SciencePG
Science Publishing Group

Research Article

Navigating Climate Challenges: Socio-Economic Impacts in Beledweyne District, Hirshabelle State, Somalia

Mahad Abdi Mohamed[1, *] (ID)**, Omar Aweis Ali[2]** (ID)**, Abdiaziz Yusuf Abdullahi[3]** (ID)**, Salma Abdulkadir Mohamed[4], Deka Ahmed Siad[5]**

[1]Faculty of Social Science, Horseed International University-HIU, Mogadishu, Somalia

[2]School of Maritime Studies and Marine Science, Darul Hikmah University, Mogadishu, Somalia

[3]Faculty of Agriculture and Environmental Sciences, Somali National University, Mogadishu, Somalia

[4]Department of Science, Somali National University, Mogadishu, Somalia

[5]Faculty of Veterinary Medicine and Animal Husbandry, Somali National University, Mogadishu, Somalia

Abstract

This study examines the profound impact of climate change on socio-economic conditions in Beledweyne District, Hirshabelle State, Somalia. Using a descriptive research design, data were gathered from 123 stakeholders, including community leaders, representatives from non-governmental organizations, and internally displaced persons, through semi-structured questionnaires. Data were collected using structured questionnaires and analyzed using Structural Equation Modeling (SEM) with SmartPLS software and Excel for Demographic characteristics. The reliability and validity of the measurement instruments were confirmed through metrics such as Cronbach's Alpha, composite reliability, and Average Variance Extracted (AVE). The findings reveal that climate change intensifies existing vulnerabilities, primarily through recurrent flooding and prolonged droughts, which diminish agricultural productivity, compromise critical infrastructure, and drive population displacement. Specifically, the results indicate substantial declines in crop yields and livestock production, extensive infrastructure damage including roads and community facilities—and rising migration as livelihoods erode. These shifts have deepened poverty, increased food insecurity, and strained social cohesion, highlighting an urgent need for targeted resilience strategies. This study provides valuable insights for policymakers and development practitioners, emphasizing the importance of climate-resilient infrastructure, adaptive agricultural practices, and robust social safety nets as mitigative measures against climate-induced socio-economic degradation. These findings offer a foundation for formulating strategic interventions to enhance resilience in Beledweyne and similarly vulnerable regions.

*Corresponding author: Mhd2043@gmail.com (Mahad Abdi Mohamed)

1. Introduction

The climate crisis represents a significant environmental challenge, defined by increasing greenhouse gas emissions that drive global warming and lead to profound shifts in climate patterns. This intensifying phenomenon manifests through more frequent and severe weather events, including droughts and floods, which exacerbate the vulnerability of ecosystems and communities globally. The ongoing climate threats place a particular burden on low-income countries like Somalia, where dependence on climate-sensitive resources, such as agriculture and water, is high, and adaptive capacity is limited. According to the Sustainable Development Goals (SDGs), notably SDG 13, there is an urgent call for climate action to mitigate these impacts, while SDG 17 emphasizes the need for strengthened partnerships to support sustainable adaptation measures, especially in regions prone to climate variability. [1]

The effects of these emissions are widespread, influencing agriculture, economic activities, infrastructure development, and social well-being. This is particularly evident in low-income countries, which are the most susceptible to the impacts of climate change, even though they contribute the least to its causes. [2, 3].

Somalia's vulnerability to climate variability is intricately linked to its geographical and socio-economic context. The nation's reliance on rain-dependent farming intensifies its susceptibility to climate change. Historical data shows that significant populations in Sub-Saharan Africa, particularly Somalia, have faced considerable challenges related to water stress, stemming from their dependence on water and pasture for their livelihoods. [2]

Moreover, the restricted ability of Somalia to adapt, shaped by elements like economic growth, educational opportunities, access to financial resources, and the integration of technology, makes it challenging to consistently evaluate and tackle the effects of climate change throughout the continent. [3].

In recent years, Somalia has encountered a variety of challenges stemming from climate change. In 2012, more than 10 million individuals faced critical challenges requiring international assistance as a result of extreme drought, which caused significant water shortages, restricted agricultural productivity, and posed serious risks to food security. This scenario compelled numerous families to relocate in pursuit of water and food, highlighting the significant effects of climate variability on the populace. [4]. Furthermore, ongoing drought conditions and erratic rainfall patterns have led to diminished crop yields and significant livestock losses, which in turn exacerbate food insecurity and lower household incomes [5]. These climatic events highlight the critical necessity for thorough strategies aimed at reducing their impacts and strengthening the resilience of the communities that are affected.

The economic consequences of the climate crisis in Somalia are significant. The backbone of the country's economy, agriculture and livestock, face significant challenges due to recurrent droughts and unpredictable rainfall patterns. The fluctuations in climate lead to diminished agricultural productivity and significant losses in livestock, jeopardizing food security and adversely affecting household incomes. The agricultural sector, which employs more than 60% of the population, faces significant vulnerability to climate variability, The resulting decline in agricultural productivity exacerbates poverty levels and reduces the country's GDP, making it more challenging for the government to allocate resources to vital sectors like health, education, and infrastructure. [4].

Furthermore, the climate crisis has led to notable changes in labor markets, as decreasing agricultural productivity prompts rural-urban migration. This phenomenon intensifies urban unemployment and poverty, establishing a detrimental cycle of socio-economic issues. [6]. The interrelation of economic and social systems indicates that the effects of climate change extend beyond rural regions, resulting in significant consequences for the nation as a whole.

The climate crisis further intensifies the infrastructural challenges faced by Somalia. Regular occurrences of flooding and severe weather conditions lead to considerable destruction of roads, bridges, and essential infrastructure, hindering transportation and communication systems. This disruption obstructs trade and limits access to vital services, thereby exacerbating the isolation of remote communities [7]. The damage to infrastructure leads to significant expenses for repair and reconstruction, redirecting resources away from other essential developmental priorities. Moreover, urban regions face heightened pressure as a result of climate-driven migration, resulting in overcrowding and the proliferation of informal settlements that frequently lack essential infrastructure and services. [8].

The climate crisis in Somalia carries deep social implications, greatly exacerbating pre-existing vulnerabilities. The rising frequency and intensity of droughts and floods significantly impact livelihoods, especially in rural regions where agriculture and pastoralism serve as the main sources of income. Extended periods of drought lead to a shortage of water, failures in crop production, and the loss of livestock, which intensifies issues related to food insecurity and malnutrition. The challenging circumstances drive communities to relocate in pursuit of water and grazing land, frequently resulting in disputes over limited resources. [4, 2]. Such displacement strains already limited social services and infrastructure, deepening poverty and vulnerability among affected populations. [3].

The health impacts of climate change in Somalia present significant concerns that must be addressed. Malnutrition and water-borne diseases are increasing as access to clean water diminishes and food security deteriorates. [9]. The healthcare

system, already under pressure, faces challenges in managing the rising incidence of disease and the requirements of displaced populations, underscoring the necessity for strong adaptive strategies. Climate change has been associated with a rise in vector-borne diseases, including malaria, as alterations in temperature and precipitation patterns establish more conducive environments for disease vectors. [10].

The education sector in Somalia faces significant challenges due to the effects of climate change. Extreme weather events result in significant disruptions, leading to extended school closures that hinder educational continuity and worsen existing educational inequalities. Furthermore, the movement of families seeking improved living conditions frequently leads to children leaving school, which further reduces their future opportunities [11].

Although there has been significant investigation into the overarching effects of climate change in Somalia, a clear deficiency exists in localized studies that concentrate on particular regions and communities. Beledweyne, a town in the Hirshabelle state of Somalia, illustrates the profound effects of climate change on the economy and social structure of a community. There is a scarcity of thorough investigations that outline the particular socioeconomic effects of climate-induced occurrences on the inhabitants of Beledweyne. This study seeks to address this gap by investigating the impacts of climate change on agriculture, infrastructure, displacement, and community well-being in Beledweyne. The results will offer data-driven insights to guide local and national policy actions focused on improving climate resilience and socioeconomic stability in the area [7].

The climate crisis presents intricate and extensive challenges, especially in vulnerable areas such as Somalia, where its effects on the economy, infrastructure, and social frameworks are significant. Confronting these challenges requires a thorough comprehension of the unique local impacts of climate change and the formulation of focused strategies to enhance resilience and promote sustainable development. This investigation centers on Beledweyne, a town in Hirshabelle State, Somalia, to examine the impact of climate-induced events like floods and droughts on agriculture, infrastructure, and community livelihoods. The study seeks to offer important findings that can assist decision-makers in crafting effective measures and adaptive approaches to address the current and future effects of climate change in the area.

The primary objectives of this study are: (1) to examine the effects of the climate crisis on social well-being and local infrastructure in Beledweyne, and (2) to assess its economic implications. Through an in-depth analysis of climate-related events, particularly floods and droughts, this research aims to elucidate the impacts on agriculture, infrastructure, and livelihoods within the Beledweyne region.
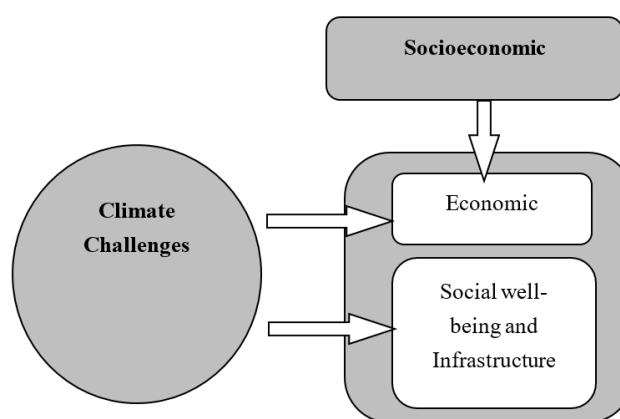

Figure 1. Conceptual framework of the study.

This study explores the adaptive strategies used by the community, which can inform resilience programs and serve as a model for other regions facing similar challenges.

The findings are significant for decision-makers, non-governmental organizations, and researchers, as they contribute to the formulation of effective policies and the expansion of academic understanding, ultimately enhancing global climate adaptation strategies.

2. Methodology

The study examines the correlation between climate change and socioeconomic using a Correlation research approach. This research uses a Correlation methodology to analyze situations or difficulties in describing associations among variables, focusing on causal relationships among social phenomena. [12].

The sample for this study was derived from a target population of 180 residents, from which 123 respondents were selected using the Krejcie and Morgan sampling table. A random sampling method was employed to ensure a diverse and representative dataset, capturing various perspectives on the socioeconomic impacts of climate change. Data collection was conducted through structured questionnaires based on a five-point Likert scale, which allowed for quantifying respondents' perspectives on climate-related challenges.

Secondary data were further subjected to content analysis, providing context and depth to the findings and situating them within the wider discourse on climate impacts relevant to Beledweyne.

Data analysis was performed using SPSS version 26 for descriptive statistical analysis of demographic data, and SmartPLS version 4.1.0.4 was used for structural modeling to assess the interrelationships among variables. Content analysis of secondary data enriched the study by enabling triangulation with primary data findings. The reliability and validity of the instruments were rigorously tested, and measures were taken to address potential biases, including gender bias, to ensure the accuracy and impartiality of the

results.

Criterion	Acceptable Value
Indicator Reliability	Outer loadings > 0.7
Internal Consistency	Composite reliability > 0.7
Convergent Validity	AVE > 0.5
Discriminant Validity	Fornell-Larcker criterion
Significance (p-value)	< 0.05
Significance (t-value)	> 1.96
Path Coefficients/R	Significant at r > 0.1 indicates a strong relationship.
R-Squared Values	Higher values indicate better model fit.
Predictive Relevance (Q2)	Q2 > 0 indicates predictive relevance

3. Results

This section presents the findings from the study, addressing the primary objectives: (1) to examine the effects of climate change on social well-being and local infrastructure in Beledweyne, and (2) to assess its economic implications. The analysis begins with an overview of the demographic characteristics of the sample population, which provides context for understanding respondents' perspectives on climate-related impacts.

3.1. Demographic Section

Table 2. Demographic section.

Variables	Frequency	Percentage
Gender		
Male	83	67.5
Female	40	32.5
Age of Respondents		
18-25	85	69
26-33	26	21
34 and above	12	10
Level of Education		
Secondary	46	38
Bachelor	57	46

Variables	Frequency	Percentage
Master	20	16
Level of Experience		
1-2 years	72	59
3-4 years	26	21
5 years above	25	20

The demographic data reveals that the majority of respondents are male (67.5%), aged 18-25 (69%), and have a Bachelor's degree (46%). Most have 1-2 years of work experience (59%). Additionally, 32.5% are female. In terms of age, 21% are aged 26-33, and 10% are aged 34 and above. Regarding education, 38% have completed secondary education, and 16% have a Master's degree. For work experience, 21% have 3-4 years, and 20% have over 5 years of experience.

3.2. The Measurement Model

The measurement model evaluates construct quality, determining validity and reliability. Factor loadings, average variance extract, composite reliability, discriminant validity, and VIF for multicollinearity identification were examined. The study's results are presented in Table 2 and Table 3.

Table 3. Measurement Model.

Variables	Indicators	Loading	CR	AVE
Social wellbeing and Infrastructure	IV1Q1	0.918	0.948	0.864
	IV1Q2	0.964		
	IV1Q3	0.926		
	IV1Q4	0.909		
	1V1Q5	0.915		
	IV1Q6	0.911		
	IV1Q7	0.939		
	IV1Q8	0.940		
	IV1Q9	0.935		
Economic Impact	IV2Q1	0.924	0.954	0.877
	IV2Q2	0.950		
	IV2Q3	0.941		
	IV2Q4	0.930		
Climate change	DVQ1	0.930	0.947	0.862
	DVQ2	0.931		
	DVQ3	0.930		

Variables	Indicators	Loading	CR	AVE
	DVQ4	0.921		

The measurement model was validated by researchers to assess its accuracy and reliability. Factor loadings within the .50 to .70 range were considered appropriate. [13] Suggested eliminating indicators with factor loadings between .40 and .70 to improve internal consistency Researchers validated the measurement model Tency.

The analysis results showed that all indicators met the validity criterion, with factor loadings ranging from .909 to .964, which is the acceptable range. [13] Suggested that convergent validity requires an Average Variance Extracted (AVE) value above a minimum threshold of .50. [14] Recommendations also suggest an acceptable value of AVE

greater than or equal to .50. The findings determined that all levels exceeded the minimal permissible threshold. Finally, composite reliability was chosen for reliability testing due to its more precise estimation. [13]. All constructs exceeded the minimum threshold of .70, with acceptable CR values ranging from .947 to .954.

The discriminant validity was assessed using one technique, as demonstrated in Table 4 Validity assesses a scale's ability to accurately measure a desired component, including convergent and discriminant validity [15]. Convergent validity is determined by factor loading and AVE, assessing the extent to which observed variability in an indicator construct is adequately explained by the latent construct. [13]. Convergent validity is determined using factor loading and AVE, as shown in Table 3. Discriminant validity is the ability of a construct to be distinguished from others based on empirical evidence [15-17].

Table 4. Fornell-Larcker Criterion.

Construct	Climate change	Social wellbeing	Economic	Infrastructure
Climate change	0.928			
Social wellbeing	0.946	0.929		
Economic	0.927	0.958	0.937	
Infrastructure	0.932	0.955	0.931	0.931

The Fornell-Larcker criterion is a method used to assess the discriminant validity of a model, determining the AVE square root of all variables. [14]. This indicates a stronger correlation between variables.

3.3. Structural Model

The study confirmed the validity and reliability of a measurement model, followed by testing the suggested structural model. This stage involved evaluating the importance and applicability of the suggested structural links. Following [13] Recommendations and indicators were used to assess collinearity between constructs and determine the coefficient of determination (R2) and Q2 Value. Detailed information on each stage is provided in later sections.

The Coefficient of Determination (R ʒ, and Predictive Relevance (Q2) Value Researchers used the Coefficient of Determination (R ʒ to evaluate the predictive accuracy of a structural model, assessing its ability to accurately predict outcomes, where the dependent variable represents the outcome [13]. The study's results are shown in Table 5. Falk and Miller (1992) suggested that R^2 values of .907 for higher are sufficient for a particular endogenous construct's variance explanation to be considered adequate. (Cohen, 1988)

suggested that R^2 values for endogenous latent variables should be assessed using a scale of .26 (substantial), .13 (moderate), and .02 (weak).

Q^2 is a statistical tool that assesses a model's predictive relevance, with values above zero indicating well-reconstructed values. Its values for each impact indicate weak (.02), moderate (.15), and high (.35) respectively. [13] Table 5 displays the study's Q^2 results revealing Q^2 values of 0.898 for climate change, confirming the model's predictive relevance as the estimated Q^2 values exceeded zero.

Table 5. Coefficient of Determination R^2 and Q^2.

The Coefficient of Determination R^2 and Q^2		
Variables	R^2	Q^2
Socioeconomic Impact	0.907	0.898

3.4. The Significance and Relevance of Path Coefficients

The research, using a bootstrapping approach with 10000

resamples, found a significant and positive correlation between climate change and socioeconomic. This confirms Hypothesis 1 (H1) and Hypothesis 2 (H2), indicating that the dimensions of Social and Economic are significantly affected by climate change, as shown in Table 6.

Table 6. Structural Model Results (Direct Relationships).

Construct	R	T statistics	P values	Decision
Social Impact-> Climate change	0.472	2.927	0.003	Accepted
Economic-> Climate change	0.295	2.177	0.029	Accepted

4. Discussion

4.1. The Impact of Climate Change on Social Well-Being

Climate change significantly impacts both the social fabric and infrastructure in Beledweyne, Somalia, with interconnected consequences. Extreme weather events, such as droughts and floods, disrupt traditional livelihoods and prompt involuntary migrations, affecting social cohesion and community resilience. For instance, severe flooding from the Shabelle River not only displaces families but also isolates communities by damaging critical infrastructure, such as roads and bridges. This limits access to essential services, including healthcare and education, and reduces economic opportunities, compounding social vulnerabilities and

economic strain.

These disruptions have far-reaching implications for mental health, social dislocations, and the stability of local communities. Vulnerable groups, particularly women and children, face heightened risks due to restricted access to resources and support networks. Damaged infrastructure also impedes access to clean water and electricity, further reducing quality of life and resilience. Studies, including those by [2, 7] highlights the necessity of climate-resilient infrastructure to support social well-being and maintain essential connections between communities. A coordinated focus on resilient infrastructure could enhance access to services and strengthen community ties, reducing the socio-economic toll of climate change.

4.2. The Impact of Climate Change on Economic

Climate change poses serious economic challenges to Beledweyne, Somalia, affecting various economic sectors directly and indirectly. The study shows a statistically significant link (p-value = .029) between climate variables and economic stability, with extreme weather events such as prolonged droughts and recurring floods from the Shabelle River severely impacting agricultural productivity, the primary economic activity for the region. These climate shocks reduce crop yields and livestock numbers, directly impacting food security and elevating poverty levels by diminishing household incomes. Such findings align with studies by [6, 5], which underscores how climate-driven economic disruptions reduce economic output and increase poverty in vulnerable areas.

Table 7. Summary of Vulnerability Elements.

Element	Susceptibility Level	Description	Supporting Literature
Agriculture	High	Climate disruptions reduce crop yields and livestock	Reuveny (2007), World Bank (2020)
Water & Irrigation Systems	High	Damage affects water access and agricultural productivity	UNDP (2018)
Roads & Transportation	Moderate	Limited connectivity affects trade and access to services	Ajuang et al. (2018)
Health & Education Access	Moderate	Infrastructure damage limits healthcare and education	Nkomo et al. (1999), Local studies

4.3. Theoretical Implications

This study significantly enhances the current body of work

regarding the socioeconomic effects of climate change, especially in at-risk areas such as Beledweyne. The empirical evidence substantiates the theoretical framework connecting climate variability to social, economic, and infrastructural

challenges. This study utilizes social exchange theory to enhance our comprehension of the intricate relationships between climate change and community dynamics. The results indicate that subsequent investigations might expand on this study's framework to examine analogous effects in different areas, thus deepening the scholarly comprehension of climate change's wider consequences.

4.4. Practical Implications

The practical implications of this study are substantial, especially for decision-makers and parties engaged in formulating climate adaptation strategies. The findings indicate that climate change significantly impacts the socioeconomic structure of Beledweyne, highlighting the need for focused efforts to strengthen community resilience. Those in positions of authority need to focus on creating and executing strategies that enhance agricultural methods, allocate resources toward climate-resilient infrastructure, and bolster social safety nets for at-risk communities. Furthermore, the results highlight the necessity of ongoing observation and evaluation of climate change effects to guide adaptive policy strategies that can alleviate potential future threats. Initiatives focused on capacity-building, including workshops and training programs, are essential for strengthening local resilience to climate change and can significantly aid the community in adapting to persistent climatic challenges.

5. Conclusion

The investigation reveals a notable connection between climate change and the socioeconomic difficulties faced in Beledweyne, Hirshabelle State, Somalia. It demonstrates that climate-related occurrences, including floods and droughts, have significantly affected agriculture, infrastructure, and the well-being of communities, resulting in heightened poverty, food insecurity, and forced displacement. The results highlight the necessity for focused strategies to bolster resilience, such as advancing agricultural methods, developing climate-resilient infrastructure, and reinforcing social safety nets.

It is essential for those in positions of authority to focus on climate adaptation strategies to ensure the well-being of at-risk communities. The study highlights the necessity of ongoing investigation to formulate effective policies that tackle the specific effects of climate change, promoting long-term sustainability and resilience for impacted areas such as Beledweyne.

6. Limitations and Future Studies

This study faces a significant limitation due to the scarcity of up-to-date and comprehensive data regarding the socioeconomic effects of the climate crisis in Beledweyne,

Hirshabelle State, Somalia. The lack of localized data regarding climate variables, agricultural yields, and infrastructure damage presents considerable obstacles in effectively evaluating the comprehensive impact of the climate crisis. Additionally, the sample size of the study, although representative, might not entirely reflect the range of experiences among various demographic groups in Beledweyne, including differences in socioeconomic status, gender, and age.

Furthermore, the study's dependence on self-reported data raises concerns about response bias, as participants' perceptions might be swayed by recent events or personal experiences, potentially compromising the objectivity of their responses. The study's time constraints hindered the possibility of conducting longitudinal assessments, which could have yielded more comprehensive insights into the long-term effects of climate change on the socioeconomic conditions of the region.

To enhance future studies, broadening the focus to encompass additional areas within Hirshabelle State and throughout Somalia would yield a more thorough insight into the effects of the climate crisis on the country's socioeconomic stability. Longitudinal studies that monitor changes over time may provide more profound insights into the dynamic nature of these impacts and the efficacy of adaptation strategies. Additionally, utilizing qualitative methods like in-depth interviews and focus group discussions may enhance the comprehension of community resilience and adaptation strategies.

Investigating the connections between climate change and various elements like conflict, migration trends, and urban development would be beneficial for crafting comprehensive policy suggestions.

Abbreviations

UNDP	United nation Development Programme
SEM	Structural Equation Modeling
AVE	Average Variance Extracted
SDGs	Sustainable Development Goals
GDP	Gross Domestic Product.
SPSS	Statistical Package for Social Sciences
PLS	Partial Least Squares
UNICEF	United Nations International Children's Emergency Fund

Acknowledgments

Author Contributions

Mahad Abdi Mohamed: Conceptualization, Data curation, Formal Analysis, Investigation, Methodology, Resources, Software, writing – original draft, Writing – review & editing

Omar Aweis Ali: Conceptualization, Data curation, Methodology, Supervision, Visualization, Writing – review & editing

Abdiaziz Yusuf Abdullahi: Formal Analysis, Funding acquisition, Resources, Software, Writing – review & editing, Supervision, original draft

Salma Abdulkadir Mohamed: Conceptualization, Data curation, Formal Analysis, Investigation, Methodology, Resources, Software

Deka Ahmed Siad: Conceptualization, Data curation, Formal Analysis, Investigation, Methodology, Resources, Software

Conflicts of Interest

The authors declare no conflicts of interest.

References

[1] I. Sarfo, O. H. Bortey, and T. P. Kumara, "Effectiveness of Adaptation Strategies among Coastal Communities in Ghana: The Case of Dansoman in the Greater Accra Region," *Curr. J. Appl. Sci. Technol.*, vol. 35, no. 6, pp. 1–12, 2019, https://doi.org/10.9734/cjast/2019/v35i630211

[2] L. Ajuang Ogallo, P. Omondi, G. Ouma, and G. Wayumba, "Climate Change Projections and the Associated Potential Impacts for Somalia," *Am. J. Clim. Chang.*, vol. 07, no. 02, pp. 153–170, 2018, https://doi.org/10.4236/ajcc.2018.72011

[3] J. C. Nkomo, A. O. Nyong, and K. Kulindwa, "The Impacts of Climate Change in Africa: The Stern Review on the Economics of Climate Change," *ResearchGate*, vol. 14, no. 1, pp. 145–173, 1999, [Online]. Available: http://www.jstor.org/stable/27646844

[4] E. J. Meeking, "A Study of Climate Change Induced Migration in Somalia," pp. 1–4, 2013.

[5] World Bank, "Somalia Drought Impact and Needs Assessment (I)," vol. I, p. 18, 2020.

[6] R. Reuveny, "Climate change-induced migration and violent conflict," *Polit. Geogr.*, vol. 26, no. 6, pp. 656–673, 2007, https://doi.org/10.1016/j.polgeo.2007.05.001

[7] UNDP, "Building Climate-Resilient Infrastructure. United Nations Development Programme.," 2018.

[8] R. S. J. Tol, "Change," vol. 23, no. 2, pp. 29–51, 2009.

[9] A. K. Githeko, S. W. Lindsay, U. E. Confalonieri, and J. A. Patz, "Climate change and vector-borne diseases: A regional analysis," *Bull. World Health Organ.*, vol. 78, no. 9, pp. 1136–1147, 2000.

[10] U. Pape and P. Wollburg, "Impact of Drought on Poverty in Somalia," *Impact of Drought on Poverty in Somalia*, no. January, 2019, https://doi.org/10.1596/1813-9450-8698

[11] UNICEF, *The climate-changed child : a children's climate risk index supplement*. 2023. https://doi.org/10.7927/h49c6vhw

[12] D. Neuman, "Qualitative research in educational communications and technology: A brief introduction to principles and procedures," *J. Comput. High. Educ.*, vol. 26, no. 1, pp. 69–86, 2014, https://doi.org/10.1007/s12528-014-9078-x

[13] J. F. Hair, G. T. Hult, C. Ringle, and M. Sarstedt, *A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM) - Joseph F. Hair, Jr., G. Tomas M. Hult, Christian Ringle, Marko Sarstedt*. 2017.

[14] Y. P. Chua, "A step-by-step guide PLS-SEM data analysis using SmartPLS4." pp. 1–311, 2023. [Online]. Available: https://www.researchgate.net/publication/362790516_A_step-by-step_guide_PLS-SEM_data_analysis_using_SmartPLS_4

[15] J. Henseler, C. M. Ringle, and M. Sarstedt, "A new criterion for assessing discriminant validity in variance-based structural equation modeling," *J. Acad. Mark. Sci.*, vol. 43, no. 1, pp. 115–135, 2015, https://doi.org/10.1007/s11747-014-0403-8

[16] W. W. Chin and P. R. Newsted, "The partial least squares approach to structural equation modeling. Modern methods for business research," *Stat. Strateg. Small Sample Res.*, no. January 1998, pp. 295-336., 1998, [Online]. Available: http://books.google.com.sg/books?hl=en&lr=&id=EDZ5AgAAQBAJ&oi=fnd&pg=PA295&dq=chin+1998+PLS&ots=47qB7ro0np&sig=rihQBibvT6S-Lsj1H9txe9dX6Zk#v=onepage&q&f=false

[17] C. Fornell and D. Larcker, "Structural equation models with unobservable variables and measurement error: Algebra and statistics. Journal of marketing research," *Adv. Methods Mark. Res.*, vol. 18, no. 3, pp. 382-388., 1994.