Mitigating Local Natural Disaster through Social Aware Preparedness Using Complexity Approach

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Abstract. During and after natural disaster, such as, eruption of vulcano, many people have to abandon their living place to a temporary shelter. Usually, there could be several time for the occurrence of the eruption. This situation, for example, happened at Sinabung vulcano, located in Karo district of North Sumatera Province, Indonesia. The people in the disaster area have become indifferent. In terms of the society, the local natural disaster problem belong to a complex societal problem. This research is to find a way what should be done to these society to raise their social awareness that they had experienced serious natural disaster and they will be able to live normally and sustainable as before. Societal complexity approach is used to solve the problems. Social studies referred to in this activity are to analyze the social impacts arising from the implementation of the relocation itself. Scope of social impact assessments include are The social impact of the development program of relocation, including the impact of construction activities and long-term impact of construction activity, particularly related to the source and use of clean water, sewerage system, drainage and waste management (solid waste), Social impacts arising associated with occupant relocation sites and the availability of infrastructure (public facilities, include: worship facilities, health and education) in the local environment (pre-existing). Social analysis carried out on the findings of the field, the study related documents and observations of the condition of the existing social environment Siosar settlements.

Keywords: Disaster, Mitigating, Preparedness, Societal complexity

1. Introduction
Construction of residential relocation area is a planned effort to transform an area that is occupied by a community with a variety of ecological, social, economic and physical limitations to become a region forward with the community quality of life equal or not far behind compared to other Indonesian society. This condition should be the focus of attention of various stakeholders towards refugees Sinabung, which will be placed in the new residential area in the village relocation program Siosar at Merek Sub Region of Karo Regency.

In the construction of the relocation area, the logging is done in the area of pine forest into something that is not inevitable. This leads to the occurrence of landslides if not controlled, so that the necessary effort to keep the preservation of pine forests in addition there are many important fauna
endangered birds such as hornbills and large mammals. Pine forest conservation rescue efforts not only to prevent the occurrence of landslides, global warming or changes in land use, but also as an effort to protect Germ Plasma of extinction, especially species that are threatened with extinction.

Relocation after the eruption of Mount Sinabung community requires careful handling effort because it involves many aspects, among others: social, cultural, economic and environment, both natural environment as well as the built environment. It is hoped this study is able to ensure that the management of various aspects of the above to be better than the original, so as to prevent the threat of landslides, flooding and the extinction of some species are considered rare.

2. Scope Of Social Impact Assessment

Social studies referred to in this activity are to analyze the social impacts arising from the implementation of the relocation itself. Scope of social impact assessments include:

- The social impact of the development program of relocation, including the impact of construction activities and long-term impact of construction activity, particularly related to the source and use of clean water, sewerage system, drainage and waste management (solid waste).
- Social impacts arising associated with occupant relocation sites and the availability of infrastructure (public facilities, include: worship facilities, health and education) in the local environment (pre-existing).

3. Research Result

3.1. Integer Settlemenet

Preparation of the master plan in development of Siosar area aimed at creating an integrated development of the residential area with the construction of public facilities and synergy with aspects of the locality in the settlements. In the implementation of the settlement, the processes that are local and which are widely should be accommodated existence and relevance to the function in the process of settlement construction as a whole. Both of these processes are accommodated into the system implementation settlement construction. Unifying settlement objectives locally or widely of and integrate every element or aspect of development will be an integral part of the overall development objectives settlements.

Integrated residential area is an area of physical elements forming the structure of a regular space and blends. However, the issue of settlements that arise can not be separated from the dynamics that occur in the life of society and government policy in managing the settlement area. The importance policy and strategy on the relocation of the Siosar village settlements is an inseparable unity. Policies and strategies should promote settlement of spatial arrangement of space that can harmonize the natural environment and the built environment. The purpose of spatial planning is to achieve integration in the use of natural resources and man-made and can provide protection against preventive function in negative environmental impacts due to the arrangement of space that is not appropriate.

Therefore, in addition to settlements is one of the basic human needs also has a strategic function in the role of family education center, nursery culture, and improving the quality of future generations, as well as a manifestation of identity. The realization of people's welfare can be characterized by increasing the quality of life of a decent and dignified, among others through the fulfillment of housing and settlement. Thus efforts to manage the housing and settlement as one of the priority sector in the development of human beings.

[1] points out that the settlements were created and developed can be a means for a life full of piety and faith, creates a feeling of security and comfort, ensure the physical and spiritual health, increase intimacy and create social relationships and interaction quality, have the basic infrastructure planned or unplanned and have facilities that support life and livelihood.

In accordance with master plan of Siosar settlements, integrated settlements models have become priorities in the future development of the area, because in addition to homes, public facilities will be built several other villages such as; health centers, schools, community centers and so forth.
Masterplan prepared a design that refers to the existing condition of existing ones, as well as data from relevant ministries and institutions. However, during the ongoing assessment of integrated models of settlements are still inadequate. Public facilities are not a single village was built. Only about 103 houses are already built with the condition of the house ready for habitation 53 and 50 home again still in the final stages of completion. Houses are built very simple home category (RSS) by type of building 36 meters. The vast size of the building amounted to 5x8 meters. The house has a rest area on the front and back of the house which is 7 meters and on the right side and left the house amounted to 2 meters.

In 10 relocation homes contained 1 septic tank that serves as the sanitary disposal of solid and liquid waste from the rest of human waste. Building an existing septic tank has met the eligibility standard to build reservoirs of fiber that is not easy to sink into the ground, so that the source of drinking water to be protected from bacterial contamination ecly. Availability sanitation should be a concern by local governments and refugees who will live here to keep the septic tank's usefulness if the reservoir has a full bath is necessary to normalize the siphon or septic tank emptying back settlements conducted regularly. Local governments prepare the means of transport, such as vacuum truck through the Department of Hygiene and reaching out to the Siosar village. These activities are carried out periodically to perform routine monitoring of the condition of the community septic tank. Until now ongoing assessment is already built 10 septic tanks were ready.

Housing relocation conditions of Sinabung volcano eruption has adequate ethical standards with 1 toilet facilities measuring 2 x 2 m, and equipped with one toilet and tap water and do not have a window. Conditions of cement-floored interior of the house still, and do not have a kitchen. Therefore, it is necessary refugee initiatives that will determine each kitchen space. Air circulation system is like in general where each house has a glass window on the front and a door on the front and one on the rear door.

3.2. Accessibility And Availability

A. Road Condition And Drainage Systems

Concepts design contained in the road network in the master plan, based on existing regional area and topography of the site, then the concept of the road network is made in the form of 'loop' is closed, thus simplifying the circulation and overall affordability of the region. The main road network is set to follow the existing topographic characteristics in order to minimize the 'cut and fill' at roadworks, so friendly to the existing contours. Secondary road network designed an extension of the main network, and aims to connect every function and villages in this region with the main road network.

The road network is able to accommodate the needs of residential infrastructure for refugees from 7 villages and 1 village, which consists of 2,053 plots of houses for disaster victims, as well as public facilities and social aims to provide a livelihood that not only match the life before the disaster, but it gives chance of a better life for the people who relocated to this area. Up to this time, the relocation of the Siosar village settlements was concentrated to prepare a settlement phase 2 and phase 3 will be built, so that the problem of accessibility to the Siosar still requires serious treatment.

[2] says that the drainage water is a series of buildings that serve to reduce or remove excess water from an area or land, so the land can function optimally. Drainage also can control the quality of groundwater in relation to salinity were able to drain, drain, discarding, or diverting unwanted excess water in an area, as well as ways alleviation consequences caused by excess water.

Structuring the drainage network system Siosar village settlement area should have a structured drainage network, comprising: a network of primary, secondary, and tertiary. This network will be able to perform normalization and rehabilitation of the channel in order to create a safe environment and good to inundation, overflowing rivers, flood, or local rain. Primary network serves as a channel that used the river and creeks as the water flow. Secondary network serves as a channel that connects the tertiary channels with the primary channel (built with concrete/stucco). While the tertiary network serves as a conduit for the flow of household waste into secondary channels, such as plastering,
plumbing and soil, thus flooding and overflow of water flowing into the house due to high rainfall is not flooded yard.

3.3. Infrastructure and Public Facilities

Infrastructure and public facilities serve as the facilities required community that provision is done simultaneously or bulk. The fulfillment level of the facility is the size of community welfare. The provision of infrastructure and public facilities include roads, electricity, water, and drainage. Facilities of the road connecting the village to another village or the surrounding area and the road network that connects the village part, plays a very important for the activity of the population and the development of the village itself and at the same time as the basic framework that forms the structure of the village [3].

Network utility as a major part of the infrastructure and facilities for basic daily life such as electricity, water and drainage constructed above and below ground. The networks usually follow or ride on the road network form. Once the utility built its presence will be long and will attract people to occupy land and build access the utility.

Electricity network has been built in all the way to the Siosar village. Electricity network built on land along the road to the Siosar village. Electricity network is intended as a source of illumination and energy to people who will live in the Siosar village. From field observations indicate the installation of electricity networks have been built in almost all residential areas with adequate conditions. In addition to the power grid, residential areas of Siosar village have built a network of water flowing into people's homes adequately. The water comes from mountain springs within approximately 2.5 miles from the relocation site. The method used to drain the mountains towards the houses is by gravity methods.

This method utilizes the properties of water that flows into the lower place. Installing water pipes to drain the water from the fountain to get into homes by utilizing the natural properties of water that always flows from a higher to a lower place, so that the availability of clean water in the Siosar village very adequate. The water can be used for 24 hours for a variety of domestic activities. If seen by naked eyes clear water conditions, cold and odorless. This course will benefit those who live later.

The process of water distribution has been prepared properly. While in the Siosar village, we find water pipes with water meter for every home that will meter can be used to control the level of spending citizens of water. With clean water distribution system like this, will not be difficult for residents in getting clean water. This of course will vary with the condition of people in the previous settlement that had to queue to get a supply of clean water.

Clean water is a vital necessity of every human being, so that the availability of water determines the health and welfare of the community. The need for clean water in residential areas have to be addressed on a massive scale in the form of provision of facilities for drinking water pipelines are maintained in quality and quantity. The facility managers are generally in the form of a local company called PDAM (Regional Water Company). The local government is expected to bridge the management of clean water to the taps Siosar settlements in a sustainable manner. However, the selves-help could also be an alternative model in water management in the future.

Pro-actively displaced communities are given instruction in the maintenance and management of communal water supply, by forming groups of administrators managing clean water, so that by itself would be awakened obligation to maintain continuity of supply of clean water for them. Surely displaced water is obliged to pay contributions in accordance with the volume of water consumption every month. The money collected can be used to finance operational in the maintenance and management of clean water to the citizens of the future. It takes a commitment of local governments through the taps to provide technical assistance to the refugee community in the form of training capacity in the control treatment water pipes and water meters in order to keep it functioning properly. Besides, given the understanding on all citizens to always pro-actively maintain the condition of the pipe is always functioning properly.
3.4. Domestic Waste Management System

Until the assessment takes place, domestic waste management for the Siosar village still not well planned. There is no shelter construction (tub) bins for each home. Likewise, the waste temporary location (TPS) is not planned well. Where trash will be disposed of and how waste management, then it is a problem in the future to achieve a clean Siosar village of waste generation.

Karo Government should prepare a variety of policies for domestic waste issue. Starting from lug and garbage collection to prevent scattering and simplify the process of collecting up to transporting waste from waste sources to landfills while (TPSS). Lug is done by providing a barrel (bath) bins for each home, providing workers in charge citing waste and prepare the vehicle (truck) garbage which operates regularly to transport garbage Siosar village every day. Karo Government's commitment to allocate a special budget is needed to support this policy, because the distance is quite far from the city Kaban Jahe will have an impact on the rising operational costs in the handling of waste.

In addition to the government's commitment, it takes creative efforts of communities to manage and utilize domestic waste into economically valuable products. The three products that can be produced from domestic waste management derived from residual organic materials, namely: charcoal, compost and Takakura composting of duck excrement. Third products are the potential of processed products made by refugees, considering the manufacture of these products can be obtained easily and not costly. Processing methods can be learned easily, without having to follow special education. Provide intensive training and periodically by bringing the facilitators who have skills in making briquettes and compost.

![Figure 1. Management of manure compost ducks](image)

Briquettes and compost product can be utilized solely by refugees for agricultural purposes as well as for fuel in cooking food that still depend on gas and kerosene. If the processing of organic waste can be developed into a superior product, then this sector could be one of creative economy and be a source of rural income. Community empowerment can be done communally by forming groups of micro-businesses that are able to create a populist economic power competitive. Local governments and other stakeholders are expected to provide massive support to the sustainability of the future development of this business.

For the processing of inorganic waste from domestic waste, can be done by reused economically valuable products, such as: making crafts (souvenirs) derived from processed, plastic, rubber, steorofooam, bottles of mineral water and others. Refugee communities provided with training to recover these wastes into economically valuable souvenir products. This product will be marketed to Berastagi or other tourist destinations that can accommodate and market derived from refugee communities Siosar craft.
4. Conclusions And Recommendations

4.1. Conclusions
1. An integrated model planning of settlement is still not performing well. Only about 103 houses are already built with the condition of the house ready for habitation 53 and 50 home again still in the final stages of completion. No one woke public facilities.
2. The availability of infrastructure is not yet fully adequate. Only the power grid and water network that has been built in almost all residential areas with fairly good condition.
3. The management of domestic waste of the Siosar village is still not well planned. Not having found the construction of shelters (tub) bins for each home. Likewise, the temporary of waste location (TPS) is undeveloped.

4.2. Recommendations
1. Policies and strategies of spatial Siosar settlement should put forward a model of integrated settlements can harmonize the natural environment and the built environment. The goal is to achieve integration in the use of natural resources and man-made and can provide protection against the negative impact of prevention function on the environment and serves as a family education center, nursery culture, improving the welfare and quality of future generations, as well as a manifestation of identity.
2. The local government is expected to bridge the management of clean water to the Siosar settlements with PDAM in a sustainable manner. However, efforts by themselves could also be an alternative model in water management in the future.
3. Create a policy in the provision of infrastructure to cope with the problem of waste. For example: the provision of places (tub) storage bins for each home, providing workers in charge citing waste and prepare the vehicle (truck) garbage which operates regularly to transport garbage of Siosar village every day.
4. Creating the best practices of communities to manage and utilize organic waste and anorganic domestic become creative economic sectors, namely: charcoal briquettes from domestic waste, composting of residual domestic waste (takakura) and compost from dirt ducks, handicrafts from husk and cob corn and crafts of plastic household waste (souvenirs, bags, plastic flowers, flower pots)

5. References
[1] Pramumijoyo, S., & Karnawati, D., 2006. Pemantauan dan Mitigasi Bencana Alam Longsor. Makalah dalam Seminar “Pemantauan dan Mitigasi Bencana Alam Banjir, Tanah Long-sor dan Kekeringan. Balai Penelitian dan Pengembangan Teknologi Pengelolaan DAS Wilayah Indonesia Bagian Barat. Surakarta, 29 Agustus 2006.
[2] Pawitan H., 2009. Perubahan Penggunaan Lahan dan Pengaruhnya Terhadap Hidrologi Daerah Aliran Sungai (Land Use Changes and Their Impacts on Watershed Hydrology). Laboratorium Hidrometeorologi FMIPA IPB, Bogor.
[3] Bintarto.1983. Interaksi Desa Kota dan Permasalahananya. Jakarta : Ghalia Indonesia.