

EFFECT OF ENVIRONMENTAL DISASTER MANAGEMENT ON SOCIO-ECONOMIC DEVELOPMENT IN RWANDA A CASE STUDY OF MUSANZE DISTRICT

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Abstract:

The study of whether environmental disasters are a real obstacle to the growth and socio economic development of a country is a study that is being carried out by many experts, considering that environmental disasters are unpredictable events but have a real effect on the economy. Ample research has been done on disasters and socioeconomic indicators, but little has been done on how environmental disaster management affects community socioeconomic development or how the community contributes to managing the disaster rather than leaving it to the responsible authorities and environmental disaster management experts. Therefore, this study tries to close a research gap in environmental economics by examining the impact of environmental disaster management on Rwanda's socioeconomic development by emphasizing on community of selected sectors of Musanze District. To determine the structural relationship between environment disaster management and socio economic development, the multiple linear regression model is used. This approach is an approach previously not found in economic and environmental studies. This study uses primary data collected 476 households from Muko, Kinigi, Nyange, Musanze, Shingiro, Gataraga and Busogo sectors. The participant households were selected using systematic sampling technique, based on the interval between households. Regression analysis revealed a positive relationship ($R = 0.953$). The R coefficient of 0.953 indicates that the predictors of the model which land slide management and flooding management, have an effect of 95.3% with the dependent variable (social economic development) The study also revealed that a combination of land slide management and flooding management together contributed to 90.8% ($R^2 = 0.908$) of the social economic development. The researcher noticed that Musanze district implemented measures to mitigate the impact of climate change on the livelihood of Musanze district households; therefore, the researcher concluded that environmental disaster management had an impact on Musanze's socioeconomic development. However, in some

area of the research, researcher found there is a need of improvement especially on environmental degradation management and climate change management since they showed a weak effect on social economic development of Musanze district.

Key words: Environmental, Disaster, Management, Social, Economic and Development

1. INTRODUCTION

Many specialists are investigating whether environmental disasters constitute a true barrier to a nation's socioeconomic development and prosperity. This is because environmental disasters are unpredictable phenomena that have a significant impact on the economy (Hidalgo, 2019). A disaster in a particular location will result in economic losses, among other things, in the form of infrastructure damage in the disaster area (Baez, 2019). Numerous specialists have studied disasters and come to the conclusion that abrupt disasters (hurricanes, earthquakes, and floods) will harm infrastructure and productive capital. Different things happen to disasters categorized as disasters that occur slowly (drought and floods) where these disasters have a wider and long-term impact (Baez, 2019).

Communities all over the world are becoming more and more vulnerable to many types of risks in an era of greater human alteration of nature. These dangers,

which can be either natural, man-made, or a combination of the two, frequently lead to catastrophes that have effects on the economy, society, culture, environment, and politics. Since the 1950s, extreme precipitation events have increased in frequency and produced more rain in many parts of the world, including much of the United States. The Midwest and Northeast in the United States have had the sharpest increases in heavy precipitation events (Bartlett, 2008).

As a result of the disaster-economic nexus, namely the connection between environmental harm, natural catastrophes, and wealth disparity (Kuznets, 2021). The distribution of attitudes is found to be significantly impacted by climate change in the long-term study model of economic factors, and this is explained by (Piontek, 2019). The disaster worsened economic disparity in the afflicted communities, according to (Peter, 2018), who also discovered this. Because of their less stable and favorable economic situations, emerging nations are particularly sensitive

to the effects of climate change, which could ultimately result in a catastrophe if these nations do not properly prepare for them.

Depending on the hazard scale, human vulnerability, human behavior, and activities that increase exposure by disregarding local hazardous circumstances, weather-related natural hazards like floods, storms, landslides, and wildfires can result in disasters with considerable human and economic losses. A greater understanding of the processes for readiness and resilience is made possible by the recording, analysis, and assessment of the many impacts in relation to these aspects, potentially improving emergency response (Katerina, 2022).

The Musanze District depends heavily on agriculture. A minimum of 91% of the populace works in agriculture. Musanze is regarded as a rural grain store. Coffee, tea, pyrethrum, wheat, bananas, beans, sorghum, and potatoes are among the agricultural items grown in this area. The most important issues, however, are that all agricultural activities are conducted on unstable land in many localized areas of the district, where the majority of landslide and flooding fatalities are caused by human

activity on steep slopes, a lack of drainage systems and rain water collection, and poor soil cohesion (Action Aid, 2021).

With an average temperature of 20°C and rainfall that ranges from 1400 mm to 1800 mm, the Musanze District has a tropical climate. The wettest months are April and May, while a much more moderate rainy season will occur in October and November 2021. This will cause substantial damage to homes, crops, latrines, livestock deaths, road destruction, household item losses, and even human fatalities (Minema, 2021).

In fact, ample research has been done on disasters and socioeconomic indicators, but little has been done on how environmental disaster management affects community socioeconomic development or how the community contributes to managing the disaster rather than leaving it to the responsible authorities and environmental disaster management experts. Therefore, this study tries to close a research gap in environmental economics. As a result, this study examined the impact of environmental disaster management on Rwanda's socioeconomic development by emphasizing on community of selected sectors of Musanze District.

This work pacifically aims:

- To analyze the effect of land slide management on socio-economic development of selected sectors of Musanze district for the period of 2017-2021,
- To assess the effect of flooding management on socio-economic development of selected sectors of Musanze district for the period of 2017-2021.

The following hypothesis have been tested:

- H₁. There is no effect of land slide management on socio-economic development of selected sectors of Musanze district for the period of 2017-2021.
- H₂. There is no the effect of flooding management on socio-economic development of selected sectors of Musanze district for the period of 2017-2021.

People without home and threatening their lives (Ebi, 2012). Mountainous and coastal areas are the most affected regions but that does not mean that the other areas are safe. Landslides cause huge damage in the world and kill many people each year. Casualties are caused by rockslides, rock falls, and debris falls. In order to know this phenomenon better, and eventually protect

themselves from its destructive action, people should be aware of how landslides are formed and how they act (McLennan et al., 2014).

Flooding management

Today, flood risk management is primarily a function of local governments (e.g., cities and counties), especially local emergency and floodplain managers. Whereas emergency managers are responsible for coordinating efforts to mitigate, prepare, respond, and recover from any and all disasters and emergencies, floodplain managers are responsible for developing, implementing, and overseeing the community's floodplain management program. This frequently includes "enforcing the community's flood damage prevention ordinance, updating flood maps, plans, and policies of the community, and any of the activities related to administration of the National Flood Insurance Program" (Association of State Floodplain Managers 2010).

Depending on the size and structure of a locality, the emergency and floodplain manager may be a dual job title and, thus, occupied by the same local government employee. However, in other communities, the floodplain manager is a second job title of a city or county community development director, engineer, building code official, or

zoning officer (Tyler 2018; Tyler and Sadiq 2018). Rarely, is a floodplain manager the sole function of a local government employee. Rather than using the terms floodplain manager or emergency manager to describe the individuals that play a decision-making role in managing communities' flood risks, the authors use the term "flood management decision-makers" to include policymakers and other agencies and groups that are involved in making decisions to minimize a community's flood risks.

➤ **Empirical review**

Akhtar (2019) carried a study on the impact of environmental disaster management upon Economic Growth in Pakistan, the research is based on the natural disasters in Pakistan, and their overall impact on the economy of Pakistan. Disasters are hypothesized to have a significant effect on the GDP of Pakistan. Moreover, Pakistan is considered as a disaster prone nation due to its geographical location. Pakistan has always been likely to be affected because of floods due to monsoon rains. But looking at the recent history, Pakistan has experienced massive loss due to 2010 floods and due to the earthquake in 2005, these two being considered as the biggest disasters in Pakistan of all time.

The Time-series Distributive Lag (DL) model has been used to find the model estimates. Number of people killed in disasters is taken as a proxy for disasters and its effect on economy is seen. Interaction of glacier meltdown with consumption of ozone depleting substances has been developed and is seen as a proxy cause for global warming, which ultimately results in climate change and is likely to cause natural disasters. The results suggest that natural disasters and global warming have a negative impact on the economic growth. Moreover, the study focuses on the policy implications from National Disaster Management Authority (NDMA) and to avoid huge losses with better mitigation plans has been incorporated and suggestions in conclusion that how can the losses from disasters be minimized.

Yang (2020) carried a study on socioeconomic development and the impact of natural disasters: some empirical evidences from China. Significant advancements have been made in examining the relationship between economic development and disaster losses at the global and national scales, but very little research has been done at the sub-national level, especially in China. Based on socioeconomic and disaster impact data

from 31 provinces (municipalities, and autonomous regions) in China from 1990 to 2010, ordinary least squares regression was used to determine the relationship between socioeconomic development and effects of natural disasters. Results showed that economic development played a distinct role in mitigating disaster damages in the whole China and its eastern, central and western regions.

There existed a U-shaped relationship between economic growth and disaster losses in the whole China and its eastern region, and an Inverted-U nonlinearity linkage in its central and western areas. These findings further confirmed the existence of a nonlinear relationship between economic development and disaster losses. Economic growth had played a more important role in mitigating disaster losses in the central region of China than that in the western one. Further investigations demonstrated that as economic develops, there were fewer deaths caused by natural hazards in whole China and all its three regions. The combination of the lower level of education, higher unemployment rate and greater gross dependence ratio has contributed to the increase in death toll

caused by natural disasters, but this trend could be partly offset by wealth growth.

According to Drake C. (2014), the effectiveness of several flood mitigation strategies for reducing peak discharges in the Upper Cedar River Watershed located in northeast Iowa. Triggered by record flooding in June 2008, the Iowa Watersheds Project was formed to evaluate and construct projects for flood reduction. The Upper Cedar was selected as a pilot watershed and a hydrologic assessment was performed to better understand its flood hydrology. Evaluation of different flood mitigation strategies was performed with HECHMS, a lumped parameter surface water model. The hydrologic model development is described and the model applications are analyzed.

The HMS model was used in several ways to better understand the flood hydrology of the Upper Cedar River Watershed. First, the runoff potential of the basin was assessed to identify the primary runoff generation mechanisms. Areas with agricultural land use and moderately to poorly draining soils had the highest runoff potential. Following, the model was used to evaluate the impact of several flood mitigation strategies increased infiltration through land use changes, increased infiltration through soil

improvements, and added storage in the watershed to hold runoff temporarily and reduce downstream flood peaks for different flood frequency events. Although each scenario is hypothetical and simplified, they do provide benchmarks for the types of reductions physically possible and the effectiveness of strategies relative to one another. In order to reduce the impacts of flooding in the Upper Cedar, a combination of projects that enhance infiltration and/or store excess runoff was necessary.

➤ **Research Gap**

Several studies have been conducted in relation to the disaster management such as Akhtar (2019) carried a study on the impact of environmental disaster management upon Economic Growth in Pakistan, Yang (2020) carried a study on socioeconomic development and the impact of natural disasters: some empirical evidences from China. Drake C. (2014), the effectiveness of several flood mitigation strategies for reducing peak discharges in the Upper Cedar River Watershed located in northeast Iowa. Kusi (2020), environmental risk management are a serious global issue attracting attention and research from academia, the media and other international discourse. Ali (2019), carried out a research

on assessment of the institutional framework for disaster management in Tanzania and Aime et al (2019), conducted a research on Estimating damage costs of flooding on small- and medium-sized enterprises in Kigali, Rwanda.

Researchers have focused on the strategies and policies in place to mitigate the risks of environment disaster, thus the research will focus on the analysis of environment disaster management and its effect on the socio economic development of selected sectors of Musanze district.

3. METHODOLOGY

➤ *Research design, population, sample size and data collection instruments*

Research design: This study used descriptive analysis research design because it allows the researcher to gather information, summarize, present and interpret for the purpose of clarification. Therefore, a descriptive survey research is intended to produce statistical information about aspects of floods risk, their socio-economic effects and a five-point Likert Scale survey questionnaire was used to obtain the data.

The population: Population can be defined as "the totality of persons or objects with which a study is concerned. Thus, population is any group of people, organization about which one wants to draw conclusions (Grinnell & Williams, 1990). The total population of this study was from 7 selected sectors of Musanze which is 220,000 households.

Sample size: The sample of the research was 476 selected using Systematic sampling technique

Data collection instrument:

During the study, the researcher used questionnaire, interview and documentary as data collection instruments.

The questionnaire included closed-ended questions where respondents chose from the alternative answers. Questionnaire was chosen because of the following advantages: it saves time since many respondents can be dealt with at once, it allows easy analysis of data collected, it is easy to administer when the sample is literate.

In designing questionnaires, the researcher has used Likert scale to measure the respondents' views on the critical factors of environmental disaster management. The same rating scale was also used for the factors of socio economic development. Using Likert Scale, the respondent indicated whether he/she strongly agree (SA), agree (A), disagree (D), or strongly disagree (SD).

Description of Regression Analysis

The model used in the study took the form below:

$$Y = \alpha + \beta_1 L_{sx} + \beta_2 E_{dx} + \beta_3 F_{x3} + \beta_4 C_{cx4}$$

Where:

Y = Social economic development.

α = Constant Term

β = Beta Coefficient – This measures how many standard deviations a dependent variable will change, per standard deviation increase in the independent variable.

X = Any change occurs at each independent variable

L_{smx} = Land slide management

F_{mx} = Flooding management

E_x = Education

A_x = Agriculture

I_{gix} = Income generation

Hx = Health

4. RESULTS

The relationship between landslide management, flooding management and socio economic development was determined using multiple regression

Table 1: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.953 ^a	.908	.623	.16282	.1653	123.031	3	65	.000

a. Predictors: (Constant), land slide management, and flooding management

From the table 1; regression analysis revealed a positive relationship (R = 953). The R coefficient of 0.953 indicates that the predictors of the model which land slide management, and flooding management,

Table 2: ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.992	4	.248	5.11	.015 ^a
	Residual	.369	471	.045		
	Total	1.361	475			

a. Dependent Variable: Social economic development of Musanze district

analysis. The hypotheses also were tested as follow:

Regression analysis

In regression the researcher analyzed the model summary, variances and coefficients of variables.

have an effect of 95.3% with the dependent variable (social economic development) The study also revealed that a combination of land slide management, and flooding management together contributed to 90.8% (R²= 0.908) of the social economic development.

b. Predictors: (Constant), land slide management, and flooding management.

Table 2. shows ANOVA, that variations in social economic development can be explained by the model to the extent of 0.992 out of 1.361 or 72.8 % while other variables not captured by this model can explain 27.1 % (0.369 out of 1.361) of the variations in social economic development. F value of the model produces a p-value of

0.015 which is significantly different from zero. A p-value of 0.015 is less than the set level of significance of 0.05 ($0.015 < 0.05$) for a normally distributed data. This means that the model is significant in explaining social economic development of Musanze district.

Table 3: Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.	95% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
1 (Constant)	.562	.863		.292	.774	.262	.601
Land slide management	.816	.255	.212	3.849	.046	.185	.322
Flooding management	.572	.322	.452	1.265	0.04	.068	.210

a. Dependent Variable: Social economic development of Musanze district

From the data in table 3, the established regression equation was:

The regression output is laid on Table 4 Standardized coefficients (Beta) were used to determine the relative importance of the significant predictors of social economic development. The larger the absolute standardized coefficient, the larger the contribution of that predictor to social economic development as indicated by the T-statistics. The land slide management contribute to ($\beta=0.452$) to social economic development, followed by Environmental

land slide management ($\beta=0.212$), and climate change management ($\beta=0.452$).

In fact, a unit change in land slide management, would lead to increase in social economic development of Musanze district by a factor of 0.452 which is the most predator of the research, and a unit change in land side management, lead to increase in social economic development of Musanze district by a factor of 0.212

As far as concerning the hypothesis of the research, researcher confirm the null hypothesizes of the research which stated

the there is no effect of land slide management on socio-economic development of selected sectors of Musanze district for the period of 2017-2021 and there is no the effect of flooding management on socio-economic development of selected sectors of Musanze district for the period of 2017-2021. The researcher based on the fact that all significant values were below 0.05 al t-test was greater than 0.05 which indicates a positive relationship between environmental disaster management variables and social economic development of Musanze district.

5. CONCLUSION

In general, research on the impact of environmental disaster management on socioeconomic development has been limited to a few sectors. The majority of the issues raised were primarily related to agriculture and animals. Remember from earlier pages that the community's socioeconomic and development style in assessed areas was built on agriculture and livestock? Farmers account for almost 95% of the population, and many of them mix farming and cattle.

The majority of households in these areas hit by landslides are facing issues such as houses collapsing, others being damaged,

farmlands, highways, and streets sliding. In Rwaza areas, some cattle surrounding Five pork have died, while environmental degradation has created a slew of problems.

The researcher noticed that Musanze district implemented measures to mitigate the impact of climate change on the livelihood of Musanze district households; therefore, the researcher concluded that environmental disaster management had an impact on Musanze's socioeconomic development.

6. RECOMMENDATION

The following are recommendations based on research into the environmental disaster management and socioeconomic development in the study's limited areas: The community and local governments have done a lot to enhance the settlement policy and its implementation in order to mitigate the effect of environmental disaster. However, in some area of the research, researcher found there is a need of improvement especially on environmental degradation management and climate change management since they showed a weak effect on social economic development of Musanze district.

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