

Recognizing and Integrating Indigenous Knowledge into Disaster Early Warning System in Mentawai

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Abstract: This paper explores the indigenous knowledge that can be combined with modern technology in disaster risk reduction in a contemporary context in Mentawai, West Sumatera, Indonesia. It is also aimed to promote the use of integrated local knowledge to reduce human loss as the impact of disaster.

On 25th of October 2010, a 7,7 earthquake happened in the western coast of Sumatera. The earthquake's worst impact was felt on the Mentawai islands. The tsunami followed the earthquake reached the height of 3m and swept off the island as far as half kilometer. With no early warning management and not enough knowledge about disaster, it caused a high number of fatalities: more than 530 people were dead or missing. Many of them were those who lived on the seashore. Two of the early warning systems installed following the 2004 Indian ocean tsunami had failed to function properly. Official said the system's buoys had been vandalized and were inoperative. This incident had caused lack of trust of local people to modern technology.

This earthquake has also raised the awareness of those who concern about Megathrust. A study shows that an approximately 8,9 magnitude earthquake is threatening Mentawai island and western coast of Sumatera island. Introducing hybrid knowledge (integrating modern and local knowledge) in reducing disaster risk becomes the main concern.

The aim of this research is to recognize and capitalize local wisdom that can be modified and integrated into modern technology as an early warning system in Mentawai. Empowering indigenous and local people to recognize and capitalize valuable indigenous knowledge for mitigation can contribute to increase people's resilience. Studying the literature and doing interview conducted in this preliminary research. Snowball sampling and interview was employed for key information interviews. This article argues that integrating indigenous and local knowledge with modern knowledge in order to fulfill each other's flaw will result is some kind of "hybrid" knowledge that will be critical for promoting community resilience in disaster area. This integration will also be beneficial for sustainability of indigenous knowledge in reducing disaster risks.

Keywords: Disaster risk reduction, indigenous knowledge, early warning system, disaster management

Introduction

Many efforts had been done to mitigate impact of disaster, mainly focus on infrastructural development, such as flood canal, sea wall, hi-tech early warning system and many other projects that based on scientific data and knowledge. Even though these scientific solution could saves many lives when disaster comes (Wisner, 2004). However some evidences show that some practices that not based on modern and scientific knowledge also play a significant role in disaster mitigation, practice that handed down from one generation to next generation through oral tradition (Deckens, 2007). These practices believed as an important factor that can improve community resilience (Yate and Anderson, 2004), which is local or indigenous knowledge that helped community dealing with many critical conditions in their existence.

Decken (2007) believe that local knowledge has play a vital role in disaster mitigation since the early of seventeenth century, however the remarkable value of local and indigenous knowledge gets more attention particularly since mid of 20th, when the 2004 Indian Earthquake and Tsunami strike west coast of Sumatran island Indonesian, and many other countries in Asia and Africa, with the story of how

some indigenous island dwellers could save from the catastrophe simply rely on the old song. They become an icon of indigenous knowledge value, that modern knowledge and technology cannot do.

Many scientists have studied local knowledge and its relevance to disaster management, even more this idea has become main agenda in the Hyogo Framework For Action (2005-2015) acknowledged "Traditional and Indigenous knowledge and culture heritage as one source of knowledge innovation and education to build a culture of safety and resilience at all level (UNISDR, 2007) and also formulated in United Nation report in 2008 with title " Indigenous Knowledge for Disaster Risk Reduction: Good Practices and Lesson Learned From Experience in The Asia Pacific Region (UNISDR, 2008). But only a few that really concern about the implementation of local knowledge and even a small number of them that studied about mainstreaming local and indigenous knowledge in disaster risk reduction.

Even though researchers and professional acknowledge that local knowledge and practice could play an important role in disaster risk reduction only little documentation and its application in disaster management. The research and article about local and indigenous knowledge kept in library and read when disaster occurs. There

is no serious movement to mainstreaming this knowledge and practice to official channel or taking a part in development and resources management. As Battista and Baas (2004) said that it is not enough only to understanding the local knowledge, this knowledge need to be brought “higher” by promoting it for more advance and comparative measure. As mention before, local knowledge and practice related to disaster mitigation have been well documented, however only recently practitioners give serious attention to improve society resilience toward disaster impact by using local knowledge and practice and integrate it in policy making and planning.

Local and indigenous knowledge often connected with participatory approaches to disaster management, bottom-up approach and community based disaster management, since on these approaches local people in a community are the main actors who took the major part when disaster occurs (Baatista and Baas, 2004). Moreover Deckens (2007) argued that to understand about local knowledge one has to understand account for people’s way’s of knowing (different type of knowledge) their practice and also their belief and values. By understanding all these aspect, it could explain why local people do thing the way they do to cope with certain situation especially when disaster occurs.

What is Indigenous knowledge?

The understanding of Indigenous in this discussion differs from the conventional modern usage which is more restricted to those or person or community who by a variety of historical and environmental circumstance have been placed outside of the dominant state system (Intercontinentalcry, 2011), and also it is not similar to the definition that adapted by UN economic and Social Council

Sub-Commision on Prevention of Discrimination and protection minorities that explained that indigenous are those who have a historical continuity with pre invasion and pre colonial societies that have developed on their territories and consider themselves as distinct from other sectors of societies now prevailing in those territories or part of them (United Nation, 2004). Indigenous in this discussion refer to those who naturally existing in a certain place rather than arriving from another place (Cambridge dictionary, 2004), no matter where they are and whenever they live.

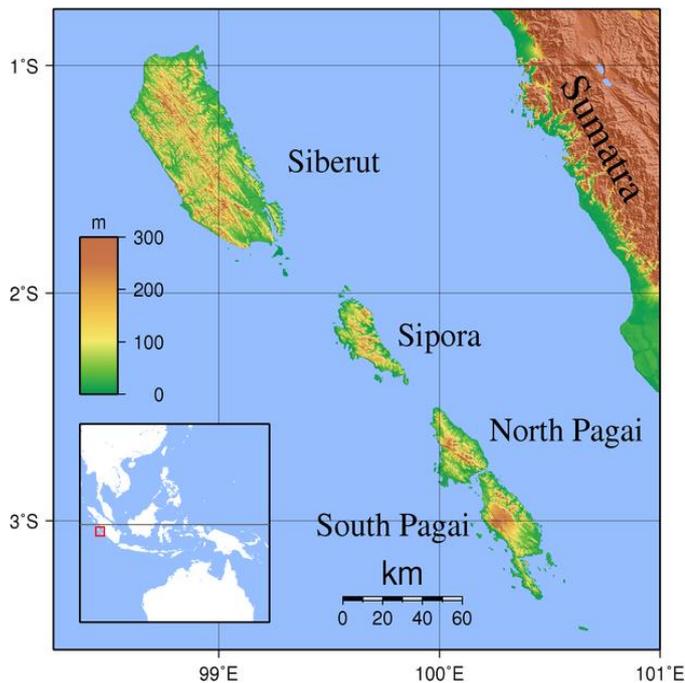
In modern science there are various classification of knowledge, there are modern and traditional knowledge, or global and local knowledge. In local knowledge, its can be classified into two type of knowledge which are experience knowledge (Deckens, 2007) and transmitted knowledge (Berkes 1999). Experience knowledge is the knowledge that they acquired through experience while transmitted knowledge is knowledge that handed down from one generation to other generation.

In this paper terms of Indigenous Knowledge refers to transmitted knowledge and experience knowledge because this type knowledge still in their original form since the beginning it was created while local wisdom refers to experience knowledge where the knowledge they obtain may come from the assimilation between their indigenous knowledge and their recent experience and knowledge.

Indigenous Knowledge In Mentawai Island

Mentawai is archipelagos situated in west part of Sumatera Island and belong to West Sumatera Province, consisting of 323 islands and islets (BPS 2003). The four main islands which are Siberut, Sipora, North Pagai and South Pagai with Siberut, spanning 4.480 square kilometers, being the largest

Fig. 1 Map of Mentawai Islands



islands with 90 percent of their population are of indigenous Mentawai origin, the other 10 percent are essentially made up of Minangkabau (clan from west sumatera), Javanese (java people), and Batak (clan from north sumatera) (Batisde, 2008), Indigenous people in this paper refers to Mentawai origin. These islands lay amid in three most active fault lines: the Mentawai faults, the Great Sumatera faults and the Sunda trench. Before the great Indian Ocean tsunami, the local people inhabiting Mentawai Islands are unaware of threat posed by disaster even though the movement of those tectonic plate and the resulting earthquake and tsunami threat dictates their island. They got accustomed with Earthquake and believe that as a blessing in disguise since the Earthquake bring them more luck especially in their harvest.

Mentawai islands provide an example of community that has experience knowledge dealing with the threat posed by earthquakes and tsunamis. Regard to livelihood, most of indigenous people of Mentawai lives deep in the forest, mainly in the upstream of the river, while in the other hands outsider or “mainland people” concentrated in the capital city in

the coast. Even though they are considered as “Island People” a very small percentage of the population obtains its income from fishing. Most economic sources for local people come from coconut farming and depend on resources that can be found in the forest. They gain money from selling rattan (*Calamus sp*), Eaglewood, shrub yielding fragrant oil, sago palm (*metroxylon sago*), coconut, *dipterocarpaceae* and mangrove.

Indigenous Knowledge On building system in Mentawai

The characteristic of Mentawai sociocultural is unique. The basic unit of the traditional society is the household or the “Uma. This is not necessarily a nuclear family but may be a number of families of the same kin sharing a traditional house (Tarida, 2007). All the member of this Uma is blood related through the patrilineal line different from Minangkabau in the main island that has matrilineal line. This family relation in Mentawai called *Pusarainaan*, which is mean brotherhood. The member of Uma may be categorized as a clan. The clan itself named after their Uma.

Uma also may be seen as Indigenous building methods and systems are part of architectural heritage of society. The knowledge related to technique utilized, material used and skill employed reflects the wisdom of a society. This kind of building has existed for century and may have experienced their toughest test by nature for any kind of disaster and natural phenomenon. According to Guitierrez (2004) this building may be called as Vernacular building or houses since it’s construction not based on engineering theory and transferred through tradition which could withstand its physical environment and accepted by local people easily. Their ability to withstand from earthquake, flood, climate change that makes them survive and exist

until today. Reimar Schefold (1991) believes that Uma is a proof of skill and technique of Mentawai people since in building uma they never use a single nail. The strength of construction relies on joint made by special technique. In built an Uma, Mentawai people always working together since in building an Uma they need a lot of resources, and cost. Cost in this case not only money but moreover food supply. None of the worker was receiving money in that process. The entire worker work voluntarily, and they may come from the same clan or other clan invited by a clan leader to help them



built an uma.

Fig. 2 Traditional house of Mentawai (Uma)

Before they built an Uma, there are several considerations in deciding the location, first it must built near to water sources, in Mentawai language called *Batsopak* which is mean small river. Second, it has flat surface area, which being used for building Uma and *Sapou* (small house). Third, it has basin area that being used for sago (*Metroxylon sago*) plantation. Fourth, it has hilly surface for other commodity. And last but not least it should be has historical connection with their previous ancestor. Uma construction is influenced by climate and availability of material in Mentawai Island as well as socio-economic cultural factors. This practiced had played a significant role in in improving community

resilience toward natural disaster especially flood and earthquake.

Tuddukat

One of the traditional technologies that each Uma should have is *Tuddukat*. It being used as information technique in indigenous Mentawai, for spread the news about death or tells other clan member that a group of hunter gets their prey. It is a drum made from wood, which is struck, to produce sound. *Tuddukat* can also being used as a warning for disaster in other word its also can be used as an early warning system in their community. It made from *kulip* (*Nephelium Sp*) or from hairy fruit, while *Tektektek* (the stick) made from *Lakoba'* (*Garciana Mangostana*). *Tuddukat* consist of three different sizes in each set. When this tools struck will produce code sound that can be interpreted by the community member. Beside it function as communication tool, *Tuddukat* also a symbol of pride and sacred tool in an Uma. This tools known as an effective instrument since it can produce sound for a long range, so those clan members that went to their agriculture field or to the forest still could hear that sound. It already becomes a tradition for the clan members to gather in Uma whenever they get their prey or death of clan member. Usually this sound also used to show a clan success in hunting and mock other clan for their success. These activities called *Pako*, or social competition among the clan.

From this point, it can be seen that Mentawai as ingenious community already have their own tools in early warning system. This tool is local knowledge that was past and inherited from one generation to next generation. However nowadays Uma and their communication technology are rarely seen in modern Mentawai community. Those who left their original clan and moved to other place and adopt modern livelihood may not able to interpret

the sound code from *Tuddukat* and not practicing the way of live that their ancestor used to live. They rely on modern technology such siren and government early warning system. And this phenomenon has cost them much. In 2010, when tsunami struck Mentawai, hundreds of people that rely on modern technology became the victim of their unawareness for the Tsunami. No one ever experience Tsunami before since most of them usually live in the forest. When they moved to coastal area, they do not have such knowledge how to deal with tsunami.



Fig. 3 Tuddukat

Cultural Revolutionary

Mentawai experienced two phase of civilization, which are cultural phase, and disintegration phase. Cultural phase started since the early settlement of Mentawai people in Mentawai Islands, while disintegration phase started in 1950es with abolition of practise *Arat Sabalangun* or local religion (in Mentawai language religion was called Arat), and any ritual tradition in local community.

The migration to coastal area mostly was done involuntarily, it started in 1954, under government initiative to civilized indigenous people, a program designed to integrate tribal community into cultural and social mainstream began (Persoon, 2004). Those

who lived in the remote forest are forced to move to a certain location provide by the government. They were forced to put aside their culture, their way of live, their religion even their tradition and ritual. The government also forced the indigenous people to hand over their tool that they used in their ritual to be burnt and destroyed. While theirs shamans (*Sikerei*) were being forced to slave labor, beaten and arrested. Based on *Pancasila*, the five principles that formulated by Indonesian founding fathers, the government only recognized five religions, and Mentawai that practicing *Arat Sabulungan* is not among them. The government began to enforce their religious policies; the indigenous people were force to convert their belief mostly to Christian or Islam.

In 1971 the central government also implemented a new program called PKMT (Pemukiman Kembali Masyarakat Terasing) Resettlement for Indigenous People, which is development of a series resettlement village (Henri, 2012). The central government builds a new settlement and construct housing where all the house should have the same design in the riverbank or in the coastal area. At the same time the indigenous people are banned to practice their culture and forced to abandon their ancestor tradition such as Uma and its tools. In five years this program was handed down to local government authorities to maintain progress and control. At this period of time logging companies were began to take over the forest left by indigenous community for economic reason throughout Mentawai islands.

In the late 1980's some clan that forgotten by the Government project and still practicing their tradition are become tourism attraction (henry, 2012). For this reason, the government somewhat relaxed their pressure in their resettlement program which a blessing for indigenous people in Mentawai because they find themselves free to practice their cultural

activities in area that far away from the modern settlement area. However the numbers of indigenous peoples that actively practicing their culture, ritual and ceremonies are remain limited. Most of them live in deep forest in Siberut, the biggest island in Mentawai.

The consequence and impact of this integration and this resettlement in Mentawai local people is reducing the knowledge and understanding of their native culture and moreover is their knowledge and understanding for environment is almost non existent (Henry, 2012). This program made them more vulnerable to disaster because they did not have experience about other disaster such as tsunami or abrasion, and economical poor as well. They were forced to build rice cultivation without proper education. While the new research held by Henry (2012) show the fact that 90% the society could not survive without having access to Sago plantation, which is the main portion community food intake. They were already far away from their traditional or local knowledge they need to survive.

For those who live their life as Indigenous people in small population, still consider Earthquake as a blessing for them, since this kind of disaster did not bring any destruction to them, even more Earthquake are the gift from the god. One thing that still remain in their collective memory that earthquake is a indication that the spirit of their ancestor bless them with the plenty of fruit harvest, even though this believed need a further research but this believes are not only hold by the indigenous people but also those who adopted modern way of live.

Only after the great Indian Ocean Tsunami in 2004 they realized that they lived in dangerous zone and started frightened by the disaster especially prepared for the tsunami. Those who life in the coastal area

and having agricultural field in the forest started to build a shelter in high land and keep their food stock in their shelter. At the beginning storing food in the small house in their agricultural is for practical reason, since they spent more time in that place, and only going back to their house at the weekend. However, they still need a kind of tool for early warning system. In some village they already have a similar tool with their ancestor heritage by using simpler *Tuddukat*. These activities show that their knowledge about disaster is not only came from their predecessor but also from others experience the success story from Simelue Island has great impact and encouraged many coastal communities in Indian Ocean and western part of Sumatra to internalize their cultural tradition in disaster management. They learn the need of early warning system in the community using everything they have and not only rely on modern technology.

Soon after the great Indian Ocean Tsunami and Earthquake, Government with assistant from foreign donor built Early warning system called InaTEWS (Indonesia Early Warning System) mainly in west coast of Sumatera. This system intended to reduce the impact of disaster mainly saved human life. However in October 25 2010 this system failed to worked properly. The system succeeds to deploy information to institution interface and central government that the earthquake has tsunami potency using internet connection, however no warning that acquired by local government and local people who live in that area. The reason was there is no information that government got at that time due to lost of Internet connection, and the sirens from tsunami buoy also did not worked. The official said that tsunami buoy placed in the ocean was stolen. It shows that the awareness about disaster management from the community still remain low. At that time, no one knows that Tsunami has struck Mentawai and

caused hundreds of casualties. Since there is no connection can be made between Mentawai local government and Provincial Government in Padang. Two days after the events, one of local newspaper could send a message to their contributor through satellite phone; no cellular phone could operate at that time, told about situation in Mentawai. This condition was exacerbated by bad weather; high wave and tropical cyclone also took place at the same time that the small ship could not reach the island.

In 2010 when tsunami struck several places in Mentawai islands, there is an experience told by the head of local community that all the people in one village survives from tsunami because they practicing their local knowledge. This villager struck the small *Tuddukat* to tell other people that there is indication of tsunami, the sea level in the beach subside, threatened theirs live. Hearing the alert, all the people, except one person who run to opposite direction which found death later, went directly to the higher land and stay in someone shelter waiting for the waves to come. They stayed at that place for a couple of days and still did not lack of food supply because they already prepared their food stock in their shelter. This experience could be a success story for next generation that and the story will remain in those places. However in other places they were not aware for tsunami after the earthquake shock Mentawai islands.

Lesson Learned, Challenge and Policy Implementation

Indigenous knowledge on Earthquake, Tsunami and flood resistant are available in various part of Indonesia. They derived from long experienced process in the past, adopted and handed over to next generation trough evolutionary process. However as the time goes by, many of this knowledge vanished

due the modernization, change way of life, an adequate policy in preserving the knowledge, economic pressure and globalization among others.

Government policy in the decentralization government system has aggravated the sustainability of indigenous knowledge, such as banned practicing traditional culture and ritual in indigenous community. Relocation without considering local knowledge and forcing a community to live apart from their root also play a significant role in declining community resilience toward disaster. There is a need to consider indigenous knowledge in implementing a program or strategy to a certain community or society.

This study found some interesting feature of traditional house and some tradition in Mentawai Islands that can be used in disaster management. Their bond with nature reflected in their traditional house, its ability to withstand flood, climate and earthquake makes them survived and still being use until today. It instruments play a significant role as an early warning system for any kind of disaster. Moreover their tradition keeping food in their agricultural field also increasing their resilience from disaster impact. Other technic such as observe animal behavior and celestial bodies in predicting the hazard still being used even in limited community mostly the elders. While the youngster assumed that activity is "out of date".

For those who not know about that certain knowledge nor gain any transmitted knowledge regarding natural disaster they remain in higher risk of being casualties. People interviewed in Sipora and Pagai islands often referred to the need of information about hazard from the government.

For a better result, Mercer et al (2007) believe that indigenous knowledge should be combined with

modern technology. Recently, in Mentawai, local NGOs initiated combining and integrating indigenous knowledge with modern technology. Tuddukat as an early warning system may be combined with modern technology such as using radio station. This radio station broadcasting using Mentawai language therefore easily spread the message to the community.

Without conducting further research, it is not possible to quantify the influences of this integrated knowledge in disaster risk reduction program. However such action promote using indigenous knowledge and empower communities to use their own knowledge and combined or supplemented by outside knowledge. Hopefully this integration makes it possible to policy maker to enacted policies that support such activities.

Conclusion

Mentawai people as an Indigenous community already have their own way to cope disaster threat. First their traditional house, which is called Uma, is earthquake resistant. None of the uma ever collapsed because of earthquake. The second, their predecessor already taught where to live and avoid coastal area for it possible tsunami. Third, their village usually close to water supply but not in the river bank that allowed them to avoid flood. Fourth, this community has their tradition to store food supply for drought or flood that hit their agriculture field. Last but not least for spread the news and communicate they used *Tuddukat* that have proven work in their community.

For those who not live in the forest, those who live in the riverbank and coastal area and assimilated with modern way of live, they learned from their experience. They keep their communication tool as their early warning system to deal with tsunami.

They did not get this knowledge from their ancestor but from their experience in daily life and success story from other area. The success story from Simeleu Island encouraged them to developed a new strategy to face incoming disaster especially tsunami.

From the above discussion it can be concluded that indigenous knowledge not only the knowledge that inherited from their predecessor which is called Transmitted Knowledge but may also come from their experience and combine with their previous knowledge and called experienced knowledge.

An encouraging policy is needed to maintain this knowledge for it beneficial for local people in Mentawai and if it possible to be transferred and promoted to other places that have the same condition and environment as an integrated approach for disaster risk reduction adaptation.

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