.

Table 5. Assumptions and diagnostic checks

Assumption	Method Used	Test Statistics / Result	Interpretation
Multicollinearity	Variance Inflation Factor (VIF)	All VIF values < 5	No significant multicollinearity detected; independent variables are not highly correlated.
Normality	Shapiro-Wilk Test and Q-Q Plot	Shapiro-Wilk p-value > 0.05; Q-Q plot close to reference line	Residuals follow an approximately normal distribution, ensuring valid inferential results.
Homoscedasticity	Breusch-Pagan Test	p-value > 0.05	No evidence of heteroscedasticity; residual variance is constant, supporting model consistency.

Source: Diagnostic tests (VIF, Shapiro-Wilk, Breusch-Pagan) performed on the study data.

Table 6. Normality check

Method	Test Statistic / Plot	Result Interpretation
Shapiro-Wilk Test	W = 0.98, p-value = 0.12	Residuals are approximately normal
Q-Q Plot	Residuals closely follow reference line	No substantial deviation from normality

Source: Results from the Shapiro-Wilk test and Q-Q plot analysis conducted by the authors.

The p-value of the Breusch-Pagan test is greater than 0.05, indicating that there is no significant evidence of heteroscedasticity. This means that the residuals have a constant variance, supporting the consistency of the model's predictions.

Table 7. Breusch-Pagan test results

Test Name	Test Statistic	p-value	Interpretation
Breusch-Pagan Test	BP = 5.21	0.18	No heteroscedasticity detected

Source: Authors' statistical analysis using the Breusch-Pagan test.

These diagnostic checks provide confidence that the regression model used in the study is statistically valid and reliable, ensuring that the inferences drawn regarding the impact of Social, Human, Economic, Cultural, and Environmental Resilience on Local Economic Development are robust and dependable.

Robustness Checks

To verify the robustness of the findings, an ordinal probit regression model was applied as an alternative to the ordinal logistic model. This alternative estimation method aimed to validate the reliability of the findings and yielded results consistent with the ordinal logistic regression. However, to further enhance robustness**,** bootstrapping was performed with 1,000 replications to estimate confidence intervals for the regression coefficients. Bootstrapping results confirmed the statistical significance of all five resilience factors, supporting the robustness of the model (Table 8).

Table 8. Robustness checks-bootstrapping

Variable	Coefficient Estimate	Bootstrapped Standard Error	95% Confidence Interval
Social Resilience (SR)	1.779	0.134	[1.520, 2.045]
Human Resilience (HR)	1.655	0.143	[1.379, 1.917]
Economic Resilience (ER)	0.293	0.076	[0.145, 0.441]
Cultural Resilience (CR)	0.975	0.102	[0.775, 1.180]
Environmental Resilience (ENR)	0.189	0.055	[0.081, 0.295]

Source: Bootstrapping analysis with 1,000 replications conducted by the authors.

Overall, Social and Human Resilience have the strongest influence on LED resilience, followed by Cultural, Economic**,** and Environmental Resilience. The bootstrapped confidence intervals confirm the statistical significance of all factors, underscoring their relevance in enhancing LED resilience in rural Ghana.

Regression Results

The results from both the ordinal logistic regression model and the ordinal probit model are summarized in Table 9.

Table 9. Ordinal Logistic and Probit Regression results

Dependent Variable:	Variable	Ordered Logistic Coefficients	Ordered Probit Coefficients
LED Resilience	Human Resilience (HR)	1.655***	0.889***
	Economic Resilience (ER)	0.293***	0.211***
	Social Resilience (SR)	1.779***	0.837***
	Cultural Resilience (CR)	0.975***	0.621***
	Environmental Resilience (ENR)	0.189***	0.476***

Note: ***p<0.001, **p<0.05. The coefficients represent the influence of each independent variable on LED.
Source: Results from the ordinal logistic and ordinal probit regression analyses performed on the study data.

These models examined the impacts of Social, Human, Economic, Cultural, and Environmental Resilience on LED resilience.

Interpretation of Findings

The regression analysis showed that all resilience determinants significantly affect LED resilience. Specifically, Social Resilience (SR), Human Resilience (HR), and Cultural Resilience (CR) had the most substantial positive effects on LED resilience, indicating that enhancing these forms of capital contributes significantly to improving local economic resilience. Economic Resilience (ER) and Environmental Resilience (ENR) also had positive effects, but to a lesser extent. The findings highlight the importance of a multifaceted approach to improving LED resilience in rural Ghanaian communities. The significant positive effects of Social Resilience and Human Resilience align with previous studies that emphasize the role of social cohesion, education, and skills development in fostering local economic stability [2, 11, 18].

Investments in social cohesion, human capital (such as education and skills development), and cultural preservation were identified as key areas for policymakers to focus on to enhance LED resilience. Economic resilience, although significant, was not as influential as social or human resilience, suggesting that local economic development strategies should prioritize community networks, skills development, and cultural assets over purely economic diversification efforts.

LED Resilience Framework in Settlement Types

The comprehensive framework for enhancing Local Economic Development (LED) resilience in rural Ghana focuses on five key determinants: social, human, economic, cultural, and environmental resilience. This integrated approach is aimed at addressing the unique needs of agricultural, mining, fishing, and forest-based settlements in Ghana.

Social resilience is fostered through community cohesion, collective action, and trust-building, which are crucial for enabling local collaboration and reducing economic shocks. Human resilience involves improving health, education, and leadership, empowering

rural communities to enhance productivity and governance capability.

Table 10. LED resilience framework in settlement types

Resilience Determinant	Indicator	Settlement Type Relevance	Targeted Interventions for Enhancing Resilience	Potential Outcomes
Social Resilience	Collective Action	All settlement types	Develop cooperative models, community-based action programs.	Enhanced social cohesion, increased adaptive capacity
	Community Membership	All settlement types	Promote collective identification with local development initiatives.	Strengthened community ties, improved collective efficacy
	Trust & Norms	All settlement types	Facilitate community dialogues, trust-building workshops.	Reduction in transaction costs, increased local participation
	Social Networks	All settlement types, but critical in fishing and mining	Foster inter-community collaboration, cross-sectoral networks.	Improved information flow, collective problem-solving capacity
	Partnerships	All settlement types	Encourage public-private partnerships, NGO collaborations.	Enhanced resource mobilization, diversified funding sources
Human Resilience	Health	Agricultural, Mining, and Fishing Settlements	Improve healthcare accessibility, community health education.	Increased productivity, reduced absenteeism
	Education	All settlement types	Establish rural educational infrastructure, mobile schools.	Human capital enhancement, reduction in youth migration
	Skills	All settlement types	Launch vocational training, skill-specific development programs.	Increased employability, diversified economic opportunities
	Leadership	All settlement types	Leadership development programs for local officials and community heads.	Effective community governance, enhanced initiative mobilization
	Technological Application	Particularly important for Agricultural and Mining settlements	Technological transfer projects, access to digital tools.	Improved efficiency in agricultural and extractive processes
Economic Resilience	Occupation & Income	Agricultural, Mining, Fishing	Create micro-financing opportunities, promote income diversification.	Increased household income, reduced economic vulnerability
	Entrepreneurship	All settlement types	Support start-ups via micro-loans, entrepreneur incubators.	Boost in local enterprise, job creation
	Economic Activity Diversification	Agricultural-based, Mining-based	Offer incentives for alternative livelihood ventures beyond main activity.	Reduced over-reliance on single sector, stability during shocks
	Market Access	Agricultural and Fishing Settlements	Upgrade transport links, establish rural marketplaces.	Enhanced economic integration, higher market prices for produce
	Government Assistance	All settlement types	Design targeted subsidies, social safety nets for vulnerable groups.	Economic safety during shocks, enhanced financial security
	Asset & Property Ownership	Agricultural and Historical Settlements	Formalize land tenure systems, support legal ownership structures.	Economic security, increased investment in land improvement
Cultural Resilience	Attitudes	Forest-based and Historical Settlements	Conduct awareness programs that enhance collective cultural identity.	Cultural continuity, enhanced community pride
	Religion	Agricultural, Fishing, and Historical Settlements	Engage religious leaders in community-led programs.	Foster moral accountability, enhanced mobilization capacity
	Heritage	Forest-based and Historical Settlements	Promote eco-tourism, heritage site preservation.	Revenue from cultural tourism, enhanced cultural conservation
Environmental Resilience	Climate Change Adaptation	Agricultural and Mining Settlements	Develop local climate resilience action plans, adaptation funds.	Reduced climate vulnerability, sustainable resource use
	Natural Disasters	All settlement types	Community disaster preparedness training, risk management frameworks.	Improved readiness, reduced disaster impact
	Soil Fertility	Agricultural-based Settlements	Implement organic farming techniques, soil conservation practices.	Enhanced agricultural yield, long-term soil health
	Environmental Quality	All settlement types	Introduce strict pollution control and local recycling initiatives.	Improved public health, increased land productivity
	Access to Facilities	Fishing and Forest-based Settlements	Develop infrastructure for healthcare, water supply, and education.	Reduced inequality, enhanced standard of living
	Location	All settlement types	Targeted regional infrastructure projects to improve market access and resource allocation.	Increased geographic equity, improved logistics

Source: Adapted from reviewed literature and authors' conceptual framework.

Economic resilience emphasizes income diversification, market access, and asset ownership, promoting financial stability and reducing vulnerabilities in local economies.

Cultural resilience focuses on heritage conservation and community engagement, ensuring the preservation of traditions while supporting economic activities like tourism.

Environmental resilience addresses climate adaptation, disaster management, and environmental conservation, aiming to sustain natural resources critical to rural livelihoods.

The framework promotes an integrated approach where social, human, economic, cultural, and environmental factors work together to strengthen rural community resilience. The goal is to enhance rural

livelihoods, reduce vulnerability to shocks, and promote sustainable, inclusive growth across diverse rural settlement types in Ghana (Table 10).

The findings reveal that Social Resilience (e.g., community cohesion, collective action), Human Resilience (e.g., education, skills, health), and Cultural Resilience (e.g., cultural heritage preservation) have the most significant impact on LED. Social resilience was highlighted as a critical factor, emphasizing the importance of community collaboration in overcoming economic shocks. Human resilience, particularly through education and skills development, is essential for adaptability and productivity enhancement. Economic Resilience (e.g., income diversification, asset ownership) and Environmental Resilience (e.g., sustainable practices, environmental quality) also contribute but have a comparatively lower impact.

The study underscores the need for a multifaceted approach that integrates these resilience factors. For instance, policies should prioritize human capital enhancement, community networks, and sustainable environmental practices to strengthen LED resilience across all settlement types. The findings suggest that relying solely on economic diversification without addressing social and human resilience may not yield sustainable outcomes.

Comparative Analysis of Resilience Determinants

Table 11 indicates statistically significant differences in social, economic, environmental, and cultural resilience ($p < 0.05$), with respective F-values suggesting variations across these domains. However, human resilience did not show a statistically significant difference, with a p-value of 0.342.

Table 11. Comparative analysis of LED resilience determinants

Resilience Determinant	F-Value	p-Value	Significant Difference ($p < 0.05$)
Social Resilience	3.56	0.018	Yes
Economic Resilience	4.21	0.012	Yes
Environmental Resilience	5.09	0.005	Yes
Cultural Resilience	2.87	0.039	Yes
Human Resilience	1.12	0.342	No

Source: Authors' statistical analysis comparing resilience determinants across settlement types.

This implies that while certain resilience determinants differ meaningfully across settlement types, the human resilience factor may have common characteristics across these communities. These results underscore the necessity of tailored resilience-building strategies that consider unique differences across settlement types for factors such as economic and environmental resilience.

CONCLUSIONS

To enhance LED resilience in rural Ghana, policymakers must adopt an integrated approach tailored to the unique characteristics of each settlement type. Strengthening social cohesion, investing in education and health, promoting economic diversification, preserving cultural heritage, and implementing sustainable environmental practices are all critical to supporting LED resilience. Specific interventions, such as vocational training centers for skill development, cooperative models for community engagement, and climate adaptation funds, can help rural communities adapt to economic shocks and foster inclusive growth.

Detailed policy recommendations for each settlement type include:

(i)Agricultural-Based Rural Settlements: Establish vocational training centers focused on modern agricultural techniques and sustainable farming practices. Provide subsidies for agricultural inputs and promote cooperatives to enhance collective bargaining power and improve market access.

(ii)Mining-Based Rural Settlements: Implement community health programs to address occupational hazards and promote alternative livelihood programs to reduce dependency on mining activities. Develop local governance structures to manage revenue from mining operations transparently, ensuring equitable distribution of benefits.

(iii)Fishing-Based Rural Settlements: Introduce sustainable fishing practices and provide training on fish processing and value addition. Establish cooperatives to facilitate access to credit and market linkages and invest in infrastructure such as cold storage facilities to reduce post-harvest losses.

(iv)Forest-Based/Historical Rural Settlements: Promote eco-tourism and cultural heritage preservation by providing training on hospitality and tourism management. Support initiatives that protect forest resources while creating alternative income opportunities, such as beekeeping or handicraft production, to reduce dependence on forest exploitation.

The findings of this study aligned with several United Nations Sustainable Development Goals (SDGs), enhancing its global relevance. Specifically, the proposed LED resilience framework contributes to SDG 1 (No Poverty) by promoting income diversification, SDG 8 (Decent Work and Economic Growth) through skills development, and SDG 11 (Sustainable Cities and Communities) by preserving cultural heritage. Furthermore, the focus on environmental resilience and climate adaptation supports SDG 13 (Climate Action), offering a holistic approach to enhancing sustainable development in rural Ghana while addressing global sustainability challenges.

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