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POST DISASTER RECOVERY PROCESS OF LANDSLIDES IN DEVELOPING COUNTRIES: A CASE STUDY OF ARANAYAKE LANDSLIDE - SRI LANKA

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ABSTRACT

The basic principle for the recovery of residential area from a landslide disaster is restoring the damaged area to its condition before the disaster. This study focuses on evaluates the recovery process and reinstallation of pre-disaster economic functions after the landslide occurred in the year 2016 at Aranayake, Sri Lanka. Estimated values of the collapsed infrastructure is 7,806 USD, and the affected region generates 200 000 USD for the annual country GDP. In contrast, 887 families directly or indirectly affected by the landslide. The primary data were obtained from comprehensive questioner survey of affected household (n=120), semi-structured focused group discussions, and key informant discussions. Recovery was assumed as a function of emergency recovery (ER), infrastructure resettlement (IR) and long-term recovery (LtR). Correlation analysis and multiple regression analysis were used to model the association between dependent variable Recovery and independent variables ER, IR and LtR. The findings revealed that, there is no systematic procedure used to monitor the progress of recovery programme. LtR has a profoundly positive effect on recovery with compared to IR and ER. Results suggest that ER and IR are individually insignificant but they effect on recovery jointly. Multiple regression model can be expressed as Recovery = 0.205+ 0.640ER + 0.124IR + 0.249LtR. The finding of this study is recommended to establish an institutional framework to monitor, evaluate and rectify the disaster recovery process with standardized indicators, procedures, and guidelines. Further, it is recommended to adopt a community based long-term recovery approach for sustainable landslide disaster recovery.

Contribution/Originality: In many projects landslide disaster recovery limited to damaged infrastructure development in contrast, this study recommended the significant of long term recovery plan in any recovery project. Further this study proposed a recovery model which allowed monitoring recovery in a manner that is rapid, independent and reliable.

1. INTRODUCTION

Natural disasters severely impact on the human and socio-economic development of a country. Disasters cause for loss of human life, damages on livelihood, property and infrastructure of around 250 billion USD worldwide

[1]. The increasing trend of global damage reached in the year 2017 to 335 natural disasters, which affected over 95.6 million people and 9,697 human lives with 335 billion USD losses [2]. Landslide is one of the most damaging and deadly natural hazards, which responsible for over 10,000 deaths and left 2.5 million people homeless from 2001 to 2010 [3].

A substantial cost incurred to recover the damage done by the disasters and the cost depends on the vulnerability exposed [4]. Thus the reduction of vulnerability is now a standard concept that guides recovery efforts [5]. Disaster recovery is a phase of the disaster management cycle that frequently overlaps with emergency recovery [6]. Recovery may be the attempts that bring the post-disaster damage to the level of acceptance by rectification [7].

The adverse economic effects of landslides include the cost to repair structures, loss of property value, disruption of transportation, medical costs on the injury, and indirect costs such as loss of income sources [4]. However, increase of frequency and severity of landslides in Sri Lanka, attention on landslide recovery becomes more significant and complicated [8]. The landslide recovery process is often long, costly and complex, and the responsibilities of the recovery project distributed among numerous sectors and stakeholders [9]. Because of the complexity of the landslide disaster recovery process, it becomes more conceptualized as a dynamic process [10]. Landslide recovery has been shown to vary over time and space due to socio-economic and political factors and because of a multitude of decisions made before, during and after a disaster [11]. However, many research discovered that the impact of landslides is extremely severe specially in developing countries [12].

Consistency in monitoring and evaluation of landslide disaster recovery interventions would provide further guidance to rectify the recovery process according to standards improving efficiency and effectiveness. Besides, the regular landslide disaster recovery programme has the potential to reduce future hazard risks in landslide-prone regions. The consensus is that the minimum goal is to replace.

Landslide disruptions make affected communities displaced from their original settlements and force them to resettle by the damage done and removing settlement due to future risk. Notably, the evacuations of homelands show a negative impact on the income of the agricultural based rural community [12] specially in developing countries. Because of a multi-directional aspect of the landslide impact, the recovery process should have a multi-directional approach. However, relatively distinct types of social units consider in disaster recoveries such as households, household income (business), and government agencies [6]. Because of multi-directional approach outcomes and indicators pose some issues. A minimum goal of the recovery is to replace households and return to pre-disaster economic function [10]. However, both the progress and quality of the recovery should monitor [13]. Currently, there is no fixed standard method or indicator for evaluating the landslide recovery process [9]. Measures and monitor the extent of recovery over time with community feedback would be of immense benefit to develop indicators for the recovery process.

This study focused on evaluating the process of replacing lost housing stock, to examine the progress of return progress of infrastructure development and pre-disaster economic function. However, only a little emphasis has been given to understand the growth of economic recovery and the adopted resettlement process of implemented programs within the context of landslide disasters. The study based on the recovery progression of the massive landslide occurred in the Aranayake, Sri Lanka in the year 2016. The main aim is to analyze the quantitative and qualitative factors that can apply to a successful recovery process.

2. STUDY AREA AND DESCRIPTION OF THE ARANAYAKE LANDSLIDE

Aranayake landslide in Kegalle, Sri Lanka is the first massive landslide recorded in the recent past Figure 1. However, there are several shreds of evidence for paleo-landslides around the site [12]. The paleo-slides seem to be activated around 500-1000 years before thus the Aranayaka people never experienced a landslide in their lifetime.

The field observations revealed a massive mound of rocks and debris piled up at the base of the mountain. Many houses and home gardens had been located in the damaged slope Figure 1. The entire area had been cultivated with minor export crops such as cloves, cardamom, and pepper and fruits while showing typical identities for the Kandyan home garden (KHG) [12]. Most of the access roads made by concrete or gravel, which shows lower development compared to other regions of the country.

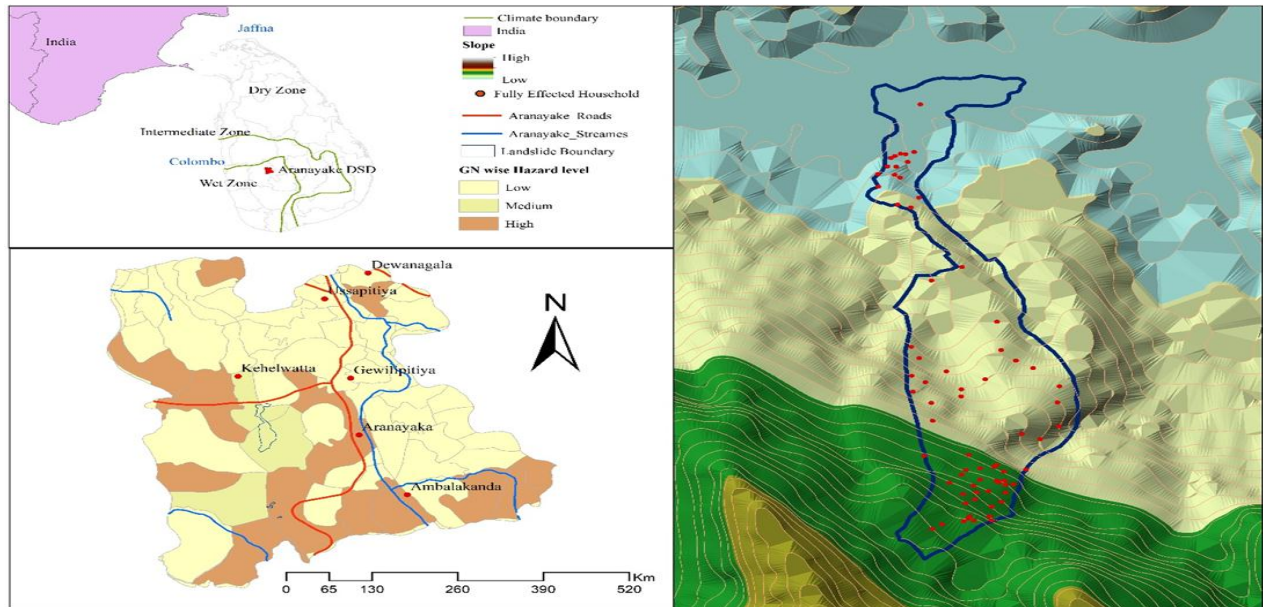**Figure-1.** Study Area with Aranayake landslide and its background and affected households.
Source: Created by Author based on 1:50,000 topographic maps obtained from Department of Survey-Sri Lanka (2015)

The average width and height of the scarp of the landslide are about 350-350m and 50-75m respectively, and the most extensive region of the slide is around 600m. Partially affected or vulnerable home gardens and a natural vegetation cover observed at the surrounded areas. The middle of the slide is having few houses remain undamaged. Besides, a quite rapid and muddy ground water flow observed in the right-side of the landslide for several months. The unexpected landslide destroyed a large land area and was one of the most massive landslides recorded in history. Fourteen families buried entirely, and 127 lives lost [12]. The landslide affected the region and abandoned area shows future landslide risk. The KHGs in the area has an output of around 160,000 USD annually from their home gardens and plantations (Tea, Rubber, and Paddy) for the GDP [12]. This revealed that both the social and economic systems profoundly influenced by the landslide [12]. The population of Aranayake is approximately 68,464 with a 1:1 male to female ratio. Overall, 47% of the residents are permanently or temporarily employed. The high rate of dependency reaches 53% of the total population. More than 50% of the population included in the labor force, and most of them engaged in the home garden and plantation agriculture. Although recorded incomes are low, people have alternative income sources and food security from their home gardens [12].

3. MATERIALS AND METHODS

In this study factors related to the success of post-disaster recovery have been studied independently. Recovery was assumed as a function of emergency recovery (ER), infrastructure resettlement (IR) and long-term recovery (LtR). There might be several factors (performance Indicator) that could be assumed to affect in positive and negative mean on dependent variables of ER, IR and LtR as shown in Table 1 [4, 8, 14].

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Table-1. Conceptual Framework: Dependent variable and assumed independent variables.

Dependent Variables (y)	Performance Indicator (Independent Variable, x)
Emergency Recovery (ER)	Rescue operations
	Evacuation process
	Camping process
	Donation distribution
	Emergency Management
Infrastructure Reinstallation (IR)	Reconstruction of transportation facilities
	Repair electricity facilities
	Administration health and education
	Resettlement process and assistance
Long-term Recovery (LtR)	Community recovery plan (CPR)
	Damage assessment
	Basic needs at new settlements
	Safety in new settlements
	Reestablishment of income sources

3.1. Data Collection and Sampling Process

In this study, both primary and secondary data were obtained. The primary data were collected using comprehensive questionnaires, field observations and formal discussions. The total population of this study consists of partially or fully affected people from the landslide. They were classified as resettled, returnees and living in transitional shelters. The sample of the population was selected from these three categories. Eight hundred eighty-seven families were affected by the landslide, and the estimated sample size was one hundred twenty under 90% accuracy [12] which selected from the population by applying the stratified random sampling technique.

Besides focus group discussions and field observations were used as a qualitative approach to gain an in-depth understanding of social issues related to the recovery process in the affected community. Secondary data were obtained from the government local authorizes, national disaster management center (DMC), published journal articles and reports to verify the feedback on the recovery indicators and to acquire ground knowledge from official statistics.

3.2. Data Analysis

The results were analyzed using Minitab ver 14 statistical package (Minitab Inc.) for descriptive statistics such as absolute and relative frequency, average, standard deviation, standard error, skewness, and kurtosis. The Pearson product-moment correlation coefficient and the coefficient of determination were used to evaluate the association between quantitative variables, and several non-parametric tests were used to study the association between qualitative variables. All hypotheses were tested at the significance level of p = 0.05. The normality of pairs of tested variables were also studied.

4. RESULTS AND DISCUSSIONS

The performance indicators under Emergency Recovery (ER), Infrastructure Resettlement (IR) and Long-term Recovery (LtR) provided a rich source of information that can be interpreted independently or integrated to provide a holistic understanding of the progress of recovery of the selected Aranayake landslide.

4.1. Progression of Landslide Recovery

Existing post landside management process demonstrated three distinct phases; Emergency recovery, Infrastructure reinstallation, and Long-term recovery. Data synthesis was carried out via averaging, to ensure the objectivity and legitimacy of the results. Table 2, summarised descriptive statistics for scaled questions (1=Strongly disagree, 2= Disagree, 3= Neither agree nor disagree, 4 = Agree, and 5= Disagree) for the landslide recovery

process. A questionnaire survey revealed that emergency recovery (ER) shown just above the average level of Mean = 3.05, Table 2 satisfactory level. Emergency recovery response includes several activities such as rescue, evacuation, camping process, and donation distribution. Just after the landslide rescue operation team from Sri Lankan Army reached to the affected area and they have been implanted rescue operations and evacuation with the support of the Government, local organizations, non-government organizations (NGOs), INGOs and individuals. After the evacuation affected community was moved to several temporary camps such as schools and temples. Since the rescue centers were congested, there was a significant concern for water and sanitation. This indicates poor preparedness for landslide hazards in the region. The government and community organizations provided basic needs of the affected community such as foods, clothes, sanitary facilities and other things which they want. Because of the poor camp management practices of the authorized personalities unequal distribution of donations, huge congestions occurred within the camp environment as a result of that community estimation on the camping process, and donation distribution was at below the average, satisfactory level. However, rescue and evacuation were at just above the average, adequate level.

Table-2. Affected community responses on recovery process.

Sample Statistics		ER	IR	LtR	Recovery
N	Valid	120	120	120	120
Mean		3.76	3.05	2	2.13
Std. Error of Mean		0.055	0.041	0.045	0.059
Std. Deviation		0.6	0.45	0.5	0.65
Skewness		-0.006	-0.125	0.199	0.473
Std. Error of Skewness		0.221	0.221	0.221	0.221
Kurtosis		-0.213	-0.377	-0.55	0.051
Std. Error of Kurtosis		0.438	0.438	0.438	0.438

Source: Prepared by author based on collected field data.

The results in the table show that satisfaction with Infrastructure Reinstallation (IR) was at just above the average. Community perception on infrastructure reinstallation was measured by reconstruction of transportation facilities, repair electricity and water supply and re-establishment of administration, health & education. However, the restoration of essential services such as communication and power as well as restoration of infrastructure facilities like roads and water supply was at an acceptable level because the government was being able to reconstruct roads, water supply, and electricity better than it was. However, people mentioned that the reconstruction process has been delaying. Figure 2 illustrates the progression of road construction in Aranayake DS division. The landslide has destroyed the only 6Km of non-Asphalt road and 8.5Km of Asphalt road. However, the government decided to expand and develop the road network just after the landslide with carpet roads.
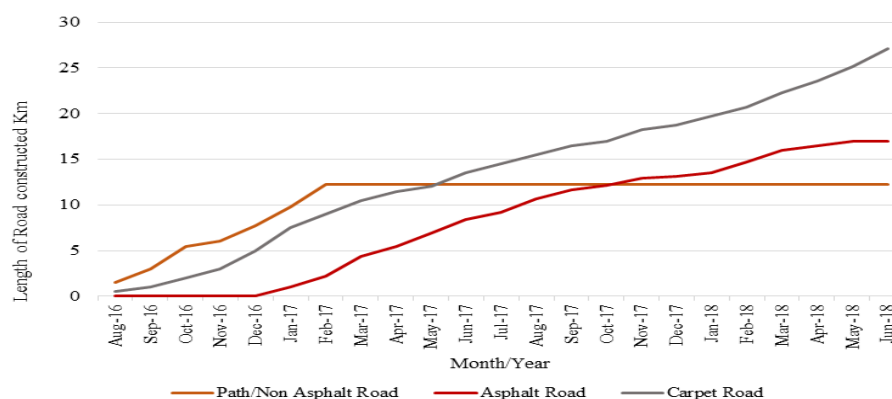

Figure-2. Progress of the Road construction.
Source: Prepared by author based on secondary data obtained from District Secretariat office Mawanella.

All the activities regarding the Long-term Recovery (LtR) related to the Aranayake landslide were failed as shown by the above Table 2. Independent variables used to determine LtR as given in the conceptual framework Table 1. It took an extended period for the land selection and other pre resettlement activities as shown in Figure 3.
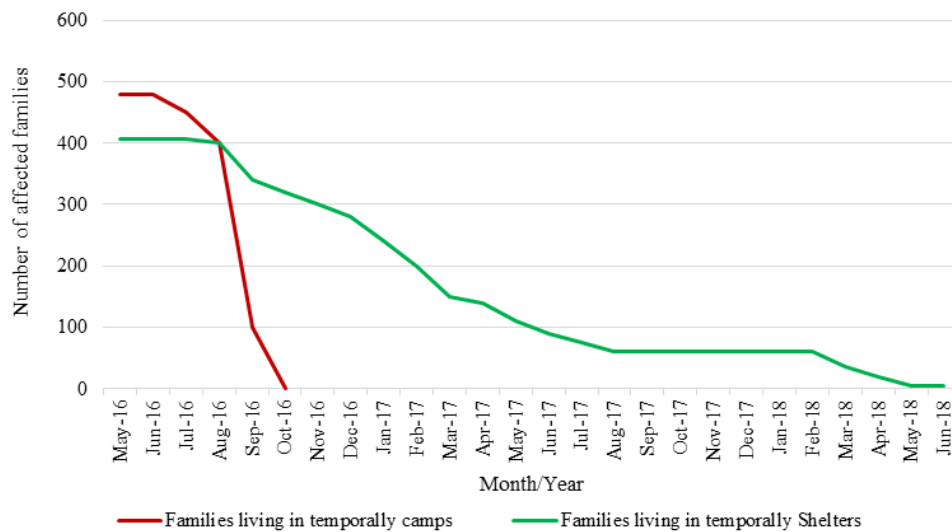

Figure-3. Progress of resettlement process.

Source: Prepared by author based on secondary data obtained from District Secretariat office Mawanella.

Just over two years after the landslide more than 50 families had been living in temporary shelters. The main issue found to be related to long-term recovery was the absence of a formal community recovery plan. As results of that resettlement procedure also delay and many failures occurred in the reinstallation of economic functions. Further focus group discussion revealed that there was no assistance after the resettlement. Most of the issues of long-term recovery published by community response of the questionnaire indicate satisfaction of LtR was at a reduced level Table 2. This is very common in Sri Lankan post-disaster management recovery programmes [15].

The results in Table 2, show that satisfaction with the recovery was at a reduced level (Mean = 2.13). Though emergency recovery and infrastructure installation were at a certain satisfactory level, long-term recovery was at an adequate secondary level (mean = 2), and it was highly influenced on the satisfaction of the recovery process.

Further descriptive statistics of Table 2, shown that skewness is between -0.5 and +0.5, it indicates that data are normally distributed. Besides, the absolute value of Kurtosis of Infrastructure reinstallation, Emergency Recovery, and Long-term recovery is less than three times of standard error of kurtosis data are normal. Further, Std. The failure of the mean is shown relatively low variability (>0.65) it indicates that respondents have the same estimation towards the landslide recovery process.

4.2. Correlation Analysis

Correlations of independent variables (ER, IR, and LtR) to the dependent variable, recovery was summarised in Table 3 as a collection of all pair-wise correlations. Pearson's correlation coefficient is the test statistics that measure the statistical relationship, or association, between two variables. It is known as the best method of measuring the association between Likert scale variable [16].

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Table-3. Correlation Matrix.

Variables	Test summery	ER	IR	LtR	Recovery
ER	Pearson Correlation	1	.727**	.863**	.664**
	Sig. (2-tailed)		.000	.000	.000
	N	120	120	120	100
IR	Pearson Correlation	.727**	1	.749**	.704**
	Sig. (2-tailed)	.000		.000	.000
	N	120	120	120	100
LtR	Pearson Correlation	.863**	.749**	1	.914**
	Sig. (2-tailed)	.000	.000		.000
	N	120	120	120	100
Recovery	Pearson Correlation	.864**	.724**	.916**	1
	Sig. (2-tailed)	.000	.000	.000	
	N	120	120	120	100

**. Correlation is significant at the 0.01 level (2-tailed).
*IR = Infrastructure reinstallation, ER=Emergency recovery, and LtR=Long term recovery.

According to the correlation matrix, the Pearson correlation between and recovery is 0.67 which indicates that there is a moderate positive relationship between the variables. Further Table 3 shows that there is a moderate positive correlation between IR and recovery (person's correction = 0.704). Pearson correlation between LtR and recovery is 0.914 which indicates that there is a strong positive relationship between the variables. It means that LtR is profoundly influenced to determine the recovery process with compared to ER and IR. In these relationships, the p-values for the correlations less than the significance level of 0.05, which indicates that the correlation coefficients are significant.

4.3. Regression Model

In this study, a multiple linear regression model was used to explain the relationship between the dependent variable; recovery and independent variables of ER, IR, and LtR. Results obtained from the regression analysis were summarised as Model summery Table 4, Regression ANOVA Table 5 and Coefficient Table 6.

Table-4. Model Summery

Model	R	R Square	Adjusted R Square	Std. The error of the Estimate	Durbin-Watson
1	.930[a]	0.864	0.858	0.22928	1.884

a. Predictors: (Constant), ER, IR, LtR
b. Dependent Variable: recovery.

According to model summery R Square is 0.864. It indicates by the regression model explains 86% of recovery. Since the R square value is higher than the 60% model can be considered as perfectly fit(Gaur and Gaur, 2006). Multiple regression model summary Table 4 represents the joint association of independent variables (ER, IR, LtR) with the dependent variable of overall recovery. SinceR-value (0.93) higher than 0.70 it can be determined that a robust joint association between variables (Gaur and Gaur, 2006). According to model summery Durbin-Watson test statistics is 1.884 (1.5 < 1.884 < 2.5) and it is close to 2.0, it indicates that residuals are independent.

Analysis of Variance (ANOVA) consists of calculations that provide information about levels of variability within a regression model. The statistical summary obtained from the ANOVA table for the multiple regression model is given in Table 5.

Table-5. Analysis of Variance (ANOVA) for multiple regression model.

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	31.778	4	7.945	151.12	.000[b]
	Residual	4.994	95	0.053		
	Total	36.772	99			

a. Dependent Variable: Recovery
b. Predictors: (Constant), ER, IR, LtR.

According to the individual coefficient of the p-value of LtR is 0.000 Table 6 this is a highly significant particular β value is 0.249 this indicates that LtR has a profoundly positive effect on recovery with compared to IR and ER.

Table-6. Coefficients of multiple regression model.

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		β	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	Constant	0.205	0.157		1.307	0.194		
	ER	0.64	0.085	0.62	7.541	0.102	0.212	4.722
	IR	0.124	0.077	0.143	1.612	0.11	0.182	5.487
	LtR	0.249	0.067	0.288	3.718	0	0.238	4.2

a. Dependent Variable: Recovery.

Results suggest that ER and IR are individually insignificant since their p-value is more than 0.05 Table 6, which means that ER and IR do not influence on recovery personally, but they affect jointly.

Finally, a multiple regression model can be expressed as follows,

Recovery = 0.205+ 0.640ER + 0.124IR + 0.249LtR

5. CONCLUSION AND RECOMMENDATIONS

Recovery of communities affected by landslide disasters is difficult due to the multi-directional impact of landslides. Compared to other phases of the disaster management cycle, landslide recovery is highly influenced by community desires. Therefore, feedback of landslide victims has a significant contribution to evaluate the progress of the landslide recovery process. Integrated of community feedback with physical recovery indicators provides a holistic view of the overall recovery process. Step down the recovery process to Emergency Recovery (ER), Infrastructure Reinstallation (IR) and Long-term Recovery (LtR) helped to evaluate the recovery process systematically.

Researchers and practitioners agree that recovery should be more profound than a mere return to a pre-disaster state especially when pre-disaster life is defined by persistent conditions of oppression [4]. However, In Aranayake landslide incident emergency recovery was most rapidly and effectively achieved due to community engagement and the official contribution of forces. It can be concluding that cultural values and bounteous of the Sri Lankan community profoundly influenced the success of the emergency recovery. Just after landside many community organizations very quickly attended in camp management and to provide meals.

Most of the problems as well as challenges were identified in the phase of long-term recovery. It can be concluding that drawbacks in community recovery plan have caused to arise in this situation. It has been recognized that the resettlements led to a reduction of earnings opportunities from agroforestry based home gardens and their plantations. Before the landslide, 36% of the income is comprised of home gardens [12]. However, in the long-term recovery phase authorities were unable to restore the economic functions of the community. It was evident that this recovery process has no or minimal community consultation; most of the beneficiaries were directly allocated a property for resettlement as in many other recovery programmes in Sri Lanka [17]. The results of the study have revealed that people's attitudes also make considerable influence to increase the complexity of the issues and challenges of post-landslide management.

The results suggest the long-term recovery is the most critical and significant phase in the recovery process. However, the present life of the resettled community is in more poor condition than their previous life because the implementation of housing interventions has often been ineffective and their intended outcomes have not been achieved as in other developing countries [17].

It is recommended to establish an institutional framework to monitor, evaluate and rectify the disaster recovery process with standardized indicators, procedures, and guidelines. With findings and literature review it is

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recommended that the requirement of a community based participatory long-term recovery approach for sustainable disaster recovery project.

REFERENCES

[1]   J. J. Clague and N. J. Roberts, *Mechanism of landslides. In: J.J. Clague and D. Stead (eds) Landslides: Types mechanisms and modeling*, 1st ed. Cambridge: Cambridge University Press, 2012.

[2]   UNISDR, "Making development sustainable: The future of disaster risk management," Global Assessment Report on Disaster Risk Reduction, Geneva, Switzerland2015.

[3]   Centre for Research on the Epidemiology of Disasters (CRED), "EM-DAT: The OFDA/CRED international disaster database," ed: Institute Health and Society, Catholic University of Louvain, 2011.

[4]   E. N. C. Perera, D. T. Jayawardana, P. Jayasinghe, and M. Ranagalage, "Landslide vulnerability assessment based on entropy method: A case study from Kegalle district, Sri Lanka," *Modeling Earth Systems and Environment*, vol. 5, pp. 1-5, 2019. Available at: https://doi:10.1007/s40808-019-00615-w.

[5]   O. Aijazi, "Social repair and structural inequity: Implications for disaster recovery practice," *International Journal of Disaster Resilience in the Built Environment*, vol. 6, pp. 454-467, 2015. Available at: https://doi.org/10.1108/ijdrbe-08-2013-0033.

[6]   M. K. Lindell, "Recovery and reconstruction after disaster," *Encyclopedia of Natural Hazards*, pp. 812-824, 2013. Available at: https://doi.org/10.1007/978-1-4020-4399-4_285.

[7]   E. L. Quarantelli, "The disaster recovery process: What we know and do not know from research," *Preliminary Paper No 286. The University of Delaware. Disaster Research Center*, 1999.

[8]   E. Perera, D. Jayawardana, and P. Jayasinghe, "A rainfall intensity-duration threshold for mass movement in Badulla, Sri Lanka," *Journal of Geoscience and Environment Protection*, vol. 5, pp. 135-152, 2017. Available at: https://doi.org/10.4236/gep.2017.512010.

[9]   D. Brown, S. Platt, J. John Bevington, K. Saito, B. Adams, T. Chenvidyakarn, Spence, R. Chuenpagdee, and A. Khan, "Monitoring and evaluating post-disaster recovery using high-resolution satellite imagery – towards standardized indicators for post-disaster recovery," presented at the 8th International Workshop on Remote Sensing for Disaster Applications. Tokyo. October, 2010.

[10]   R. Olshansky, L. Johnson, and K. Topping, "Post-disaster redevelopment: Lessons from Kobe and Northridge," Final Report, NSF Award No. CMS-9730137, July 112003.

[11]   E. L. Harp, M. E. Reid, J. P. McKenna, and J. A. Michael, "Mapping of hazard from rainfall-triggered landslides in developing countries: Examples from Honduras and Micronesia," *Engineering Geology*, vol. 104, pp. 295-311, 2009. Available at: https://doi.org/10.1016/j.enggeo.2008.11.010.

[12]   E. N. C. Perera, D. T. Jayawardana, P. Jayasinghe, R. M. S. Bandara, and N. Alahakoon, "Direct impacts of landslides on socio-economic systems: A case study from Aranayake, Sri Lanka," *Geoenvironmental Disasters*, vol. 5, pp. 45–57, 2018. Available at: https://doi.org/10.1186/s40677-018-0104-6.

[13]   C. B. Rubin, M. D. Saperstein, and D. G. Barbee, *Community recovery from a major natural disaster*, 1st ed. Colorado: Institute of Behavioral Science, University of Colorado Institute, 1985.

[14]   E. M. Luna, J. G. J. Molina, and M. F. Molina, *Recovery status report, The Southern leyte landslide 2001*. Chui-Ku Japan: International Recovery Platform (IRP) Secretariat, 2011.

[15]   H. Maheshika and R. P. Sangasumana, "Issues and challenges of post landslide management in Sri Lanka: A case study of Meeriyabedda landslide in Badulla District," *International Journal of Scientific and Engineering Research*, vol. 6, pp. 215–225, 2017.

[16]   J. Murray, "Likert data: What to use, parametric or non-parametric," *International Journal of Business and Social Science*, vol. 4, pp. 258–264, 2013.

[17]   M. Gjerde and S. de Sylva, "Governance and recovery: comparing recent disaster recoveries in Sri Lanka and New Zealand," *Procedia Engineering*, vol. 212, pp. 527-534, 2018. Available at: http://doi:10.1016/j.proeng.2018.01.068.