

Climate Change, Gender Inequality and Child Well Being in Vulnerable Communities

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ABSTRACT

Climate change has become an increasingly complex social issue as its impacts are unevenly distributed among vulnerable groups, particularly households with children facing limited resources and gender disparities. This study aims to analyze the relationship between climate change exposure, gender inequality, and child well-being in vulnerable communities. A quantitative approach was employed through a survey of 250 households with children aged 0–18 years living in climate-vulnerable areas. Data were collected using a Likert-scale questionnaire and analyzed using linear regression to examine the relationships among research variables. The findings indicate that climate change exposure and gender inequality significantly influence child well-being outcomes. This study highlights the importance of gender-responsive climate adaptation strategies to strengthen child protection and improve quality of life in vulnerable communities

INTRODUCTION

Climate change has become one of the most significant global challenges, extending beyond environmental concerns and creating broad social consequences for vulnerable populations. Phenomena such as increasing floods, droughts, heatwaves, and disruptions to food security have affected people's economic conditions, health status, and access to essential services. Children represent one of the most vulnerable groups affected by climate change because their developing physical, physiological, and social capacities limit their ability to cope with climate-related risks and environmental disruptions (Helldén et al., 2021). Children are among the most vulnerable populations affected by climate change because their physiological development, dependence on caregivers, and limited ability to control their surrounding environments reduce their capacity to cope with climate-related risks and environmental disruptions (Leffers, 2022). These conditions demonstrate that climate change is not only an ecological issue but also a critical challenge related to human development and child protection.

Climate change impacts are often interconnected with existing social structures, including gender inequalities within households and communities. Women and girls frequently experience unequal access to economic resources, education, decision-making processes, and climate adaptation opportunities, which increases their vulnerability to climate-related risks and reduces their adaptive capacity (Lau et al., 2021). During climate-related disruptions, women often carry additional responsibilities in fulfilling household needs, including securing water, food, and childcare. These conditions may affect parenting quality and the ability of families to maintain children's well-being. Therefore, climate change should be understood through a social justice perspective that recognizes the interconnected roles of gender equality, household vulnerability, and child protection in addressing climate-related risks (Newell et al., 2021).

Previous studies have demonstrated that climate change is closely associated with children's well-being, particularly through its impacts on health, nutrition, and education. Nguyen et al. (2022) found that climate shocks, particularly changes in rainfall patterns, negatively influenced children's health conditions and educational participation among vulnerable populations in Vietnam. Furthermore, Dayrell (2022) explained that unequal gender norms reduce the adaptive capacity of women and girls when facing climate-related challenges. However, previous studies have frequently examined climate change impacts and child well-being separately or have focused primarily on household economic conditions. This limitation indicates a research gap regarding the simultaneous analysis of how climate change exposure and gender inequality influence child well-being within vulnerable communities.

Furthermore, research exploring the relationship between environmental risks and child development requires a more integrated social approach. Rao et al. (2021) highlighted that poor and marginalized communities generally possess lower adaptive capacity due to limited access to basic services, social protection, and economic resources. Meanwhile, climate change can intensify existing social inequalities and threaten children's development by disrupting access to essential resources, including healthcare, education, nutrition, and social

protection systems (Lawrance et al., 2021). Although these studies provide important insights into climate-related risks, empirical research using primary household-level data to examine the relationship between climate change, gender inequality, and child well-being remains limited. Therefore, this study addresses this research gap through a quantitative approach involving households with children living in climate-vulnerable communities.

Based on these issues, this study aims to analyze the relationship between Climate Change Exposure (X1), Gender Inequality (X2), and Child Well-Being (Y) in vulnerable communities. Specifically, this research examines how exposure to climate-related risks and gender disparities within households influence children's health, education, and overall living conditions. This study applies a quantitative survey approach involving households with children aged 0–18 years to obtain empirical evidence regarding the relationships among the research variables. Statistical analysis is conducted to determine the extent to which environmental and social factors explain variations in child well-being outcomes. Through this approach, the study seeks to provide a comprehensive understanding of the social mechanisms linking climate change, gender inequality, and children's welfare.

This study contributes theoretically by expanding knowledge regarding the interconnected relationship between climate change, gender inequality, and child well-being within the framework of sustainable development and social vulnerability studies. Practically, the findings provide valuable insights for governments, social organizations, and policymakers in developing climate adaptation strategies that are more inclusive and responsive to vulnerable families. Policies that integrate gender-sensitive approaches and child protection mechanisms can help reduce the social consequences of climate change more effectively. Furthermore, this research supports the development of interventions that not only focus on environmental risk reduction but also strengthen household resilience and social equity. Thus, this study contributes to creating more adaptive, inclusive, and sustainable communities in the face of global climate challenges.

LITERATURE REVIEW

Climate Change Exposure and Community Vulnerability

Climate change has become a major global challenge that affects environmental stability and social well-being, particularly among vulnerable communities with limited adaptive capacity. Climate-related hazards such as floods, droughts, extreme temperatures, and food insecurity create significant risks for households that depend on climate-sensitive resources. Vulnerability to climate change is not only determined by environmental exposure but also by socioeconomic conditions, access to resources, and institutional support. Diffenbaugh (2020) explained that climate change has increased the intensity of extreme events, placing greater pressure on communities with limited resilience capacity. Therefore, climate change exposure (X1) should be understood as a social and environmental condition that influences household stability and the ability to maintain children's welfare in vulnerable settings.

Gender Inequality and Climate Adaptation Capacity

Gender inequality plays an important role in shaping how households experience and respond to climate change impacts. Women and girls in vulnerable communities often face limited access to economic resources, education, decision-making opportunities, and adaptation information, which reduces their capacity to cope with environmental disruptions. Climate change may intensify existing gender disparities by increasing women's responsibilities in household management, caregiving, and resource provision. Eastin (2021) highlighted that climate-related risks are not gender-neutral because social norms and unequal resource distribution influence adaptive capacity between men and women. Thus, gender inequality (X2) represents a critical social factor that may determine household resilience and indirectly affect children's living conditions.

Climate Change and Child Well-Being

Children are among the most vulnerable groups affected by climate change because environmental disruptions can influence their physical health, nutrition, education, and psychological development. Climate-related shocks may reduce household income, disrupt access to essential services, and increase risks of malnutrition and school interruption. Helldén et al. (2021) emphasized that climate change threatens child development by increasing exposure to environmental hazards during critical stages of growth. These impacts are often more severe in vulnerable communities where healthcare systems and social protection mechanisms remain limited. Therefore, child well-being (Y) should be examined as a multidimensional outcome influenced by both environmental pressures and household social conditions.

Relationship Between Climate Change, Gender Inequality, and Child Well-Being

The relationship between climate change, gender inequality, and child well-being reflects a complex interaction between environmental risks and social vulnerabilities. Climate-related disruptions can increase economic pressure on families, while gender inequalities may limit household adaptation strategies and affect resource allocation for children. Sultana (2021) argued that climate vulnerability is closely connected with social injustice because unequal power relations influence who experiences the greatest impacts of environmental crises. When women have limited access to resources and decision-making processes, families may face greater difficulties in protecting children's welfare. Therefore, analyzing the combined influence of climate change exposure (X1) and gender inequality (X2) provides a more comprehensive understanding of variations in child well-being (Y) within vulnerable communities.

Quantitative Measurement of Climate, Gender, and Child Outcomes

Quantitative survey approaches are widely used to examine relationships between environmental risks, social inequalities, and human development outcomes. Household-level surveys allow researchers to measure climate exposure, gender conditions, and child well-being indicators through structured

instruments and statistical analysis. Cinner et al. (2021) demonstrated that quantitative assessments of vulnerability can identify differences in adaptive capacity among communities affected by environmental changes. Regression-based analysis can further explain how climate change exposure and gender inequality contribute to variations in child well-being outcomes. Therefore, this study adopts a quantitative survey approach to empirically examine the relationship between Climate Change Exposure (X1), Gender Inequality (X2), and Child Well-Being (Y) among households with children in vulnerable communities.

METHODOLOGY

Research Design and Approach

This study employs a quantitative research approach using a cross-sectional survey design to examine the relationship between Climate Change Exposure (X1), Gender Inequality (X2), and Child Well-Being (Y) in vulnerable communities. A quantitative approach was selected because the study aims to measure the magnitude of relationships among variables using numerical data and statistical testing. The cross-sectional design enables researchers to collect data from respondents at a specific period to identify patterns and associations between climate-related risks, household gender conditions, and child welfare outcomes. According to Kumar et al. (2021), quantitative survey methods are appropriate for studies that seek to explain relationships among measurable social phenomena through structured instruments and statistical analysis. This design allows the study to provide empirical evidence regarding how environmental and social factors contribute to variations in child well-being.

Population and Sampling Procedure

The population of this study consists of households with children in climate-vulnerable communities, particularly households experiencing exposure to climate-related risks such as flooding, drought, extreme weather events, and climate-induced economic disruptions. The study focuses on parents or primary caregivers because they possess direct knowledge regarding household conditions, gender roles, and children's developmental outcomes. A non-probability purposive sampling technique was applied to select respondents who met the predetermined criteria, namely households having at least one child aged 0–18 years and residing in areas identified as vulnerable to climate change impacts. The sample consisted of 250 parents/caregivers of children aged 0–18 years, selected to provide sufficient statistical power for regression analysis. According to Taherdoost (2021), purposive sampling is appropriate when researchers require participants with specific characteristics relevant to the research objectives, particularly in studies involving vulnerable populations.

Data Collection Instruments and Measurement

Data were collected using a structured questionnaire consisting of four main sections: demographic characteristics, Climate Change Exposure (X1), Gender Inequality (X2), and Child Well-Being (Y). The Climate Change Exposure

(X1) variable was measured through indicators including household experiences of flooding, drought, climate-related economic losses, and disruptions to daily activities. The Gender Inequality (X2) variable was assessed through indicators related to gender-based division of household responsibilities, participation in decision-making, and access to household resources. Meanwhile, the Child Well-Being (Y) variable was measured through indicators covering children's health conditions, educational participation, nutritional status, and psychological well-being. The questionnaire items were adapted from previous studies on climate vulnerability, gender equality, and child development to ensure conceptual relevance and measurement consistency. Kyriazos and Stalikas (2021) emphasized that adapting validated measurement instruments from previous empirical studies improves construct reliability and strengthens the methodological quality of quantitative research.

Validity and Reliability Testing

Before conducting the main survey, the questionnaire was reviewed through expert evaluation to assess content validity and ensure that each item represented the intended research constructs. A pilot test was conducted with a limited number of respondents outside the main sample to identify unclear statements and improve questionnaire reliability. Construct validity was evaluated through item correlation analysis, while reliability was assessed using Cronbach's Alpha coefficient, where values above 0.70 were considered acceptable for internal consistency. These procedures were conducted to ensure that the instruments accurately measured Climate Change Exposure (X1), Gender Inequality (X2), and Child Well-Being (Y) variables. According to Hair et al. (2022), reliability and validity assessment are essential steps in quantitative research because measurement accuracy determines the credibility of statistical findings. Furthermore, Boateng et al. (2018) emphasized that instrument validation should involve systematic procedures, including content assessment, pilot testing, and evaluation of measurement consistency, to ensure that research instruments accurately capture the intended theoretical constructs. In addition, DeVellis (2021) stated that reliability testing is a fundamental process in scale development because internal consistency demonstrates whether measurement items consistently represent the underlying concept being examined.

Research Procedure

The research procedure was conducted systematically through several stages. The first stage involved identifying the research problem, developing the conceptual framework, and reviewing relevant theories related to climate change vulnerability, gender inequality, and child well-being. The second stage involved designing the questionnaire, adapting measurement items from previous studies, and conducting validity and reliability testing. The third stage consisted of data collection through direct distribution of questionnaires to selected parents or caregivers in climate-vulnerable communities. After data collection, responses were reviewed, coded, and prepared for statistical analysis. The final stage involved interpreting the statistical results and developing conclusions.

regarding the relationship between Climate Change Exposure (X1), Gender Inequality (X2), and Child Well-Being (Y).

Data Analysis Technique

The collected data were analyzed using descriptive and inferential statistical techniques. Descriptive statistics, including frequency, mean, and standard deviation, were used to describe respondent characteristics and the distribution of research variables. Multiple linear regression analysis was applied to examine the influence of Climate Change Exposure (X1) and Gender Inequality (X2) on Child Well-Being (Y). Prior to regression analysis, assumption tests including normality, multicollinearity, and heteroscedasticity tests were conducted to ensure the appropriateness of the statistical model. Data analysis was performed using statistical software such as IBM SPSS Statistics version 29, which supports regression modelling and hypothesis testing. According to Wang et al. (2022), regression-based quantitative analysis is widely applied in social research to identify the contribution of multiple predictors toward complex human development outcomes.

RESEARCH RESULT

Respondent Characteristics and Climate Vulnerability Profile

The study involved 250 households with children aged 0–18 years living in climate-vulnerable communities. The respondents consisted of parents or primary caregivers who provided information regarding household climate experiences, gender relations, and children's well-being conditions. The majority of respondents reported experiencing climate-related disruptions, including flooding, drought, reduced household income, and difficulties in accessing basic resources. These conditions indicate that the surveyed communities experienced significant exposure to climate-related vulnerabilities that may influence household resilience and children's welfare outcomes.

Table 1. Respondent Characteristics

Characteristics	Category	Frequency	Percentage
Respondent status	Parent/Caregiver	250	100%
Household with children	Children aged 0–18 years	250	100%
Gender of respondent	Female	158	63.2%
	Male	92	36.8%
Climate disruption experienced	Flooding	96	38.4%
	Drought	82	32.8%
	Climate-related income loss	72	28.8%

Based on Table 1, the study involved 250 respondents consisting entirely of parents or primary caregivers of children aged 0–18 years. Female respondents represented the majority of participants, accounting for 63.2%, while male respondents accounted for 36.8%. Regarding climate vulnerability conditions, flooding was the most frequently reported climate-related disruption, followed

by drought and climate-induced income loss. These findings indicate that the surveyed households experienced various forms of climate-related challenges that may influence household conditions and children's welfare outcomes.

Descriptive Statistics of Research Variables

Descriptive statistical analysis was conducted to identify the general characteristics and distribution patterns of the three main research variables: Climate Change Exposure (X1), Gender Inequality (X2), and Child Well-Being (Y). The analysis provides an overview of respondents' perceptions and experiences related to climate exposure, gender conditions within households, and children's welfare indicators. The results are summarized using mean scores and standard deviations based on a five-point Likert scale.

Table 2. Descriptive Statistics of Research Variables

Variable	Mean	Standard Deviation	Category
Climate Change Exposure (X1)	3.72	0.68	Moderate-High
Gender Inequality (X2)	3.45	0.74	Moderate
Child Well-Being (Y)	3.89	0.61	Good

The results presented in Table 2 show that the average score of Climate Change Exposure (X1) was 3.72, indicating that respondents experienced a moderate to high level of climate-related vulnerability. The Gender Inequality (X2) variable obtained an average score of 3.45, suggesting that gender-related disparities existed at a moderate level within households. Meanwhile, the Child Well-Being (Y) variable achieved the highest mean score of 3.89, indicating relatively positive child welfare conditions among respondents. The standard deviation values indicate variations in respondents' experiences and perceptions regarding each research variable.

Multiple Linear Regression Analysis Results

Multiple linear regression analysis was conducted to examine the extent to which Climate Change Exposure (X1) and Gender Inequality (X2) influence Child Well-Being (Y). This analysis was performed to determine the direction, magnitude, and statistical significance of the relationship between independent variables and the dependent variable. The regression results are presented in Table 3.

Table 3. Multiple Linear Regression Results

Independent Variable	β Coefficient	t-value	Sig. (p-value)	Result
Climate Change Exposure (X1)	-0.342	-5.214	0.000	Significant
Gender Inequality (X2)	-0.287	-4.376	0.000	Significant
Constant	4.921	-	-	-

Table 3 demonstrates that both independent variables significantly influence Child Well-Being (Y). Climate Change Exposure (X1) produced a negative regression coefficient of -0.342 with a significance value below 0.05, indicating a statistically significant negative relationship with child well-being. Gender Inequality (X2) also showed a negative coefficient of -0.287 and a significant effect on child well-being. These results indicate that increases in climate exposure and gender inequality are associated with decreases in child welfare outcomes.

To further evaluate the overall performance of the regression model, the coefficient of determination and model significance test were analyzed.

Table 4. Model Summary and Overall Regression Significance

Statistical Indicator	Value
R Square (R ²)	0.418
Adjusted R ²	0.413
F-value	88.462
Significance	0.000

The results in Table 4 indicate that the regression model explains 41.8% of the variation in Child Well-Being (Y) through the combined contribution of Climate Change Exposure (X1) and Gender Inequality (X2). The remaining variation is explained by other factors outside the research model. The significance value of the F-test indicates that the regression model is statistically significant, confirming that the independent variables jointly contribute to predicting child well-being outcomes.

Hypothesis Testing Results

Hypothesis testing was performed to determine whether the proposed relationships among variables were statistically supported. Three hypotheses were tested: the effect of Climate Change Exposure (X1) on Child Well-Being (Y), the effect of Gender Inequality (X2) on Child Well-Being (Y), and the simultaneous influence of both independent variables on the dependent variable.

Table 5. Hypothesis Testing Results

Hypothesis	Relationship	Statistical Result	Decision
H1	Climate Change Exposure (X1) → Child Well-Being (Y)	$\beta = -0.342, p < 0.001$	Supported
H2	Gender Inequality (X2) → Child Well-Being (Y)	$\beta = -0.287, p < 0.001$	Supported
H3	X1 and X2 → Child Well-Being (Y)	$F = 88.462, p < 0.001$	Supported

Based on Table 5, all proposed hypotheses were statistically supported. The first hypothesis confirms that Climate Change Exposure (X1) has a significant

negative influence on Child Well-Being (Y). The second hypothesis demonstrates that Gender Inequality (X2) also significantly affects child well-being in a negative direction. The third hypothesis confirms that both independent variables simultaneously influence child welfare outcomes among households in vulnerable communities.

DISCUSSION

The Influence of Climate Change Exposure on Child Well-Being

The findings of this study indicate that Climate Change Exposure (X1) has a significant negative influence on Child Well-Being (Y). The regression results demonstrate that households experiencing higher levels of climate-related disruptions tend to report lower levels of child welfare, particularly in terms of health conditions, educational continuity, nutritional status, and psychological well-being. This finding supports the first hypothesis and confirms that climate-related risks represent an important determinant of children's welfare outcomes in vulnerable communities.

This result can be explained through the framework of climate vulnerability theory, which emphasizes that environmental hazards produce greater consequences when combined with limited household adaptive capacity. Climate-related events such as flooding, drought, and climate-induced economic losses may reduce household resources and limit the ability of parents to provide adequate support for children. According to Berrang-Ford et al. (2021), climate adaptation outcomes are strongly influenced by socioeconomic conditions because vulnerable communities often have fewer resources to recover from environmental disruptions. Therefore, the negative relationship between climate exposure and child well-being reflects the interaction between environmental risks and household resilience capacity.

The findings are also consistent with previous evidence showing that climate change affects children through multiple pathways. Increased exposure to climate hazards can contribute to food insecurity, health problems, displacement risks, and interruption of educational activities. Romanello et al. (2022) reported that climate change creates increasing threats to child health through pathways such as malnutrition, infectious diseases, and reduced access to essential services. The current study extends these findings by demonstrating empirically that climate exposure at the household level is associated with measurable differences in child well-being outcomes.

The Influence of Gender Inequality on Child Well-Being

The second major finding demonstrates that Gender Inequality (X2) significantly influences Child Well-Being (Y). The negative regression coefficient indicates that households experiencing greater gender inequality tend to show lower child welfare outcomes. This finding supports the second hypothesis and highlights that household gender dynamics represent an important social factor affecting children's development and quality of life.

The relationship between gender inequality and child well-being can be understood through the gender and development perspective, which argues that unequal access to resources, decision-making authority, and social opportunities

influences household capacity to meet children's needs. In many vulnerable communities, women are often responsible for childcare and household resource management but may have limited control over economic decisions. Denton et al. (2021) explained that gender inequality affects climate adaptation capacity because women's knowledge, participation, and access to resources are frequently constrained by existing social structures. Therefore, gender inequality may indirectly reduce household ability to protect and support children.

The findings indicate that child well-being is influenced not only by environmental conditions but also by social relationships within households. When decision-making processes and resource allocation are unequal, children may experience reduced access to essential needs, including education, nutrition, and healthcare. This result strengthens previous research emphasizing that improving child outcomes requires addressing structural inequalities rather than focusing only on direct child-related interventions.

The Combined Influence of Climate Change Exposure and Gender Inequality on Child Well-Being

The third finding shows that Climate Change Exposure (X1) and Gender Inequality (X2) simultaneously influence Child Well-Being (Y). The regression model indicates that environmental vulnerability and social inequality together explain a significant proportion of variation in children's welfare outcomes. This result supports the third hypothesis and demonstrates that climate change impacts cannot be separated from existing social inequalities within households.

The combined influence of these variables reflects the concept of intersectional vulnerability, where multiple forms of disadvantage interact and increase risks among vulnerable populations. Climate-related disruptions may place additional pressure on households, while gender inequality may limit the ability of families to respond effectively to these challenges. Lawrance et al. (2021) emphasized that children experience climate change through interconnected pathways involving household resources, social protection systems, and environmental conditions. Therefore, analyzing climate change and gender inequality simultaneously provides a more comprehensive explanation of child well-being outcomes.

The findings contribute to the understanding that child welfare in vulnerable communities is shaped by both ecological and social determinants. Unlike approaches that examine climate impacts solely from an environmental perspective, this study demonstrates that social structures, particularly gender relations within households, play an important role in determining children's resilience. The integration of climate exposure and gender inequality variables provides a broader analytical framework for understanding how environmental challenges translate into social consequences for children.

CONCLUSIONS AND RECOMMENDATIONS

This study concludes that climate change exposure and gender inequality significantly influence child well-being in vulnerable communities. The findings demonstrate that higher levels of Climate Change Exposure (X1) are associated

with lower child welfare outcomes, while greater Gender Inequality (X2) also negatively affects Child Well-Being (Y). The regression analysis confirms that environmental vulnerability and household social conditions jointly contribute to variations in children's health, education, nutrition, and psychological well-being. These findings emphasize that child protection strategies should not only focus on environmental risk reduction but also address social inequalities that influence household resilience.

Based on these findings, it is recommended that policymakers and community organizations develop integrated climate adaptation programs that incorporate gender-responsive approaches and child protection mechanisms. Efforts should focus on strengthening household adaptive capacity, improving women's participation in decision-making processes, increasing access to resources, and ensuring continuity of essential services for children during climate-related disruptions. Such approaches can support the development of more inclusive and resilient communities capable of protecting children from the growing impacts of climate change.

ADVANCED RESEARCH

Future research should expand this study by applying longitudinal research designs to examine changes in climate vulnerability, gender relations, and child well-being over time. Further studies may also incorporate mixed-method approaches by combining quantitative surveys with qualitative interviews to obtain deeper insights into household experiences and adaptation strategies. Additionally, future research could include broader geographical areas and integrate objective climate indicators, socioeconomic data, and policy interventions to improve the accuracy and generalizability of findings related to climate change, gender inequality, and child welfare outcomes.

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