Socioeconomic Impacts and Damages Encountered with Re-activated Landslide in Udawatta Area – A Case Study from Hanguranketha Area in Nuwara Eliya District

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Abstract **- A disaster is a serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources. Developing countries suffer the greatest costs when a disaster hits. More than 95 percent of all deaths caused by hazards occur in developing countries, and losses due to natural hazards are 20 times greater in developing countries than in industrialized countries. Disasters may disrupt the normal conditions of existence and causing a level of suffering that exceeds the capacity of adjustment of the affected community. Among all the disasters, landslide had become the most commondisaster in the country within short period of time in the recent past. The social impacts of landslides may consequences to human populations who were lived within the affected area that alter the day to day life-styles, livelihood patterns, cultural integrity and social network of affected families. The study revealed that one of the major landslide which were occurred in the Hanguranketha divisional secretariat inNuwaraEliya district having comprehensive impacts on human lives which may cannot easily be unravelled.**

Keywords **- disaster, affected community, social network, livelihood patterns**

I. INTRODUCTION

Landslides are basically grouped into the category of natural disasters as such events are large triggered-off by natural phenomena such as heavy rains, lightening, earthquakes etc. But most of the occurrences are due to man-made causes such as bad land use practices, alterations to the landscapes etc. Social as well as economic losses due to slope failures are great and apparently growing as the built environment expands into unstable hillside areas under the pressures of expanding populations.

Human activities disturb large volume of earth materials in construction of buildings, transportation routes, dams and reservoirs, canals and communication systems, and thus have been a major factor in increases in damages due to slope failures. Landslides are responsible forconsiderably greater economic and casualty losses than is generally recognized. Landslides represent a significant element of many major disasters in which the magnitude of their effects is overlooked by media. In the recent past Sri Lanka have caused major social and economic impacts on people, their homes and possessions, social networks and lifelines due to the landslides occurredat several places at the country.

Most of the landslides were occurred in the million years ago and the boulders and transported soil (colluvium deposits) were deposited in the areas near hill slopes. People were settled in these colluvium deposits long period of time and tend to cultivate within these terrains due to the fertile soil present in the area. Most of the chena cultivation and paddy fields wererecognized in this type of fertile colluvium deposits in the central highlands of Sri Lanka.People in this area are considered as rural villagers and they were settled in such terrains. The main livelihood of this people are farming in the hill slopes.

Such type of rural village people who were living with chena cultivation and paddy fieldsin Udawatta area in Hanguranketha divisional secretariat experienced large scale landslide on05th January 2015.Galauda – Hanguranketha main road was lay-in across the landslide flow path where the road segment was totally damaged by this sliding.Nearly 40 families were affectedby this landslide and their properties and livelihood was seriously affected by this landslide threat.

II. LITERATURE REVIEW

'Landslide' or 'Mass movement' is a phenomenon of denudation process, where by soil, rock or debris is displaced along the slope by mainly gravitational forces. According to Varnes (1984): the term 'Landslide' comprises almost all varieties of mass movements on slopes including rock falls, topples and debris flows that involve little or no true sliding. There are several social and economic problems associated with landslides which were occurred all over the world.

Reliable numbers for the socio-economic impact from landslides are difficult to obtain on a global scale, mainly because the landslide hazard assessment is often merged with other associated natural disasters such as earthquakes, flooding, meteorological events such as hurricanes or

typhoons, and wildfire, and not differentiated as a separate hazard.

The frequency of landslide disasters is rising than an actual increase in intensity or frequency. Because of this vulnerability, the thresholds for damage, property loss and fatalities can be reached with ever lower intensity of landslides. There is increased susceptibility of surface soil to instability as a result of more extensive human interaction of different kinds, increased vulnerability of exposed population and infrastructure as a result of growing urbanization, uncontrolled land-use and increased forest clearance and cropgrowing practice (Kjekstad, 2007; Sidle and Ochiai, 2006).

The effects of climate change must also be factored in at some level, as changing precipitation patterns, increased or decreased severe weather in an area, and changing migration and settlement based on favourable or unfavourable climate for farming occur. These changes may cause frequency, intensity and location of hazardous areas to change rapidly or long-term.

Petley (2008) reports that in terms of the occurrence of landslide fatalities in the ten decades are caused by intense and/or prolonged precipitation. Other triggering processes were construction (mostly undercutting of slopes) (3.4% of deaths), mining and quarrying (1.8% of deaths) and earthquakes (0.7% of deaths). No cause was identified for 3.4% of all landslides.

It should be noted that any perceived rise in landslide occurrence, may be a function of increased exposure of population to the hazard as well as the fact that population is becoming more vulnerable. In terms of economic impact, it is difficult to separate the losses from direct and indirect causes, as the losses are usually not well documented in a developing country like Sri Lanka.

III. STUDY AREA

The Udawatta landslide is located at the Udawatta village in Hanguranketha divisional secretariat in NuwaraEliya District, central province of Sri Lanka. The landslide occurred at the upper part of the slope and flowed along the valley, which is oriented in the North – East direction.

Table 1 – GPS coordinates of the landslide

Area of Interest	Latitude (WGS 84)	Longitude (WGS 84)
Initiation Area	7.176972	80.803677
Flow Path	7.179486	80.801630
Depositional Area	7.182313	80.802433

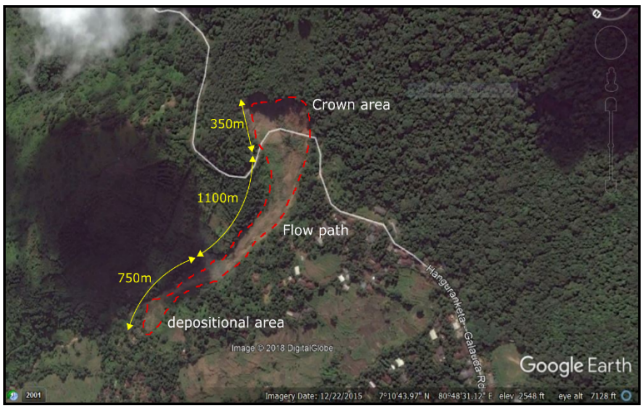

Fig. 1 - Satellite image of the landslide in Udawatta area with rough dimensions

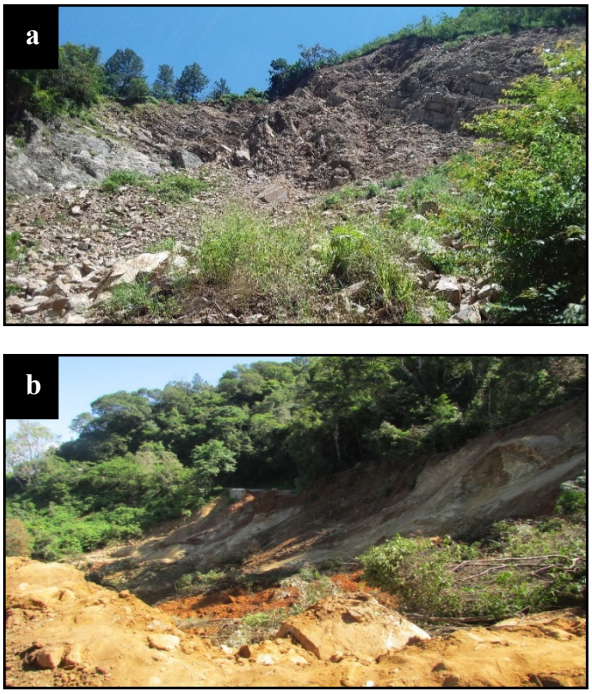

Fig. 2 (a),(b) – Crown area of the landslide where the road segment was totally damaged

IV. GENERAL GEOLOGY OF THE AREA

Geologically nine-tenth of Sri Lanka is made up of highly crystalline, non-fossiliferous rocks of Precambrian age, whereas the rest, mainly the north to north-western portion consists of Miocene sedimentary formations. As literature dictates, the Precambrian crystalline rocks of Sri Lanka can be categorized into three major and one subordinate lithostratigraphic units (Kroner *et. al*., 1993). Namely,

I. Highland Complex (HC)
II. Wanni Complex (WC)
III. Vijayan Complex (VC)
IV. Kadugannawa Complex (KC)

All these units represent the crust's various depth levels; hence the name crustal units are also used. Depending on the crustal depth the mineral content also changes from complex tocomplex.

The study area belongs to the Highland Complex and the dominant rock types in the area are Charnokitic Biotite Gneiss rock mainly impure Quartzite and Calc Gneiss. Bedrock is mainly overlain by residual soil with varying thickness at the upper slope area where the landslide initiated and then, gradually change to colluvium soil along the down slope. Solid rock outcrops are visible along the embankment slope of the pre-existing road level.

V. METHODOLOGY

A questionnaire survey was carried out among the affected families 4 months after the landslide occurred in January 2015 in the Udawatta area in Hanguranketha divisional secretariat. The questionnaire was consist with the information of the affected community such as, occupation, type of damages to the houses, type of damages to the property, and their aspiration of the landslide and the future anticipation of livelihood. In the research methodology techniques, available literature data for the study area was collected and studied prior to the detailed field investigations.

Field observations, recording of case studies, collecting spatial data and geographical coordinates by using Global Positioning System were also used to obtain accurate data of the landslide. Field observations and informal interviews were conducted in the community centre of the Udawatta village and 15 families among the affected community were randomly selected for this interview.

VI. RESULTS

The socioeconomic Impacts of Landslides were provide data of the landslide events as well as best practice for mitigation of the risk associated with landslides. Social and economic losses, and their quantification, the consequences of landslides on infrastructure development, and land use policy, are critical aspects of socio-economic issues related to landslides. The following table including the data gathered from the affected community in the Udawatta area and their future anticipation about their livelihood. When considering the problems associated with resettling the people in to another suitable area, the excessive attention should be done about their social and cultural network within the current living society.

Table 2 – Information obtained from the affected community in Udawatta area

No	Occupation	Damages to the house		Damages to the property					Remarks
		No	Partially	Buildings	Lands	Livestock	household items	Furniture	
01	Farming	1			1		1	1	New house as soon as possible
02	Daily wage labourer	1			1				New house as soon as possible
03	Daily wage labourer		1		1		1	1	New house as soon as possible
04	Farming		1	1	1				Require a land and Education facilities for children
05	Farming								Not willing to leave this place due to the current livelihood.
06	Farming		1		1				Need new house and a land for cultivation
07	Farming	1		1	1				There is a water scasity for agriculture. Need a solution for that.
08	Farming								New house as soon as possible
09	Farming			1	1				No water. A group of villagers decided to move from the area
10	Farming				1				Not willing to leave this place due to the farming
11	Farming	1			1		1	1	Not willing to leave this place due to the farming
12	Ayurvedic doctor	1			1				People have tried to take historical treasure out. The landslide activated due to that.
13	Farming				1				They believe that there is a hidden treasure in the ground and it should disappear after a certain time period. If they get a resettlement site close to the school they prefer that.

14	Farming	1		1	1				Not willing to leave this place due to the current livelihood.
15	Farming	1			1				They never believed that they would experience this kind of disaster. They are willing to leave this place and settle down at a new safe place. Willing to construct a new house with their own money.

VII. DISCUSSION AND CONCLUSIONS

Landslide mitigation cost include both direct and indirect losses affecting private and public properties. Direct cost can be defined as the costs of replacement, rebuilding, repair, or maintenance resulting from direct landslide-caused damage or destruction to property or installations. Loss of industrial, agricultural, and forest productivity, as a result of damage to land or facilities or interruption of transportation systems are major problems associated with landslides.

The largest direct public costs resulting from landslides most often have been for repairing or relocating highways/roads and accessory structures, such as sidewalks and storm drains. Indirect public costs include losses of tax revenues, reduction of transmission capabilities of lifelines, reduction of productivity of government forests, impact on quality of sport fisheries, etc.

The factors included, geology and soils of the landslide prone areas, high relief, steep slopes with poor anchorage for slope stability, continuous heavy precipitation which resulted into oversaturation of rocks and soils. The studied landslide is too large to mitigate and the mitigation of this type of re-active landslides my not applicable. As a developing country such type of cost could not be deploy for a single event of a disaster. And if the people were resettled into another suitable area, it is not practicable process to give land from the government for both cultivation and residential purposes due to the increase of land value and population growth in any area. If the people were resettled in to a safer area, the government should have care about any other infrastructure facilities to the affected people such as school for children and livelihood for the people.

As a result of population pressure in the country, hillsides in NuwaraEliya district are being developed at an accelerating rate. This development increases the risk for landslides triggered by rainfall mainly in central highlands of Sri Lanka. To counter this risk, several approaches can be employed by urban planners, with the development practices in the future such as, restricting development in landslide-prone areas, implementing and enforcing excavation, grading, and construction codes, protecting existing developments by physical mitigation measures and developing and installing monitoring and warning systems.

Where they have been utilized, these approaches generally have been effective in reducing the risk due to landslide hazards. In addition to these practices, landslide insurance holds promise as a mitigation measure by reducing the financial impact of landslides on individual property owners. Until recently, however, such insurance has not been widely available and, where it is available, it is so expensive that it has been little used.

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