

# Doctoral Dissertation

## Development Processes of Indigenous Knowledge on Tsunami Risk Reduction to Increase Community Resilience: The Case of the *Smong* in Simeulue Island, Aceh, Indonesia

(コミュニティ・レジリエンス向上に向けた津波リスク軽減に関する在来知の形成プロセス—インドネシア国アチェ州シミル島に伝わる「Smong」の事例研究—)

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## Abbreviations and Acronyms

BPBD	Badan Penanggulangan Bencana Daerah (Local Disaster Management Agency)
BPS	Badan Pusat Statistic (Central Agency on Statistic)
BRR	Badan Rehabilitasi dan Rekonstruksi (Rehabilitation and Reconstruction Agency)
DRR	Disaster Risk Reduction
FAM	Free Aceh Movement
IDNDR	International Decade for Natural Disaster Reduction
IK	Indigenous Knowledge
KM	Knowledge Management
MAA	Majelis Adat Aceh (Acehnese Adat Board)
MoU	Memorandum of Understanding
MTsN	Madrasah Tsnawiyah Negeri (Islamic of Junior High Public School)
$M_w$	Magnitude scale of earthquake
NGO	Non-governmental Organization
PETA	Pembela Tanah Air (Defenders of the Homeland)
SFDRR	Sendai Framework for Disaster Risk Reduction
SMP	Sekolah Menengah Pertama (Junior High School)

SMPIT	Sekolah Menengah Pertama Islam Terpadu (Islamic of Junior High Private School)
SMPN	Sekolah Menengah Pertama Negeri (Junior High Public School)
UN	United Nations
UNISDR	United Nations of International Strategy of Disaster Reduction
WCDRR	World Conference on Disaster Risk Reduction

# Chapter 1

## Introduction

### 1.1 The Importance of Indigenous Knowledge Studies on Tsunami Disaster

On Sunday morning, December 26, 2004 an earthquake of  $M_w$  of 9.2, followed by a tsunami, devastated Aceh Province, Indonesia and other coastal countries in the Indian Ocean (Chlieh et al., 2007; Meltzner et al., 2006). The epicentre of this earthquake was located 250 km Southwest of the Aceh, and created a 1,500 km rupture (Chlieh et al., 2007), and a slippage of up to 20 meters which resulted in a series of powerful waves that pounded the coastal areas along the Indian Ocean (Subarya et al., 2006). The tsunami swept violently up to 6 km inland over the shorelines of Aceh and also nearby Simeulue Island (BRR, 2005). More than 125,000 people were killed, and an additional 93,285 people declared missing (BRR, 2009c). Some 500,000 survivors lost their homes, while as many as 750,000 people lost their livelihood (BRR, 2009a, 2009c).

Globally, there has been an upward trend in natural disasters, affecting over 200 million people each year since 1994 (United Nations, 2015), and between 1990 and 2000, over 14 major tsunamis assaulted the world's coastlines, causing tremendous devastation and loss of lives (Bryant, 2014).

Understanding this upward trend of disasters is essential for evaluating the challenges accurately that such cataclysms pose and there is a growing need to find appropriate ways to reduce disaster risk through the community resilience. The 2004

Indian Ocean tsunami revealed the weaknesses in warning systems, while the 2011 Japan tsunami revealed the flaws in perception and preparation (Bryant, 2014). For example, with a large proportion of the world's population living on coastlines, potential effects of tsunamis cannot be ignored (Bryant, 2014).

The changes in a community after a disaster are also unavoidable. The sustainability of the community and its ability to survive from the impact of a disaster should be linked to the community's vision, identity, and strategy. In the era of globalization, when managing risk, protecting and enhancing the existing knowledge and resources of community members and their resources is the key factor in enhancing community resilience (Nonaka & Ayano, 2010).

The Sendai Framework for Disaster Risk Reduction (SFDRR) 2015–2030 highlighted the role of local resources for disaster risk reduction (DRR). Enhancing disaster preparedness for effective response and "build[ing] back better" in the recovery, rehabilitation, and reconstruction process (UNISDR, 2015). It means that the lessons learned from the previous event should be used as resources to save lives and reduce the worst impact of disaster.

A good practical example of an existing local resource of indigenous knowledge (IK) for managing risk has been found in the *Smong* story in Simeulue Island, Aceh Indonesia. The *Smong* is now widely referred to a tsunami. Simeulue Island and the other small islands around it are situated in the southwest Aceh Province, Indonesia; the island has been devastated by earthquakes and tsunamis.

Earthquakes and tsunamis occur frequently in Simeulue Island, natural disasters are a part of the collective history, and most Simeuluean people have their own story describing their experience with disaster. The 2004 earthquake of  $M_w$  of 9.2 is one striking example of a natural disaster which destroyed the Indian Ocean coastal areas,

including Simeulue Island.

The story of the *Smong* resonates within the Simeuluean people, and the story can be seen as starting from the earthquake of  $M_w$  of 7.6 that hit off Aceh on Friday, January 4, 1907. The quake developed a giant wave that reached the land, and more than 50% of (some estimates go up to 70%) the Simeuluean people were killed (Sanny, 2007). The disaster happened on Friday when most of the people were gathering in mosques for Friday prayers.

The worst impact of the 1907 tsunami was the pain that resonated in the hearts of Simeuluean people. The survivors tried to deal with the disaster by recounting the story of the *Smong*. When the earthquake of  $M_w$  of 9.2 occurred on December 26, 2004, the *Smong* story successfully alerted the Simeuluean people of the impending danger, and they ran away from the coastal areas to higher places.

When the 2004 tsunami hit Aceh on December 26, the *Smong* story successfully alerted people to run to higher ground, allowing them to survive. Three people were reportedly killed, showing the positive impact of the *Smong* story as warning signal. The success of the *Smong* story, and the knowledge gained from the people living and confronting such disasters, has also stimulated a new interest in the concept of indigenous knowledge (IK) for DRR.

## **1.2 Learning from Disaster Experiences and the *Smong* Story: Saving Lives during the 2004 Indian Ocean Tsunami**

Simeulue Island is located in an earthquake and tsunami prone area, and the Simeuluean people have recorded their experiences of natural disaster through the story of the *Smong*. The *Smong* story has also attracted researchers and provided

practitioners opportunities to conduct a study on how these stories can help save lives and reduce the impact of disaster.

Researchers had been working beside aid workers to find out the secret to the survival of Simeuluean people. What they found seemed simple; the locals have a traditional story about the *Smong*: the giant wave that follows an earthquake and the subsequent recession of seawater, which runs up onto the land, destroying buildings and drowning everything in its path.

Some scholars also recorded the *Smong* story as the Simeuluean people's IK against tsunami risk, but these scholars focused on the limitation assumption. McAdoo et al. (2006), for example, described the *Smong* story's purpose as an attempt to avoid disaster during a tsunami. Syafwina (2014) focused on the *Smong* story as an early warning system for the community, and earlier, Baumwoll (2008) also described the interrelationship between the value of IK from the *Smong* story and DRR. Some of the information was taken from the perspective of the local leaders or stakeholders, so there was insufficient information from the standpoint of the community members as a whole.

Even though the story of the *Smong* during the 2004 Indian Ocean tsunami is powerful, some questions remain even after 12 years has passed after the tsunami: How was the *Smong* story successfully transmitted from the 1907 tsunami to save people's lives in the 2004 tsunami? And how could the *Smong* story be linked to people who did not experience the 2004 tsunami and community strategy in managing tsunami risk? The current study was carried out to confirm the development processes of the *Smong* story from the community members where it is embedded.

### **1.3 Research Purpose**

The purpose of the study was to analyze the development process of indigenous knowledge based on a case study of the *Smong* story on tsunami risk through the community's resilience in Simeulue Island, Aceh, Indonesia. To analyze the *Smong* development process the following are examined:

1. To analyze the development process of *Smong* within the community members among different generations between the 1907 and 2004 earthquakes and tsunamis;
2. To examine the *Smong* story contents in terms of how the *Smong* could have contributed to save people lives in the 2004 Indian Ocean tsunami;
3. To examine the *Smong* knowledge among the post 2004 tsunami generation who did not directly experience the 2004 Indian Ocean tsunami;
4. To make the recommendations for future continuation of the *Smong* in strengthening the community's resilience.

### **1.4 Research Significance**

The role of IK for DRR through community resilience has not been widely explored. The research is limited and on briefly touches on this issue of understanding of the development process of IK especially for managing tsunami risk. In particular, the significance of this research lies in exploring the development process of indigenous knowledge through community action. Several significant contributions of this research could be as follows:

1. The lessons learned from this research will contribute to indigenous knowledge for DRR discourses, DRR practitioners and communities in strengthening the community's resilience in managing risk;

2. This research will contribute to strengthen the integration of IK with a range of DRR efforts;
3. The SFDRR 2015-2030 addressed the role of IK that indigenous peoples, through their experience and traditional knowledge, significantly contribute to DRR, and this research is also part of an action to realize SFDRR 2015-2030.

### **1.5 Structure of the Study**

The structure of the study divided into seven chapters. Chapter 1 is an introduction that aims to provide the research background, purposes, and significance, which will help to understand the research.

The Chapter 2 is the literature review, which describes the interrelationship between knowledge, IK for DRR through community resilience. Chapter 3 provides the analytical framework of this research and foregrounds the frequency of earthquakes and tsunamis that occur on Simeulue Island, and the framework that will provide the whole of the research flow and the methods. Chapter 4 gives the background of information on Simeulue Island which provides the history of demographic features, and disaster experiences through the *Smong* story.

Chapter 5 shows the results of the analysis of the development process of the *Smong* story as indigenous knowledge from the 1907 and 2004 tsunamis, and how it could be linked to future DRR efforts. Then, Chapter 6 provides the discussion especially for the recognition of the *Smong* story, focusing on the group of people who did not experience the 2004 Indian Ocean tsunami, and/or were born after that time.

Finally, the dissertation closes with conclusion which includes research limitations and proposed recommendations for future research.

## **Chapter 2**

### **Literature Review**

#### **2.1 Tsunami: the Underrated and Devastated Hazard**

Before 1990, the public perceived tsunamis as originating primarily from large, distant, underwater earthquakes that mainly occurred in the Pacific Ocean (Bryant, 2014). The 2004 Indian Ocean tsunami changed disaster paradigms significantly (Bernard & Robinson, 2009; Rodriguez, Wachtendorf, Kendra, & Trainor, 2006). Scientists also found many facts suggesting that Indian Ocean coastal areas had been devastated by several tsunamis (Rubin et al., 2017).

Scientists also found many facts if the Indian Ocean coast areas has been devastated by several tsunamis (Rubin et al., 2017). The tsunamis occurred along the Indian Ocean was not only perceived as series of stages of natural phenomena that destroyed the coastal area or caused lose lives, but it has also been understood more than it. Every community has their way of dealing with the tsunami. It is important to assess the deeper understanding on how the local community accepted and perceived the tsunami events in helping them to make a decision when the same situation occurs.

Table 1 shows earthquakes triggered the largest number of tsunamis, resulting in the most number of deaths. This is an answer to why most of the researchers in this field put specific attention on the natural phenomena caused by big earthquakes, followed by receding seawater, and, finally large waves crashing onto and devastating

shorelines.

Table 1. Cause of Tsunami in the Pacific and Eastern Indian Ocean Regions Over the Last 2000 Years

Cause	Number of event	Percentage of events	Number of deaths	Percentage of deaths
Landslides	66	4.4	14,661	2
Earthquakes	1,242	83	664,880	90
Volcanic	67	4.5	51,643	7.2
Unknown	122	8.1	5,364	0,7
Total	1,497	100	716,548	100

*Note.* Source: Bryant (2014).

Table 2. Largest Known Death Tolls from Tsunami in the Pacific and Indian Ocean Over the Last 2000 years

Date	Fatalities	Location
26 December 2004	228,432	Indonesia- Indian Ocean
22 May 1782	50,000	Taiwan
27 August 1883	36,417	Krakatau, Indonesia
28 October 1707	30,000	Nankaido, Japan
15 June 1896	27,122	Sanriku, Japan
20 September 1498	26,000	Nankaido, Japan
13 August 1868	25,674	Arica, Chile
11 March 2013	23,295	Tohoku, Japan
27 May 1293	23,024	Sagami Bay, Japan
04 February 1976	22,778	Guatemala
29 October 1746	18,000	Lima, Peru
21 January 1917	15,000	Bali, Indonesia
21 May 1792	14,524	Unzen, Ariake Sea, Japan
24 April 1771	13,486	Ryukyu Archipelago
22 November 1815	10,253	Bali, Indonesia
May 1765	10,000	Guanzhou, South China Sea
11 August 1976	8,000	Moro Gulf, Philippines

*Note.* Source: Bryant (2014).

Researchers in this field put the specific attention on the natural phenomena caused by big earthquake followed by receding of seawater and seawater reached and devastated the land. Over the past 2000 years there have been 716,548 deaths attributed to tsunamis in these two oceans. The largest total death is concentrated in Aceh, Indonesia where more than 200,000 people were killed by the 2004 Indian Ocean tsunami (see Table 2) (BRR, 2009b; Bryant, 2014; Gusiakov, 2009).

Natural disasters are endogenous factor to society and disaster risk arises when hazards interact with the physical, social, economic, and environmental vulnerabilities and exposure of populations (UNISDR, 2013).

The understanding of tsunamis as a natural phenomenon has increased and scientists have placed increased attention on understanding it more comprehensively. This consideration came from the fact that tsunamis are more complex than just big waves, and these catastrophic events have caused more deaths and influenced greater infrastructure, social and economic destruction (Bernard & Robinson, 2009).

A tsunami is defined as a wave or series of waves in a wave train, generated by the sudden, vertical displacement of a column of water (Bryant, 2014). This displacement could be due to seismic activity, explosive volcanism, landslides above or below water, asteroid impact or certain meteorological phenomena (Bryant, 2014; Kafle et al., 2016). Tsunamis could be generated in oceans, bays, lakes, rivers or reservoirs, which means there are many phenomena that could be referred to as a tsunami.

A hundred year ago researchers began to use the term tsunami. According to Cartwright & Nakamura (2008), the first occurrence of the word tsunami is found in a journal kept by a retainer of the shogun Tokugawa Ieyasu. In receiving news about

the Sanriku earthquake of 2 December 1611, fishermen around the Sanriku region called it a tsunami, and they might have used the term because its effects were most evident when they arrived back at their harbour, only to find their villages had been washed away.

So, the term tsunami derives from the Japanese language, and means harbour (tsu) and wave (nami) (Bryant, 2014; Dictionaries, n.d.; Duffin, 2011; Gusiakov, 2009; Zimmer, n.d.). This is probably true because the phenomena frequently occurred and struck the coast of Japan, with 25.2% of all tsunami events originating here (Bryant, 2014; Gusiakov, 2009). The Japanese language also has other terms to describe tsunamis, such as *onami* (large wave), *shikai namisu* (waves rise in all direction), and *kaisho* (roaring and resounding sea) (Cartwright & Nakamura, 2008).

Many languages have a special word for this type of disaster coming from the sea such as tidal waves, seismic sea waves (English), *raz de mare*, *vagues sismiques* (French), *flutwellen* (German), *maremoto* (Spanish), *vlogengolden* (Holland), *hai-i* (Chainese), *loka* (Fijian) (Gusiakov, 2009).

Subsequently, the Japanese term has been adopted worldwide and many scholars and scientists have used tsunami to describe the phenomena even though many parts of the world also experience tsunamis, and have their own term to describe it. Figure 1 describes twenty-six years of international commitment in reducing the impact of natural disaster. It has been adopted and received as a platform to implement in each country, based on the local context. However, there is much work to do, and international commitment on these issues should be strong, because international understanding will also change and depend on the dynamic global changes.

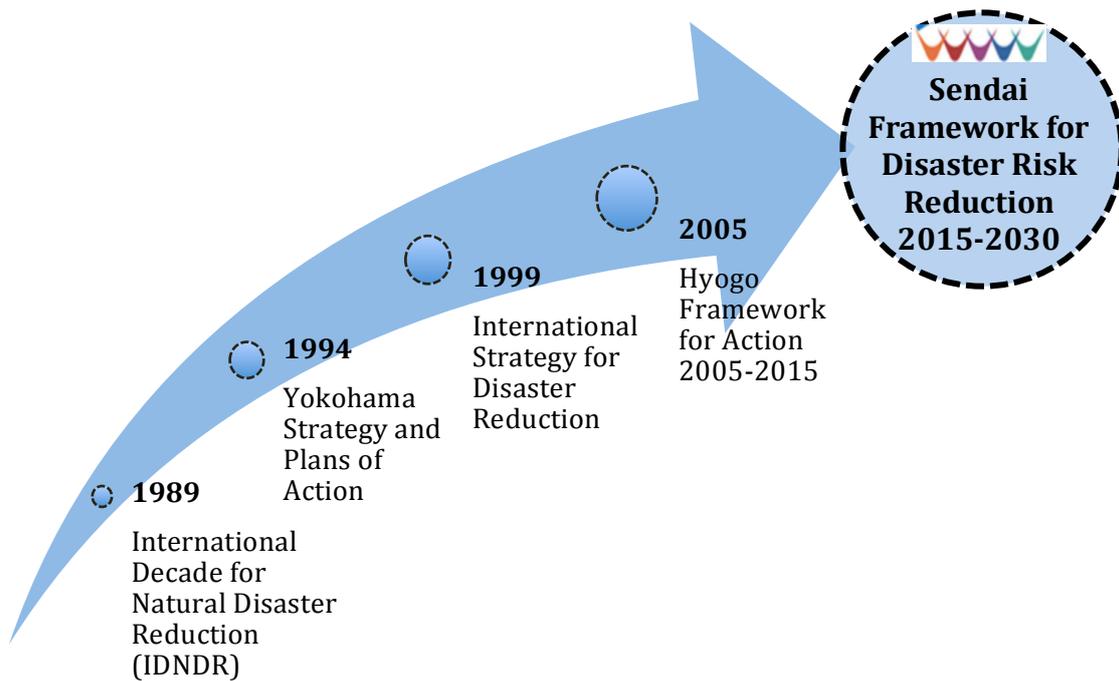


Figure 1. Twenty-six years of international commitments to Disaster Risk Reduction. Adapted from Aitsi-Selmi et al. (2015).

The Sendai Framework for Disaster Risk Reduction 2015–2030 (SFDRR) was released as a result of World Conference on Disaster Risk Reduction 2015 (WCDRR) and was needed to ensure that the DRR reflects our evolved understanding of the complexity of disaster risk in the twenty-first century.

The implementation requires a comprehensive collaboration among all sectors, including the role of local communities in order to prevent, prepare for, respond to, and recover from disasters (Aitsi-Selmi et al., 2015; Gaillard & Mercer, 2013b). As a result, the highly interdependent DRR efforts call serious attention and consideration to this issue.

## 2.2 Knowledge and Disaster Risk Reduction

The various definitions of research knowledge can be described from many points of views (see Table 3). Most definitions refer to the hierarchy of the knowledge that is common recognized by scientists and researchers. The hierarchy of knowledge is data, information, knowledge and wisdom (see also Figure 2).

Table 3. The Definition of Knowledge

Reference	Definition
Davenport, De Long, & Beers (1998)	A fluid-mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information
Fred (1981)	Identified with information-produced (or sustained) belief, but the information a person receives is relative to what he or she already knows about the possibilities at the source
Nonaka (1994)	Justified true belief and also dynamic human process of justifying personal beliefs as part of an aspiration for the truth
Zins (2007)	Knowledge is a personal cognitive framework that make it possible for human to use information
Trumble (2007)	Information and skills acquired through education or experiences or an awareness or familiarity gained by experiences of a fact or situation
Bennet & Bennet (2008)	Knowledge is the capacity (potential or actual) to take effective action in varied and uncertain situations
McInerney (2002)	Knowledge is the awareness of what one knows through study, reasoning, experience or association, or through various other types of learning

Knowledge is more subjective and intangible compared to information and data, and can be said to be what an individual takes from information and data and that they incorporate into their beliefs, values, procedures, actions etc., (Zins, 2007).

The critical role of knowledge in reducing the worst impacts of disasters has also been addressed in the Sendai framework for disaster risk reduction (SFDRR) for 2015–2030. The SFDRR’s first priority of action relates to the important role of knowledge to community resilience.

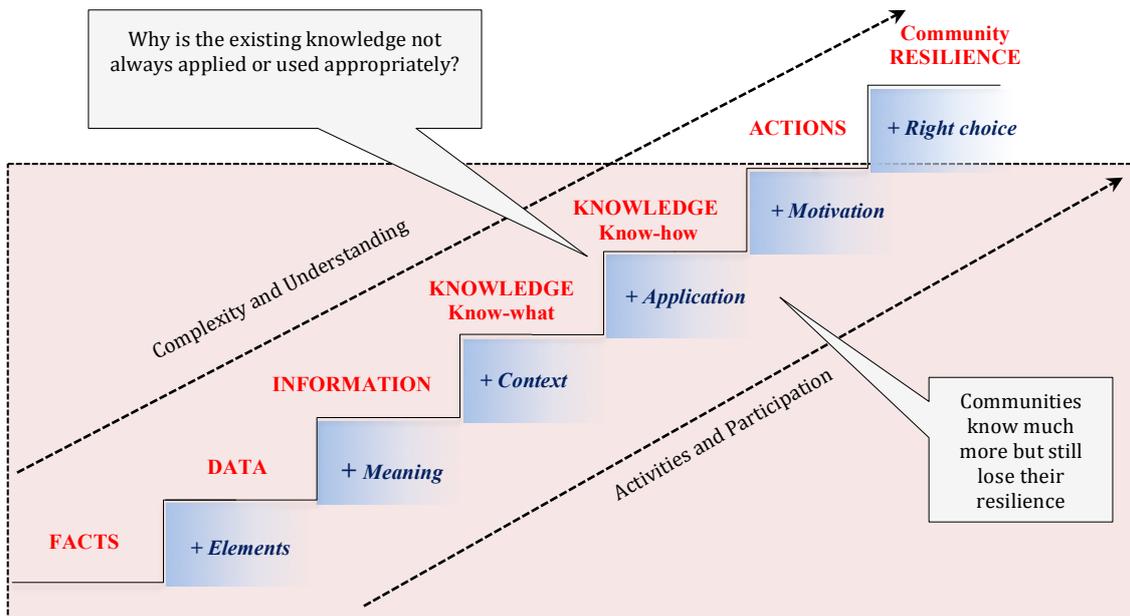


Figure 2. Knowledge ladder through community resilience. Adapted from North & Kumta (2014) and Weichselgartner & Pigeon (2015).

However improved knowledge by itself has also not automatically reversed the downward trend of community resilience (Skyrme, 2007; UNISDR, 2015). In other words, disaster awareness has strengthened disaster knowledge but, in the process, communities have lost still more of their resilience. Therefore, questions remain as to why existing knowledge is not always applied or not used appropriately, and how this knowledge can be maintained by improving on existing knowledge, especially community knowledge (see Figure 2)

Researchers must examine the nature of this knowledge, including understanding knowledge production processes, the existence of different type of knowledge and their sources, and the transfer and use of information that increases knowledge. These processes can be improved, thereby greatly contributing to community resilience in the face of disaster (Spiekermann et al., 2015).

Knowledge is vital issue in the DRR strategies involving social constructions

(Gaillard & Mercer, 2013b; Weichselgartner & Pigeon, 2015). Lessons learned from every disaster have proved that reusing and sharing knowledge can enhance community resilience to manage disaster risk (Seneviratne, Baldry, & Pathirage, 2010; Zschocke & de León, 2010). The challenge of implementing knowledge in the construction of community resilience is the lack of systematic management strategies for developing and applying community knowledge (Raymond et al., 2010). For example, knowledge management models of community resilience have not been widely recognized by academics and practitioners as a tool to support community knowledge development. However, communities' existing knowledge may present challenges, which prevent it from being used efficiently and effectively (North & Kumta, 2014).

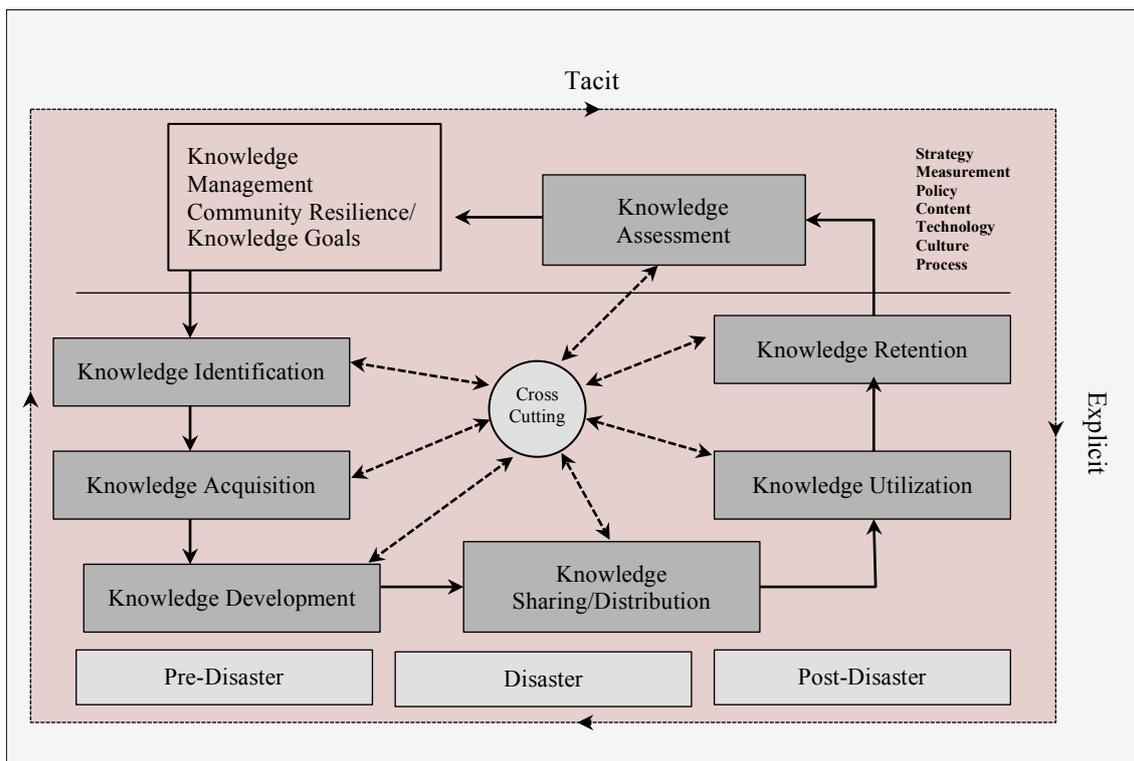


Figure 3. Framework of knowledge management to enhance community's resilience. Adapted from Probst, Romhardt, & Raub (2000).

The present study sought to see the development of IK through the community's

appropriate action that could overcome such problems and provide a successful and efficient way to encourage existing knowledge in the strengthening of community resilience to disaster risk.

Figure 3 shows the framework of knowledge management to enhance community resilience as a basic approach to understanding the flow of knowledge in communities. Effective local community resilience that manages risks and recovers from crises involves steps in knowledge management: 1) identification, 2) acquisition, 3) development, 4) sharing/distribution, 5) utilization, and 6) retention. Another important thing in knowledge management is assessment, which is responsible for maintaining and ensuring that knowledge can sustainably achieve community goals (Probst et al., 2000).

## **2.3 Indigenous Knowledge**

### **2.3.1 Indigenous knowledge discourses**

In recent years, IK has emerged as a significant resource in dealing with many research and development issues. The growing interest in IK is perhaps directly related to growing concern about the degradation of the environment (George, 2011).

The question is “What is indigenous knowledge?” To understand the meaning of IK, using the terminology of Mwadime (2011) is that IK differs from the known forms of “formal knowledge” of scientific, Western, modern societies because IK is deeply rooted in its environment, history, and experiences. IK should be captured as the information base for a community which facilitates communication and decision-making (Warren, Slikkerveer, & Brokensha, 1995).

However, the increasing number of IK and practices documented in research

on disasters have yet to lead to increased efforts to translate indigenous knowledge into initiatives that increase communities' resilience against disasters' impacts (Shaw, Uy, & Baumwoll, 2008). Indigenous knowledge has traditionally been regarded as inferior to science and technology (Agrawal, 1995), which has negatively affected communities' development processes (Gadgil, Berkes, & Folke, 1993).

The term IK arises from the experiences of many academics and practitioners. Some other terms are found in the literature referring to indigenous knowledge, such as folk, local, rural people's, indigenous technical, and traditional environmental knowledge.

Previous research justifies viewing indigenous knowledge not only as underlying technical solutions to daily problems or only information functioning as an early warning but also as containing non-technical insight, wisdom, ideas, perception, and innovative capabilities that deal with physical, environmental, ecological, biological, or geographical phenomena (Gadgil et al., 1993).

This is the reason that most academics and practitioners working in the field of indigenous knowledge have based their interpretations on geography, anthropology, and sociology. Indigenous knowledge could also be a more acceptable alternative to researchers of many backgrounds and areas of interest.

Many definitions have been developed in a variety of fields in the literature to help understand IK and distinguish it from other concepts. Some of these IK definitions can be seen in Table 4. In the context of this study, the definition of IK is the cumulative body of knowledge (Berkes, 1993) from the practices of culture and beliefs that were formed over numerous generations (Baumwoll, 2008; Gadgil et al., 1993; Grenier, 1998) pertaining to the long histories of

interactions with the people’s natural surroundings or environment (UNESCO n.d.).

Table 4. The Definition of Indigenous Knowledge

Reference	Definition
Berkes (1993)	Cumulative body of knowledge and beliefs, handed down through generation by cultural transmission, and about the relationship of living beings (including human) with one another and with their environment
Gadgil et al. (1993)	The shared knowledge where the local community has evolved over time, through trial and error
Warren et al. (1995)	The information base for a society which facilitates communication and decision-making
Grenier (1998)	The unique, traditional, local knowledge existing within and developed around specific conditions
Kok (2005)	The knowledge that has been created and developed over the period of time
Ellis & West (2004)	The knowledge that is embedded in individual and group action
Baumwoll (2008)	The approaches and practices of a culture which develop from an advanced understanding of its specific environment which has formed over numerous generations of habitation
Mercer et al. (2010)	Considered to be a body of knowledge existing within or acquired by local people over a period of time through accumulation of experiences, society-nature relationship, community practices and institutions, and by passing it down through generations
UNESCO (n.d.)	The understanding skills and philosophies developed by society with long histories of interaction with their natural surroundings. For rural and indigenous peoples, local knowledge informs decision-making about fundamental aspects of day-to-day life

### 2.3.2 Characteristic of indigenous knowledge

The term IK arose from the experiences of many academics and practitioners. Some other terms are found in the literature that refer to IK, such as folklore, local, rural people’s, indigenous technical, and traditional environmental knowledge. The

Oxford Dictionary of Literary Terms defines tradition as a body of works, styles, convention, or beliefs which are represented as having been handed down from the past to the present (Baldick, 2015). Hence IK is imbedded in the culture, and the traditions of the local people and traditions are shaped by existing knowledge and both a have strong influence on behaviour and decision making (George, 2011).

IK is a repetitive process from generation to generation and an unsystematic accumulation of new data over generations (Sillitoe & Marzano, 2009). IK has several essential characteristics (Agrawal, 1995; Baumwoll, 2008) that differentiate it from other types of knowledge as follows: It is embedded, and originated in particular communities; It is maintained through non-formal transmission; It is collectively owned; and it is developed over several generations.

Most IK, especially in developing countries, is not documented and is transmitted orally from generation to generation; its gradual disappearance is due to the influence of globalization, racism, marginalization, environmental pressures and as individuals who lived life in the old way depart this life (S. E. Edwards & Heinrich, 2006; Moahi, 2007). IK could potentially be disrupted through the breakdown of traditional, oral communication channels; the movement of communities to another place on a daily basis; and a lack of interest in learning indigenous knowledge (Grenier, 1998; Moahi, 2007).

In recent years, IK has emerged as a significant resource of knowledge when dealing with some research issues. However, the increasing number of IK and practices documented in research on disasters have yet to lead to increased efforts to translate IK into initiatives that increase communities' resilience against the impact of disasters (Shaw et al., 2008).

The globalization and reconstruction phase, the development of infrastructure,

and the sharing of information across countries have increased the vulnerability of the existing IK in communities. IK also faces a potential disruption as a result of traditional and oral communication channels being weakened, the movement of the community to another place, and the local people no longer being interested in learning it (Grenier, 1998). The lack of risk and disaster knowledge are significant drivers that increase the impact of disasters; it is all the more necessary to develop strategies to tackle these threats simultaneously and integrate the strategies within community resilience contexts.

### **2.3.3 Integration of indigenous knowledge with science and DRR**

IK has received increasing attention in the fields of DRR by both scientists and practitioners in recent years (Hiwasaki, Luna, Syamsidik, & Shaw, 2014; Inglis, 1993). Work on IK began to permeate the DRR discourse in the 1970s. However, this research expanded quite slowly, and the link between indigenous knowledge and DRR remained vague and indirect. By the 1980s, IK was still being ignored within the established disaster management discourse even as more attention was given to the role and value of IK in other fields (Baumwoll, 2008).

IK has traditionally been regarded as inferior to science and technology (Agrawal, 1995), which has affected the recognition of IK in academic literature (Gadgil et al., 1993). Even though SFDRR currently includes the significant role of IK to reduce the impact of disaster risk and protect lives, the question still remains as to whether IK is based on scientific evidence or not.

According to (Bryant, 2014), there were local stories which recorded tsunamis and accepted by the local community as story and a way for the community to translate the natural phenomena. For example, Aboriginal people have a belief that the sea like humans has an angry. As the sea grows rough and

the wind blows, Aboriginal people know the ocean is angry and impatient because their ancestors still refuse to return to where they should exist (Bryant, 2014).

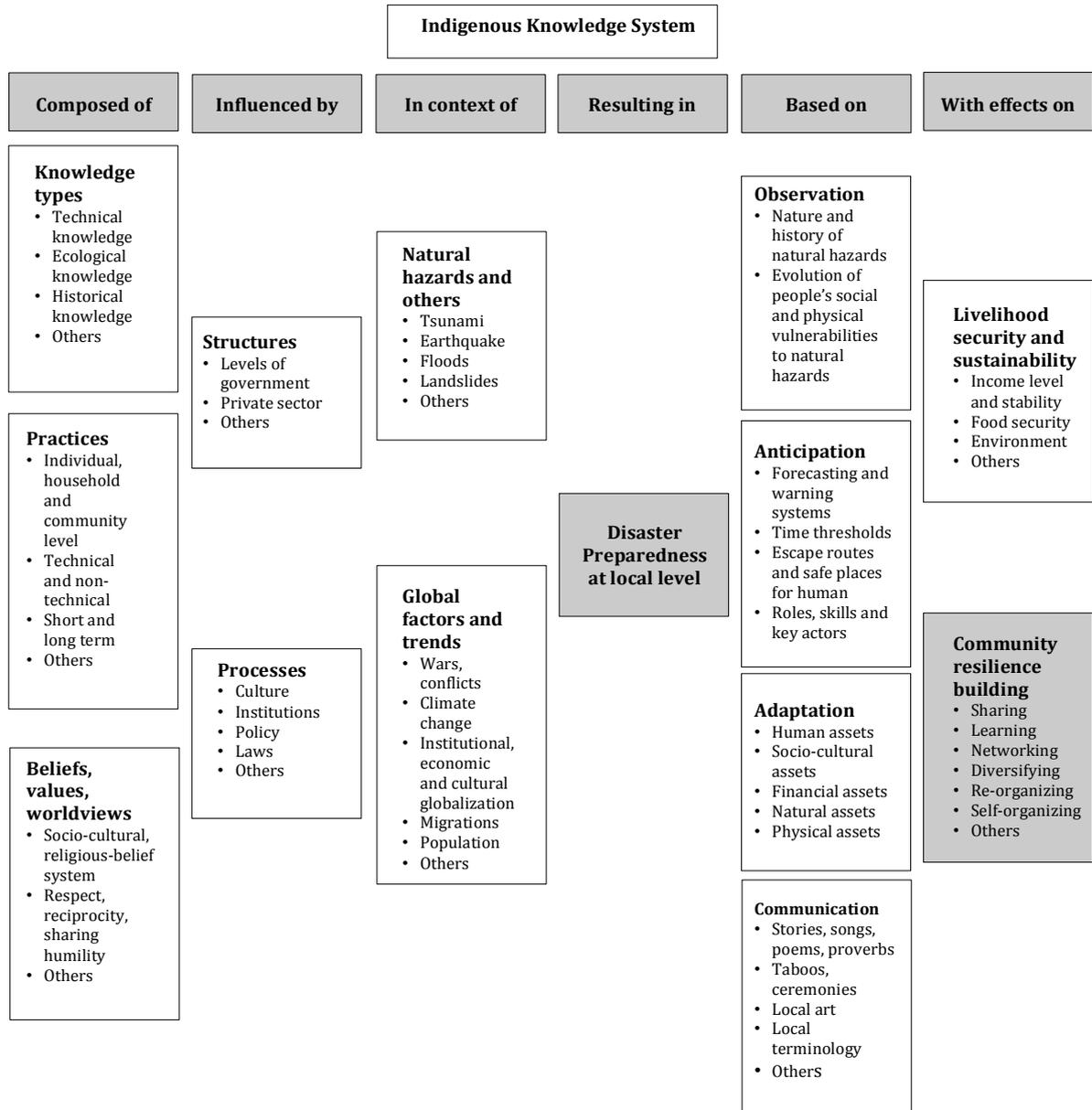


Figure 4. Framework for indigenous knowledge in disaster risk reduction. Adapted from Dekens (2007).

The integration of IK and scientific knowledge has been addressed by some researchers such as Raymond et al. (2010), Mercer et al. (2010). They propose the processes and mechanisms available for integrating different types of

knowledge in helping the community to make the appropriate decision.

The broad explanation of IK and its relationship to DRR proposed by Dekens (2007) (see Figure 4) considers knowledge not as static; it is being lost and gained all the time.

The framework proposed by Dekens (2007) does not cover how to apply IK to disaster preparedness, nor how to integrate it into disaster-related activities, plans, and policies, but the aims are to promote sensitivity towards and an understanding of IK on disaster preparedness. His assumption here is that IK and practices, whether they are relevant or not in a specific context for a specific project, should not be ignored. IK always needs to be taken into account.

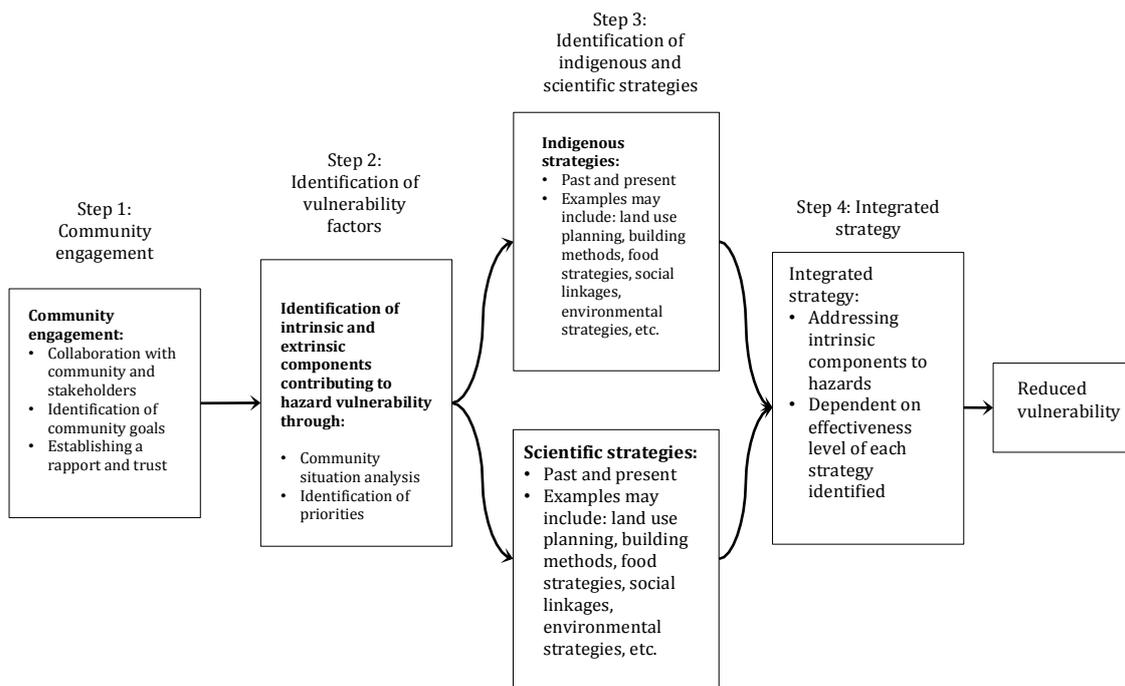


Figure 5. Process framework integrating indigenous knowledge and scientific knowledge. Adapted from Mercer et al. (2010).

A similar idea is also described by Mercer et al. (2010): a process framework which represents the main processes or steps to be taken in order to reach and identify an integrated IK strategy; and, scientific knowledge that would best reduce vulnerability to environmental hazards (see Figure 5).

IK in the literature in particular provides abundant evidence of human activities and behaviours that utilise complex but implicit scientific principles (George, 2011). Figure 6 describes the categorization of IK in its relationship to the physiologically desirable, and the cultural, traditional and spiritual acceptability the community proposed by Mwadime (2011). It will be absolutely necessary for both aspects to respond to community needs, and would be useless otherwise.

		Physiologically desirable	
		Yes	No
Culturally, traditionally and spiritually desirable	Yes	Absolutely necessary	Discretionary
	No	Necessary	Useless

Figure 6. The categorization of IK by its physiological and cultural/traditional need. Adapted from Mwadime, (2011).

Mwadime (2011) has also proposed a way to understand IK based on a scientific explanation that should consider the community explanation of their IK, such as what the scientists commonly see, and what scientists also need to see.

Most of IK functioned as the basis for decision making in solving life problems in the community. From this point of view the validation of IK should integrate how one community learns from another, whether valid and reliable or not, and should work together in the process of finding new approaches between

IK and scientific knowledge in the struggle to find solutions for their problem (Mwadime, 2011).

<p><b>I</b></p> <p><b>IK which can be scientifically explained/validated, and related to DRR</b></p>	<p><b>II</b></p> <p><b>IK which cannot be scientifically explained/validated, but related to DRR</b></p>
<p><b>III</b></p> <p><b>IK which can be scientifically explained/validated, but not related to DRR</b></p>	<p><b>I</b></p> <p><b>IK which cannot scientifically explained/validated, and not related to DRR</b></p>

Figure 7. The categorization of indigenous knowledge on disaster risk reduction and its relationship to the scientific validation. Adapted from Hiwasaki et al. (2014).

In the categorization of IK on the availability of scientific explanation, the relationship and relevance to DRR proposed by Hiwasaki et al. (2014) Figure 7 shows that quadrant I was significantly related to DRR, and was targeted by many scientists and practitioners. But the consideration of other quadrants must be accepted as facts and should not be avoided.

The researchers should be understood and translated in the right manner from a scientist's point of view. But, some stories have elements of truth, and are also reliable, for example, the story of Krakatau and the Burin Peninsula. The description of the tsunami generated by the eruption of Krakatau in 1883 is based

upon historical scientific records, mainly from the diary of Van Guest, the colonial volcanologist. And the Burin Peninsula story is linked to the Grand Banks earthquake and tsunami of 1929.

Table 5. Word Count Related to Local Context Including Indigenous Knowledge from Each of Disaster Risk Reduction Frameworks

Word	Yokohama	Hyogo	Sendai
People-centred	0	1 (People cantered EWS)	2
Participatory/participation (community)	3	3 (one of them in a footnote)	2
Indigenous	1 (NGOs)	1 (knowledge)	4 (2 as people, 1 as knowledge, 1 as both)
Traditional Knowledge	6 (methods, coping mechanisms, expertise)	1 (as same time as indigenous knowledge)	3 (twice with indigenous)
Local level	1	8	15
Local context	0	1	2
Local needs	0	1	3 (1 direct, 2 in spirit)
Local communities	3	2	4
Community-based	0	2 (once organizations, once trainings)	2 (both in references to organizations)
Community (as in local, not international or scientific)	5	4	9
Total	19	25	50

*Note.* Adapted from Poterie & Baudoin (2015).

The recognition of indigenous knowledge's role in SFDRR 2015-2030 now includes that indigenous peoples, through their experience and traditional knowledge, significantly contributed to the development and implementation of plans and mechanisms, including early warning systems (UNISDR, 2015). Table 5 describes the word count related to the local context, including IK from each International Framework, on disaster reduction. This recognition of IK in

reducing risk was significantly recognised in SFDRR compared with both former frameworks.

Most IK is intangible and, consequently, not easily codified (World Bank, 1998). It is hard to communicate real but tacit knowledge to people with a different level of knowledge (Polanyi, 2009). Some approaches have been developed to manage knowledge effectively and successfully transfer tacit knowledge into explicit formats, but researchers need to have a clear understanding of the dynamic nature of knowledge itself (McInerney, 2002). Development initiatives that pay attention to local ways and perceptions are more likely to be relevant to people's needs and to generate sustainable interventions (Sillitoe & Marzano, 2009).

However, importantly, this does not mean that all IK and practices are appropriate or sustainable. Therefore, the next important step in providing policy recommendations involves assessing how to integrate local knowledge into activities: what timeframes can IK and practices provide support; for whom and for what objectives; how it can be combined with other knowledge for disaster preparedness; and in which contexts local knowledge and practices contribute to the improvement of disaster preparedness activities (Dekens, 2007).

## **2.4 Indigenous Knowledge and Its Relation to Community Resilience**

The first conceptualization of resilience was recognized in the field of Systems Ecology, and introduced in the literature on disasters in the 1970s, but only spread widely in the 1990s (Hiwasaki et al., 2014). The concept of community resilience is defined in different ways depending on the background and viewpoint of each researcher, and, thus, this concept has many interpretations in academic discourse.

The word “resilience” derives from the Latin word *resilio*, which means “to jump back,” and definitions emphasize a capacity for successful adaptation in the face of stress, disturbance, or adversity (Norris, Stevens, Pfefferbaum, Wyche, & Pfefferbaum, 2008).

Resilience is defined in many ways. Most of the definitions show only the scope of the capacity to recover after a disaster (Aldrich, 2012; Brown & Kulig, 1996; Coles & Buckle, 2004; Paton & Johnston, 2001).

Table 6. Definitions of Resilience in Terms of Disaster Discourses

Reference	Definition
Brown & Kulig (1996)	The ability to recover from or adjust easily to misfortune or sustained life stress
Paton & Johnston (2001)	The capability to bounce back and to use physical and economic resources effectively to aid recovery following exposure to hazards
Coles & Buckle (2004)	A community’s capacities, skills, and knowledge that allow it to participate fully in recovery from disaster
Norris et al. (2008)	The ability of community members to take meaningful, deliberate, collective action to remedy the impact
UNISDR (2009)	The ability of system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effect of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions
Comfort et al. (2010)	The capacity of a social system (e.g., an organization, city, or society) to proactively adapt to and recover from disturbances that are perceived within the system to fall outside the range of normal and expected disturbances
Aldrich (2012)	Communal, not individual, level, focusing on the ability of a neighbourhood, ward, or area to engage in positive, networked adaptation after crisis

The definition of resilience in the term of disaster discourses could be found in Table 6. It seems as though the term resilience is missing the ideas of process and the

development, meaning the resilience accumulated and embedded within the community.

Resilience is also perceived as the capability to reduce vulnerability (Paton & Johnston, 2001). In many cases after reconstruction phases, the community recovers and improves significantly, but the population's vulnerability increases. Every improvement has a negative consequence because of the limitation of a decision maker and the developer to see the big picture. The dynamic and flexible movement in society must be considered to achieve the sustainability of improvement (Jørgensen, 2008; Sillitoe & Marzano, 2009).

The scope of resilience here includes the ability of communities to manage, respond to, and recover from disasters by reusing existing knowledge. A focus on resilience means putting greater emphasis on what communities can do for their members and how to strengthen these capabilities (Twigg, 2009). This makes it possible to use local perspectives and initiatives to build resilience that increases communities' capacity to recover effectively (Aldrich, 2012).

In community disaster-based management, IK is recognized by practitioners and scientists as a source of resilience (Bohensky & Maru, 2011; Semali & Kincheloe, 2011) for the community in adapting to the changes of the environment (Aldrich, 2012; Comfort et al., 2010; Hiwasaki et al., 2014; Sillitoe & Marzano, 2009). IK has proved its roles in protecting the community when a disaster occurs. IK is developed from the depth of a community's understanding in adapting and dealing with their changing surroundings (Dekens, 2007; Mercer et al., 2010). But IK is the missing link in the interrelation of IK to the community's strategy because of the loss of development knowledge.

IK can enhance the resilience of a community's systems because this knowledge is acquired through experience, learning, and intergenerational transmission. IK has also demonstrated the ability to deal with complexity and uncertainty (Berkes, 1993; Sillitoe & Marzano, 2009).

Although the concept of community resilience to disaster is complex and based on multiple factors, one of the specific characteristics that builds up community resilience is a focus on knowledge and education. More specifically, this includes the possession of appropriate technical and organizational skills and knowledge of risk reduction and disaster response at a local level. Community resilience, thus, more particularly refers to how local communities develop their capacity to cope with disaster by reusing local resources.

The definition of resilience used in this study is communities' capacity to adapt to, reduce, manage, and recover from the worst impacts of hazards by utilizing their local resources through appropriate, actionable decisions in pre-disaster, disaster, and post-event phases.

The adaptive component of resilience in the context of local communities is their capacity to make suitable and actionable decisions in the face of events. The proposed model argues that communities' existing knowledge is central to resilience when managing risk, including their ability to sustain systems and respond to, and recover from, disasters.

For this study, resilience means the capability of bouncing back and the ability to recover from a disaster (Brown & Kulig, 1996; Coles & Buckle, 2004; Paton & Johnston, 2001). The community and their local resources should be central to resilience in managing risk, and this includes the community's ability to sustain systems to recover from disasters. A focus on resilience means putting greater

emphasis on what communities can do for their members and how to strengthen these capabilities (Semali & Kincheloe, 2011; Twigg, 2009).

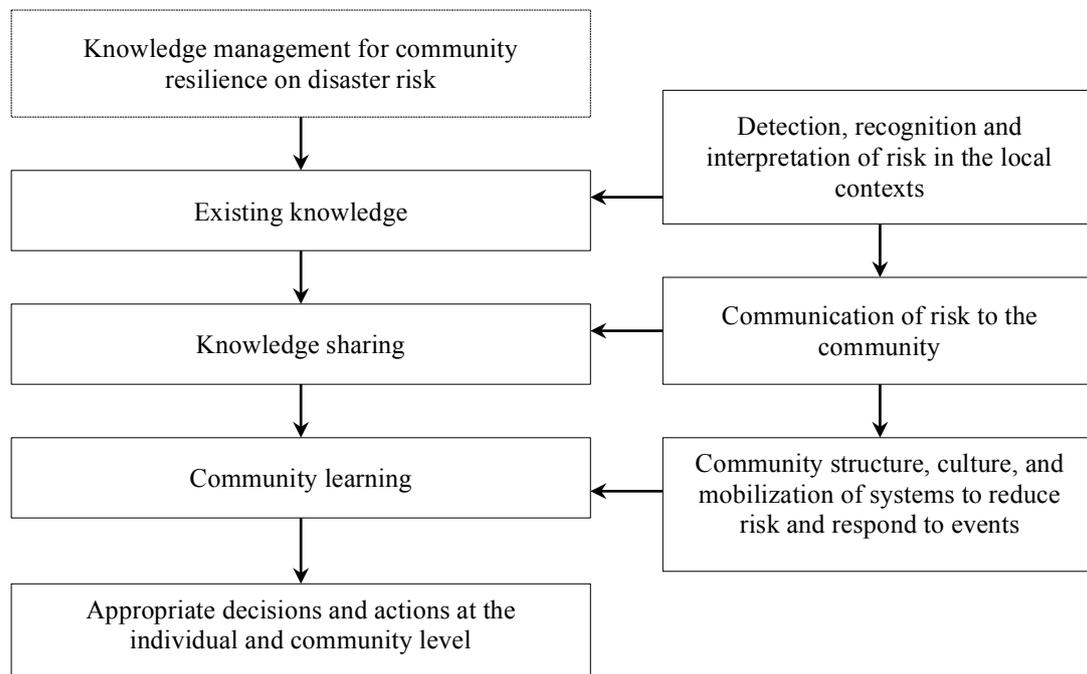


Figure 8. Knowledge utilization leading community in managing disaster risk

More specifically, appropriate decisions are one of the most important ways to reduce the loss of life during crises. Comfort et al. (2010) divide crisis management systems into four subsets of decisions: 1) detection of risks, 2) recognition and interpretation of risks in the immediate context, 3) communication of risks to the community, and 4) community structure and mobilization of systems to reduce risk and respond to events (Comfort et al., 2010) (see Figure 8).

In the present conceptualization of knowledge to enhance community resilience, utilization of knowledge is one of many processes within communities' knowledge management system. Indigenous knowledge is a source of resilience because when indigenous knowledge is integrated into socio-ecological systems, these have demonstrated the ability to deal with complexity and uncertainty (Berkes, Colding, & Folke, 2000).

The interrelationship between IK and the community's resilience in disaster discourses is that the community does not only take the right decision and action and recover efficiently but also must be seen as the complexity of the communities in formulating what they need in protecting themselves rather offer something new from the outside perspective.

Kaklauskas et al. (2009) introduces the knowledge model for post-disaster management; they focused on evaluating the post-disaster management life cycle, stakeholders, and micro- and macro-environment (Kaklauskas, Amaratunga, & Haigh, 2009). The knowledge model also demonstrated that the integration of explicit and tacit knowledge could be gained and put in the context of various aspects of post-disaster stages.

In community disaster-based management, IK is recognized by practitioners and scientists as a source of resilience (Bohensky & Maru, 2011; Semali & Kincheloe, 2011) for the community in adapting to the changes of the environment (Aldrich, 2012; Comfort et al., 2010; Hiwasaki et al., 2014; Sillitoe & Marzano, 2009). IK has proved its roles in protecting the community when a disaster occurs. IK is developed from the depth of a community's understanding in adapting and dealing with their changing surroundings (Dekens, 2007; Mercer et al., 2010). But IK is the missing link in the interrelation of IK to the community's strategy because of the loss of development knowledge.

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Some studies have argued whether IK was developed to fit a particular social

setting and hence would be difficult to transfer to another setting (Agrawal, 1995; Baumwoll, 2008) or if it could potentially be applied and replicated outside where it was developed. Although IK is generated in specific local context in response to the specific local problems, it is often influenced by knowledge generated in other forms knowledge (George, 2011).

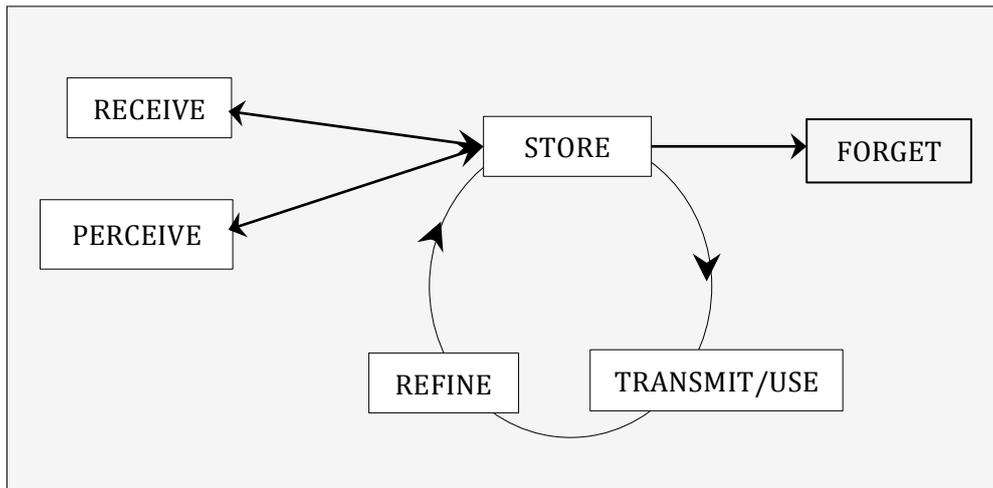


Figure 9. Knowledge life cycle.  
 Modified from J. S. Edwards et al. (2009) and J. S. Edwards (2001).

Figure 9 shows the life cycle of knowledge in a community on how the community receives, perceives, stores, and uses or forgets the knowledge. J. S. Edwards & Taborda (2016) pointed out that an understanding of knowledge and process has always been important to a community (organizations) for strengthening a community’s strategy.

It is important to understand the role of IK for DRR by knowing the role knowledge discourses itself. Weichselgartner & Pigeon (2015) described the role of knowledge for DRR from qualitative levels by understanding facts, data, information, and knowledge through wisdom. This concept could give insights into potential conceptualizations of knowledge that could advance disaster research and policy.

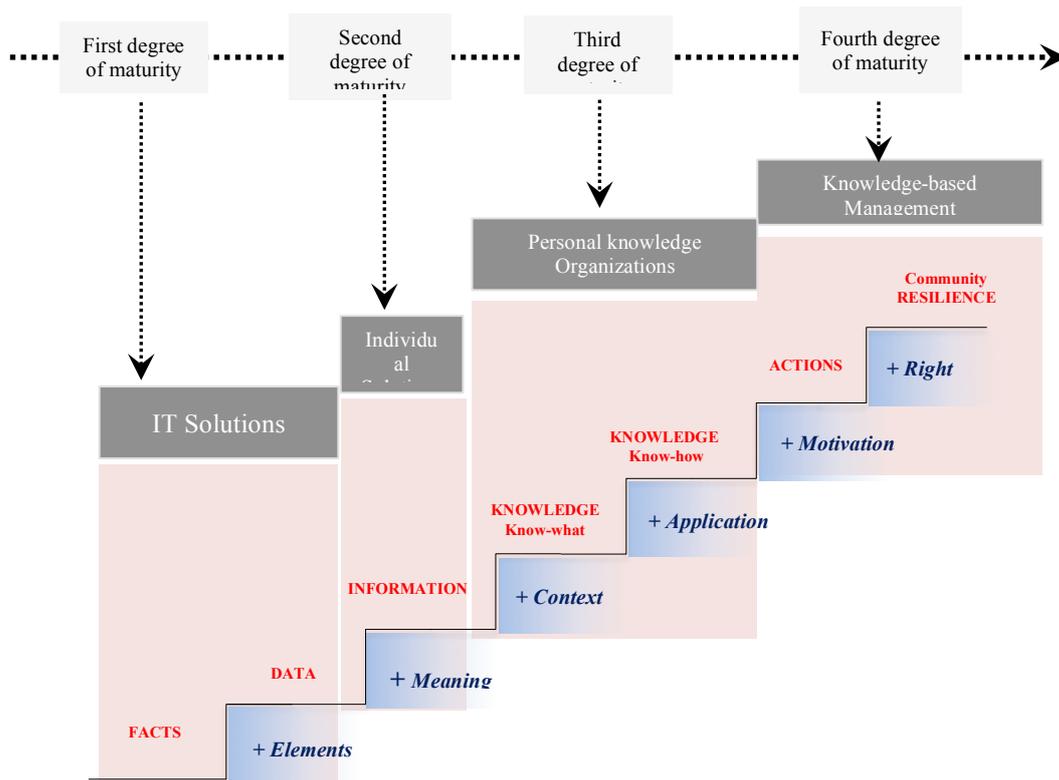


Figure 10. Degree of maturity of knowledge-based management. Modified from North & Kumta (2014).

More specifically, North & Kumta (2014) introduced the knowledge maturity model, which was based on the idea that knowledge management could help understand the interrelationship of knowledge within a community’s actions. The knowledge maturity model also provides a common understanding of the terminologies involved in knowledge based management implementation (see Figure 10).

The model is divided into four levels of maturity of knowledge. This model could explain the recognition of knowledge that has evolved in a community. Level four represents an ideal condition that is achieved by deeply shared values, teamwork, active exchange of knowledge among a group of people, active search for innovation, and an open and trustworthy culture (North & Kumta, 2014). Another major tsunami could happen at any time (Bryant, 2014; McAdoo et al., 2006) in the future, so

indigenous knowledge needs to be integrated into the entire early warning system through a local understanding of risks. A successful application of indigenous knowledge can allow locals to recognize the emerging threat in sufficient time to take informed action, thereby reducing risk and mobilizing appropriate responses and actions for the entire community, with the great benefit of reducing loss of life. Indigenous knowledge has a significant role in local communities, including how to manage dynamic interactions in community systems that move from the level of individuals' "know-how" to individual and community-level action.

## Chapter 3

### Research Analytical Framework and Methods

#### 3.1 Introduction

The analytical framework in this study is constructed by taking into account the context of the knowledge that is in the community. IK grows and develops as a way of making community decisions in response to repeated natural phenomena (Posey & Dutfield, 1996). IK grew out of past experience and was kept traditionally through this cultural (Posey & Dutfield, 1996).

The analytical framework in this study is based on the consideration of the development process of knowledge in the community. It emphasizes historical records of earthquakes and tsunamis which occurred in the Simeulue Island with a focus on the development process of the *Smong* story and how the community translated the natural phenomena through action.

#### 3.2 The Analytical Framework

Gaillard & Mercer (2013) set up a road map as a framework for integrating knowledge and action in DRR. They also justify that indigenous knowledge and scientific knowledge are all valuable and compulsory to sustainable DRR.

Figure 11 outlines a framework for integrating knowledge, actions and stakeholders for DRR. This framework emphasizes a starting process which integrates assessment of disaster risk based on different knowledge forms, then establishes

multi-stakeholder dialogue in issues and potential solutions, which lead to the final actions (Gaillard & Mercer, 2013a). The Gaillard and Mercer framework proposes away to reduce the gap between knowledge and action.

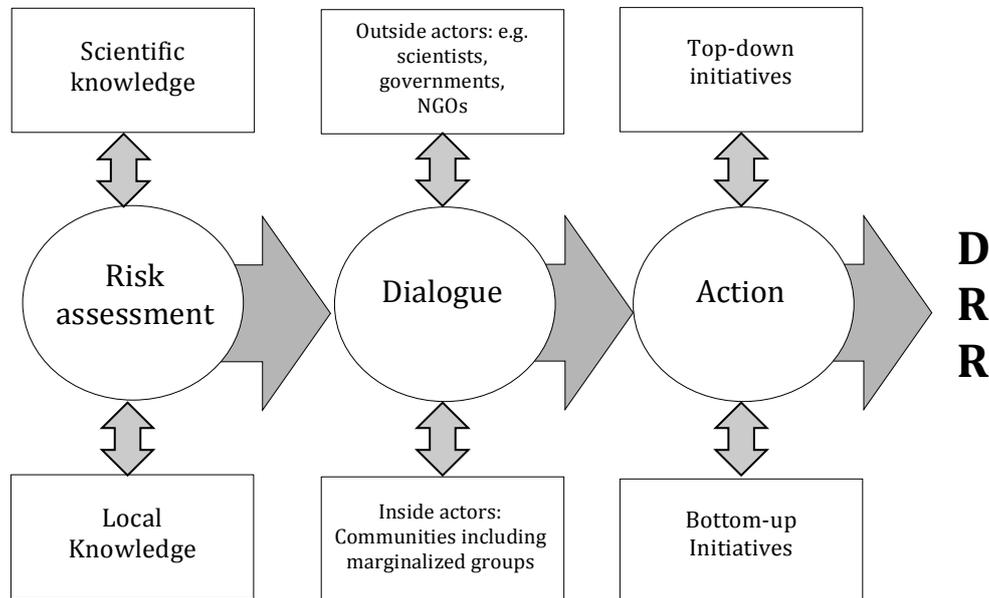


Figure 11. Framework for integrating knowledge, actions and stakeholders for disaster risk reduction. Adapted from Gaillard & Mercer (2013).

Generally, the framework is divided into three key players: the local community where the IK was developed, embedded and implemented; the outsiders who are related and interested in the *Smong* story; and the facilitator who bridges between the community and outsiders. The analytical framework in this study can be seen in Figure 12, and specifically how the framework was adapted to the *Smong* case can be seen in Figure 13. The framework describes the interrelationship of disaster experiences which were accepted and accumulated as IK within the community.

The framework describes the interrelationship of disaster experiences which accepted and accumulated as IK within the community. The accumulated of IK is also perceived and worked well in saving lives in the next event of disaster or probably forgotten by some of generation due to the lack of IK transmission.

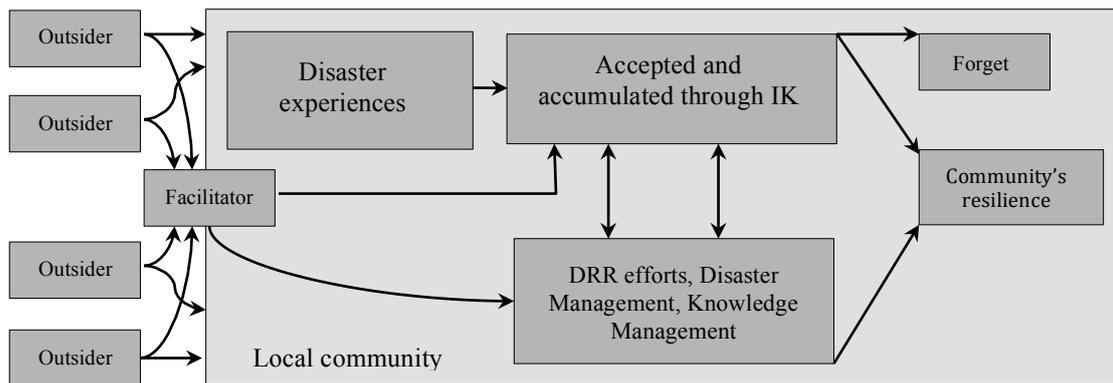


Figure 12. The analytical framework of indigenous knowledge toward community's resilience.

Many approaches have been constructed to reduce the worst impact such as disaster management, knowledge management for DRR, disaster education, etc. The IK could be potentially lost because of compromises in the culture, relocation of people, and separation of community members. So IK should be improved in the entire range of DRR efforts.

The analytical framework in Figure 14 shows specifically the development process of the *Smong* story as IK. The interactions among data, analytics, and the roles of the knowledge through actions were introduced by John S. Edwards and Taborda 2016, who constructed the knowledge in society framework. From a strategic risk management point of view, the analytics can be used as a bridge to reduce uncertainty and make a decision with better knowledge (J. S. Edwards & Taborda, 2016).

The processes of a *Smong* story from the analytical framework that could be seen in Figure 14 include the following: received, perceived, stored, transmitted, used and refined through the appropriate action and or forgotten. The analytical proposes a transformation of information into an attitude based on the earthquake and tsunami experiences and their ability to make the right decisions and take appropriate actions during 2004 Indian Ocean Tsunami.

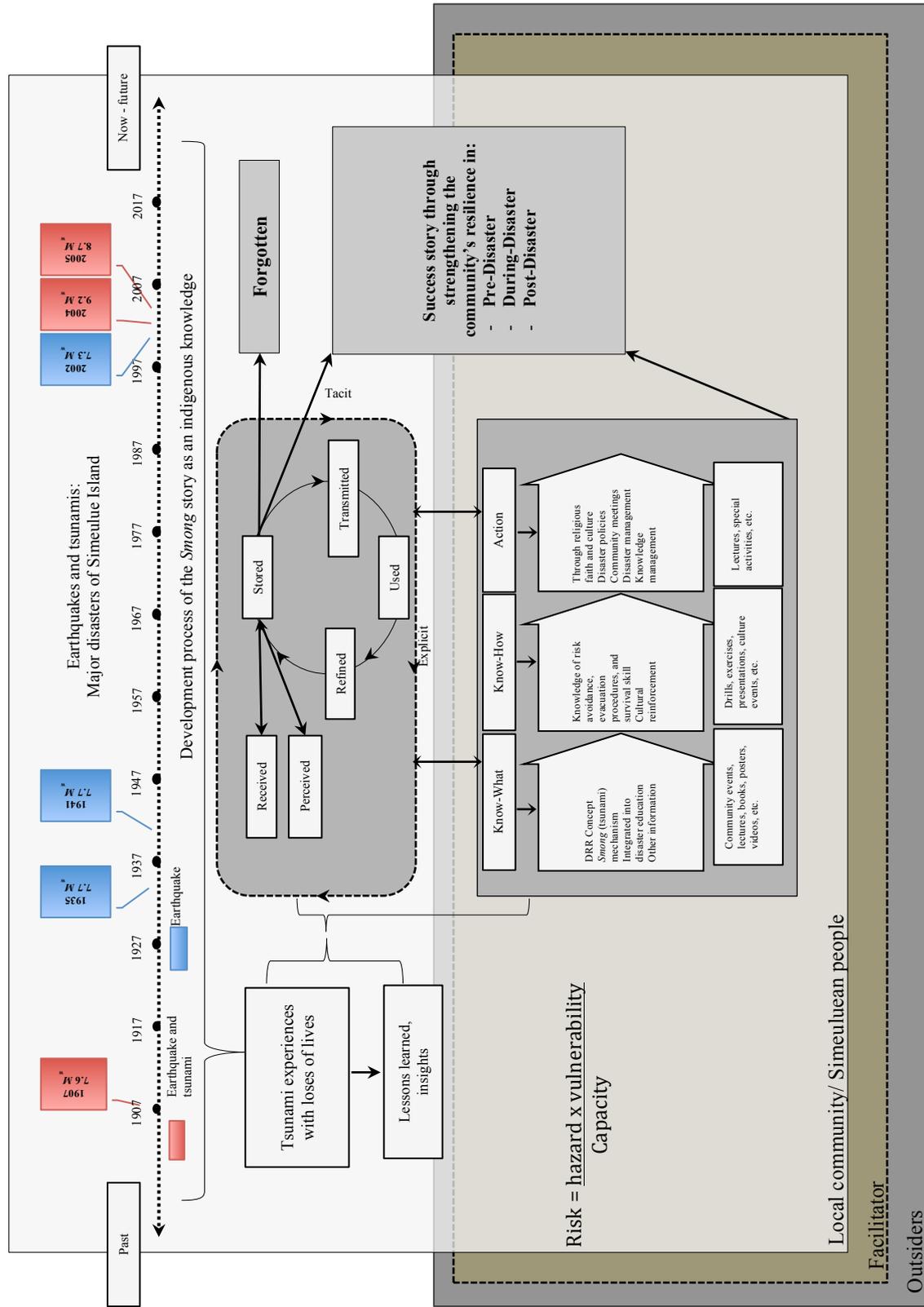


Figure 13. The analytical framework of the development process of the Smong story toward community's tsunami resilience

Table 7. Key Terms of the Analytical Framework of the Development Process of the *Smong* Story toward Community's Resilience

Term	Description
Community Resilience	The community's capacity to adapt, reduce, manage, and recover from the worst impacts of hazards by utilizing local resources with the appropriate and actionable decisions in pre-disaster, disaster, and post-disaster phases
Local Community	The shared knowledge base for the relevant knowledge (i.e., <i>Smong</i> ) because all members possess certain knowledge
Facilitator	A stakeholder who has the ability to manage the knowledge base, take responsibility for establishing and maintaining the knowledge base, and facilitate communication between the community and multiple stakeholders and outsiders.
Outsiders	The people who also possess relevant knowledge that could be used by the community, including technology, formal curriculum, and information and communication technologies
Present–Future	The conditions after the 2004 tsunami and ways the community prepares itself to face future tsunamis
Know-What	The knowledge resulting from interiorizing information
Know-How	The transformation of knowledge into skills or applications
Action	The abilities or attitudes needed to make decisions and take action using knowledge-based skills
Risk	The probability of tsunami events and their negative consequences affecting the community
Hazard	A tsunami event that may have negative consequences for the community.
Vulnerability	The community's assets, systems, circumstances or characteristics that make it susceptible to the damaging effects of tsunami hazards
Capacity	The combination of all the strengths, attributes, and resources available within the community that can be used to achieve goals for managing tsunami risk
Tacit Knowledge	The knowledge, ideas, and experiences that people have in their minds, which are difficult to access because this information is often not codified and may be hard to express
Explicit Knowledge	Knowledge that can be readily articulated, codified, accessed, and verbalized and then easily transmitted to the others.
Pre-Disaster	The appropriate decisions and actions before a disaster that reduce the potential for human, material, or environmental losses caused by tsunami hazards and ensure that these losses are minimized

	when disasters strike
During Disaster	The appropriate decisions and actions when disasters occur
Post-Disaster	The appropriate decisions and actions after tsunami events so that the community recovers effectively to face challenges and support each other and “building back better” efforts
Present–Future	The conditions after the 2004 tsunami and ways the community prepares itself to face future tsunamis
Received	The way of <i>Smong</i> story received by the Simeuluean people
Perceived	The transformation of <i>Smong</i> story perceived by the Simeuluan people
Stored	The media where the <i>Smong</i> story stored
Transmitted	The way of <i>Smong</i> story has been transmitted to the community
Used	The way of <i>Smong</i> story has been used among the community

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The analytical framework of the development process of the *Smong* story toward the community’s tsunami resilience, and the explanation of terms are given in Figure 13 and Table 7. The analytical framework begins with the community in which the platform for the *Smong* exists over numerous generations. The community provides the basic knowledge. The earthquake and tsunami experiences have been formulated through communal recognition on how the members of a community received, perceived, stored, transmitted, used, and refined the natural phenomena. This recognition translated into the *Smong* story terms to describe the natural phenomena itself.

Another important element is understanding the ways that the community defines risks, recognizes and interprets risks, and communicates these risks to its members.

This framework puts the *Smong* in a more strategic view as an IK that recognized by the Simeuluean people. Knowledge is most effective when linked to a community’s needs (Edwards & Tabor, 2016). Knowledge for implementing risk-reduction activities at the individual, household, community, and policy levels should

be the ultimate target, keeping in mind that building a culture of safety and resilience requires time, effort, resources, and continued cooperation and understanding (Kaklauskas et al., 2009). This calls for the application of knowledge and behavioral change on disaster risk promotion and information strengthening and dissemination on disaster risk and safety actions.

Additionally, the analytics process of knowledge has the potential to be part of improvement and development in the community's process and strategy (Edwards & Taborda, 2016) through its resilience. In this study, community resilience could be strengthened if the community develops its capacity to make suitable decisions and appropriate actions when facing traumatic events. In the process of adapting their tsunami experiences and lessons learned through the *Smong* story, the Simeuluean people could also strengthen their community's resilience against tsunami.

### **3.3 Methods**

The qualitative research, followed quantitative research were used in this study. The qualitative research steps taken in this study are as follows: developing and modifying theory, collecting data, elaborating or refocusing the research questions, analysing data and identifying and dealing with validity threats. These steps are usually happening more or less simultaneously, with each influencing all of the others (Maxwell, 2008; Yin, 2013).

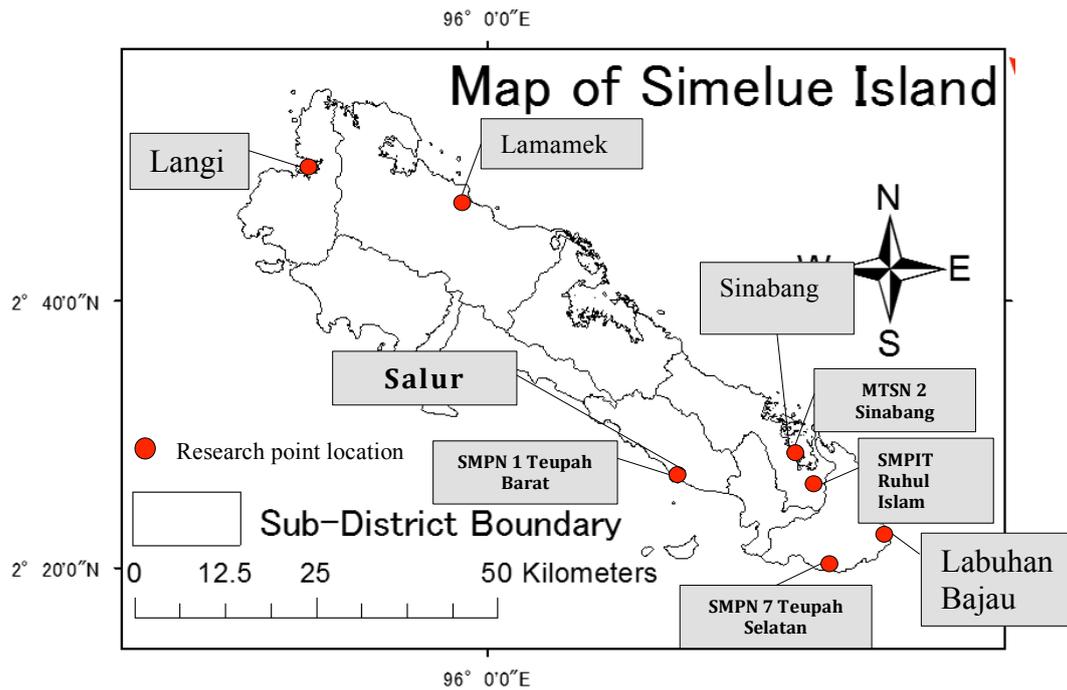


Figure 14. Map of research point location

The research locations were conducted in different villages in Simeulue Island, namely Sinabang, Salur, Lamamek, Labuhan Bajau, and Langi, where each represents a local language and the oldest villages affected by both the 1907 and 2004 tsunamis (see Figure 14). The questionnaire surveys were passed out in 4 schools: the SMPIT Ruhul Islam, which represents a school located in a non-affected tsunami area; and the MTSN 2 Sinabang, SMP 1 Teupah Barat and SMP 7 Teupah Selatan, which represents a school located in the tsunami affected area.

The study continued series of field surveys in collecting data including interview, and questionnaire survey. The both primary and secondary data sources were also included from research field. Table 8 summarizes its detail.

Table 8. Field Survey and Time Schedule

No	Time	Research Topic	Activity
1	September - October 2016	The research permission and the preliminary research survey and interview	Collect the primary data and interview related persons: <ul style="list-style-type: none"> <li>• Bupati (District Leader) of Simeulue</li> <li>• BPBD (Disaster Management Agency) of Simeulue</li> <li>• Department of Education of Simeulue</li> <li>• MAA (Adat Aceh Board) of Simeulue</li> <li>• MAA (Adat Aceh Board) of Aceh Province</li> </ul>
2	January - February 2017	<i>Smong</i> story development on the 1907, 2004 Earthquakes and tsunamis	Interview with: <ul style="list-style-type: none"> <li>• Former Bupati who served from 2001-2006</li> <li>• Interview with 25 interviewees</li> <li>• Interviewed the local</li> </ul>
3	July - August, 2017	<i>Smong</i> story development and recognition on the person (students) who did not experience the 2004 tsunami	Deliver questionnaire survey to 100 respondents in several Junior High Schools: <ul style="list-style-type: none"> <li>• SMPIT Ruhul Islam</li> <li>• MTSN 2 Sinabang</li> <li>• SMPN 1 Teupah Barat</li> <li>• SMPN 7 Teupah Selatan</li> </ul>

The interviewees who participated in this study were approached with the purposive sample. The purposive sample was used in this study and involves developing an analytical framework that influences an individual's experiences, and based on the researcher's practical knowledge on the research area, the available literature and evidence from the study itself (Marshall, 1996).

The local government also released the research permission document to help the study communicate with the interviewees, schools and community leaders and in collecting data. The community's key people and the principals were the partner's facilitator in recruiting the interviewees and respondents.

The in-depth interview was conducted in this study to collect the primary information from related persons. Even though the in-depth interview is open-ended, but still provides a general script and cover a list of topics. This technique is appropriate because only have limited opportunity to reconfirm the data to the interviewees and has to deal with complicated bureaucrats. This technique also gives this research an ability to formulate questions spontaneously during the interview (Kothari, 2004).

Several related person had to be identified in order to capture diverse points of view and obtain as much information as possible about the earthquakes, tsunami which frequently occurred in Simeulue Island and how the Simeuluean people dealt with the event. The related person identified for the interviews were from local government, community leader (see Table 8).

The next stage of this study was interviewed twenty-five of interviewees using ethnography approach. Ethnography was used in the current study defined as the process of finding out about how people live “in their words,” that is, as told from an inside rather than observer or researcher perspective (Flick, 2014; Hall, 2011; Maykut, Maykut, & Morehouse, 1994).

Interview in ethnographic require kinds of ethnographic questions that could be mixed with descriptive and structural questions. The structural questions were arranged according to several topics: The objectives and contents of research were briefly presented and explained. The interviewee was questioned about his/her daily activity and his/her role in the community. The interviewee was questioned about his/her experiences with the previous tsunami and the impact that had been observed by the interviewee during and after the event. The next section was directed toward the *Smong* story recognition and how much the interviewee knew about the *Smong*

story. The interviewee has also questioned the *Smong* story channels, shared and how it had been worked in the 2004 tsunami. Finally, the interviewee was given the opportunity to give his/her recommendation on the future of the development of the *Smong* story.

The interviewees confirmed their willingness to participate in the study. This study was also concerned with cultural insensitivity because of Aceh's history, including the more than 30-year conflict between the Free Aceh Movement (FAM) and the Indonesian armed military. Cultural insensitivity was heightened also because, during the rehabilitation and reconstruction process after the 2004 Indian Ocean tsunami, prospective donors collected data from the community and promised many programs, but never fulfilled those promises. So the current study did not ask the interviewees (group A and group B) to sign any documents.

The development of the *Smong* story preliminary interviewed result was used in constructing a questionnaire survey to address the recognition of the *Smong* story to the Simeuluan people who did not experience the 2004 tsunami.

Four Schools were participated in questionnaire survey. In order to achieve useful results and based on the availability of potential respondents, the initial sample size for the questionnaire-based was set at twenty-five respondents from each school. The questionnaire survey was taken 1-2 hours for each school.

Participation in this research was totally voluntary, and the participant's personal information has been kept confidential and undisclosed. In the case of publication or public discussion, the participant's personal identity was carefully protected to prohibit anyone from being able to identify the participant.

For the respondents under 18 years old, the research had the approval of the school's principal, and the student participants were approached and appointed by the

schools' staff. If participants felt any discomfort recalling their experience of the disaster, any kind of local issues or pressures, they could refuse to answer certain questions or withdraw from the interview entirely, at any time. A research consent form was provided and signed by both the schools and the students.

The study conducted on the conviction that children by Alderson & Morrow, (2011) and Einarsdóttir (2007) shows that children have views and perspectives, competencies, the right to be heard and spoken for themselves. They should be approached with appropriate methods such as ethical issues related to consent, confidentiality, rules, and interactions.

The analysis of the interviewed results aimed to enhance result and fill the gap and also to confirm the information that had already been collected. The recorder of the interviews was partially transcribed and choosing the essential and related information for the study. The data were identified through open coding data analysis (Creswell & Poth, 2017; Elo & Kyngäs, 2008; Hsieh & Shannon, 2005). Coherence and thematic content were considered core elements when looking for the similarities among the data (Vaismoradi, Turunen, & Bondas, 2013). Some incomplete transcription was then sent to the interviewee to let them know whether something should be added, changed and modified.

The selected and related topics were analyzed by elaborating narrative, situational and descriptive analysis. A narrative must have a progression of time, trouble, and context (Greenhalgh & Hurwitz, 1998; Kreiswirth, 2000). A narrative is an act of description and explanation in story form, consisting of a beginning, middle, and end (Danto, 1982). A narrative is a practical approach to understanding the complexity of society (Tsoukas & Hatch, 2001) and the narrative analysis can aid the

comprehension of a previous event and give insights into the current situation (Cortazzi, 2014).

A situational analysis allows a researcher to draw on studies of discourse and structure, image, text and context, history, and the present moment (Clarke, 2003, 2005; Flick, 2014). In the current study, the situational analysis helped in seeing the history, situation, and environmental changes that contributed to influence the *Smong* story. In the context of this study, the narrative analysis and situational analysis were put together as a reflection and narrated lived experience of the interviewees. The questionnaire survey results were analyzed by using statistic descriptive. Finally, the main findings were summarized and conclusions derived.

## Chapter 4

### The Simeulue on the History, Earthquakes, and Tsunamis

#### 4.1 Geography and Sociodemography of Simeulue Island

Simeulue belongs to Aceh Province, Indonesia as one of District (see Figure 15). The Aceh province covers five municipalities and eighteen districts, consisting of four parts (two municipalities and one district), west-southern coastal area (seven districts) including Simeulue, east-northern area (two municipalities and six districts), and inland area (one municipality and four districts) (Iwasaki & Rahman, 2017).

Simeulue is located 105 miles north of Meulaboh, West Aceh at  $2^{\circ}15' - 2^{\circ}55'$  north latitude and  $95^{\circ}40' - 96^{\circ}30'$  east latitude (BPS Simeulue, 2016) (see Figure 15). Simeulue is a group of islands that comprise more than 147 large and small islands.

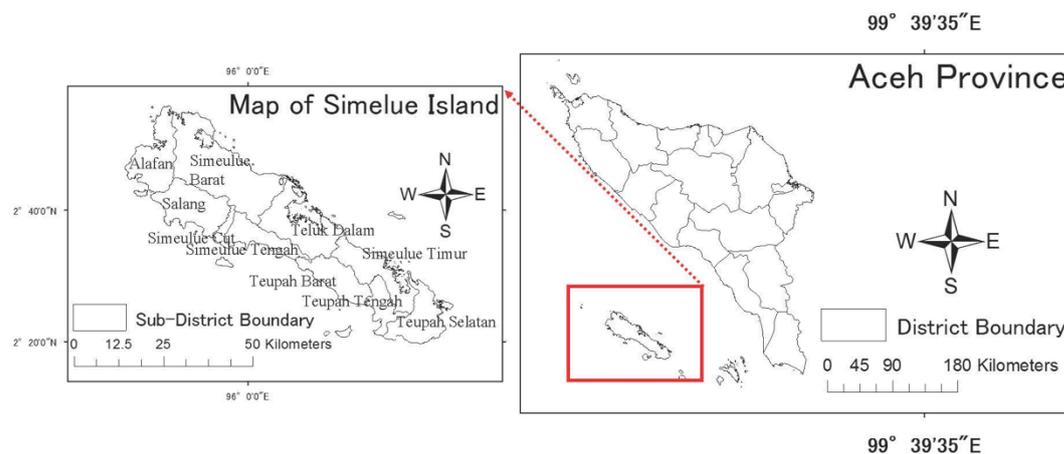


Figure 15. Map of the Island of Simeulue and the Aceh Province.

The largest island is called Simeulue, and more than 90% (88,335 people) of the archipelago's total population lives there. Simeulue's total area is 1,838.09 km<sup>2</sup> (BPS Simeulue, 2016).

The length of the island is around 97.5 kilometers and stretches to 15.8 kilometers. Simeulue Island's topography consists of mountainous areas and flat land. Small hills are commonly found 100–200 meters away from the shore. These hills served a significant role in the massive evacuation during the 2004 tsunami (Sanny, 2007). According to 2016 statistics, more than 99.74% of Simeulueans are Muslim, meaning their culture is influenced by Islamic values (BPS Simeulue, 2016).

The distribution of population and households in Simeulue's Timur sub-district is 26,785 inhabitants and 6,986 households (BPS Simeulue, 2016). This is because of Sinabang, located in the Timur sub-district, is the capital of Simeulue, and most central business activities exist there.

In general, the tropical equatorial climate dominated by the high rainfall can be found in every major in Simeulue Island. The Simeulue rainfall is 3,350 mm/year which above of Indonesia rainfall average 2,000 mm/year. In 2015 there were 253 days of rain (BPS Simeulue, 2016) which means almost every day was raining. The weather in Simeulue Island is scrubbed by two seasons. Firstly, the west season is started from September to February which indicated the frequency of rain, storm and triggered the big wave. Secondly, the east monsoon which started from March to August and indicated by interspersed drought, but the rainfall could occur at low frequencies.

No record can be found concerning the origin of the Simeuluean people. Most of the inhabitants can trace their ancestry back to various parts of Indonesia such as Sumatra, including Aceh, Minangkabau, Nias, and Tapanuli, while others are

presumed to be from the land of Bugis in South Sulawesi and Java (Baumwoll, 2008). The people consider themselves Simeuluean (orang Simeulue), even though various ethnic groups have been assimilating and creating their cultures on the island over the last hundred years.

According to 2016 data released by BPS Simeulue (BPS Simeulue, 2016), 73.86% of the people are identified as not yet working, not working, students, or another business sector, and 12% of the population consists of farmers or planters, 1.07% of agriculture-laborers, 5.51% of entrepreneurs, 2.36% of fishermen, 3.6% of civil servants, and 1.7% of honorary. Surprisingly, even though 108 out of the 138 villages are coastal communities, only a slight percentage of the population obtains its income from fishing. The greater portion of the population earns its livelihood from agriculture.



Figure 16. The Siemeuluean old man was drying and keeping cloves traditionally in front of his house in Sibigo village, Simeulue Island. The photo was taken on January 16, 2017.

In spite of the wide of fishing area in around Simeulue extent to 305,000 Hectares but the contribution of fishery sector on the economy Simeulue just only reached 3%

(BPS Simeulue, 2016). The Simeulue territory is the largest fishing area compare to another district in Aceh Province territory. The fishery commodity has the high economic value such as Kerapu Fish, Tuna, Cakalang, Lobster, Kelong Crab, etc. The cultivated seaweeds and shrimps could also be found as another commodity.

The land field crop is a prime sector in Simeulue. The Simeulue Island is also known as the high quality of clove producer. In 1970-1980 clove had become a prime commodity in contributing to Simeuluan prosperity and as a main economic mover in the whole of Simeulue Island. But it started downfall since the international clove price tends to be unstable and decreased. In 2003, the price condition still unstable and the wide of clove plantation is about 16,868 hectare with the total production reached 3,000 tons (Sanny, 2007).



Figure 17. The Siemeulue Bulls.  
The photo was taken on January 14, 2017.

The Simeulue Island is famous for the Simeulue Bull habitats. The Bull breeding is still in traditional system and trade in Sumatera areas by shipping to Sibolga city. The Simeulue Bull is not only crucial in economic sector but also for social status and culture.

## 4.2 Simeuluean History

### 4.2.1 Simeulue under period of Aceh Kingdom

Islam entered this area during the 17th century. In this period, the history of the Simeuluean people cannot be separated from the history of the Kingdom of Aceh Darussalam (Sanny, 2007).



Figure 18. The remained of first mosque pillar in Salur village, Simeulue Island. The photo was taken on January 13, 2017.

Most Simeuluean scholars believed that the first time Islam entered Simeulue was by Tengku Di Ujung (Halilullah). Halilullah originally came from Minangkabau, West Sumatera. Sanny (2007) mentioned that when Halilullah on his way of the hajj pilgrimage to Mecca, he went to the Aceh Darussalam Kingdom. Sultan asked him to postpone his trip and asked him to spread Islam in Simeulue Island. He was also married the local leader daughter to get more natural to part of the local and delivered Islam easier. Halilullah taught Islam to the Simeuluean people wisely and peacefully. Most of Simeuluean accepted Islam as a new religion. Since that time, the Islamic value had been rooted and acculturated to Simeuluean society.

Sultan Mahmudsyah II, who ruled the Kingdom of Aceh Darussalam from 1767–1787, was presented eight stones. The Simeuluean people named the stones *Sandi Salapan*, which means eight pillars. The first mosque was built in Salur village using the stones as pillars for the mosque. The mosque experienced the 1907 and 2004 tsunamis. One of the stones was missing when the 1907 tsunami destroyed the mosque.

#### **4.2.2 Simeulue under period of Dutch colonialism**

Dutch colonialism of Simeulue Island started in 1901. It was a little bit late compared to when the Dutch colonial government tried to conquer the mainland of Aceh. The Aceh War started in 1873 and ended in 1904. However, the fight was still going on in some of the remote areas from time to time (Agur, 2007). The local government was even helping the Dutch maintain control over Aceh by way of indirect rule.

#### **4.2.3 Simeulue under period of Japan invasion**

The Dutch admitted to Japan in World War II. During the Japanese invasion of Simeulue, the government left by the Dutch remained unchanged. The difference was only the term should be fitted to the Japanese rule.

The invasion of Japan in Simeulue faced no fight from Simeuluean people. The jargon made by Japan that Japan was there to help Indonesia to come out of colonialism; Japan was the older brother had attracted the sympathy from the Indonesian people including Simeuluean people.



Figure 19. One of the Japanese fortresses which were built during colonial times in Simeulue Island that survived and remained from the 2004 Indian Ocean tsunami. The photo was taken on August 3, 2017.

Japan established a regiment consisting several battalions and also recruited and trained the youth to be military troops of PETA, Heiho, Gyugun, Kaygun and Tokobetsu (Agur et al., 1996). The Japan made Simeulue Island as one of the strategic Island to defend from the allied forces (Agur et al., 1996; Sanny, 2007). The remained of Japanese fortresses could be found in several parts along Simeulue Island coast (see Figure 19).

#### **4.2.4 Simeulue under period of Indonesia independent**

On August 17, 1945, Soekarno and Hatta proclaimed Indonesia an independent country. But the Siemuluean people received the news of independence on September 25, 1945, by the way of a letter from Tapak Tuan (Agur et al., 1996). After Indonesia was declared as an independent country, Simeulue was placed in the Aceh province.

The Aceh province was affected by an armed conflict between FAM and the armed military of Indonesia from 1976–2005. The long-winded dispute was a

conflict paid in blood and fear which ultimately cost at least 1,258 – 2,000 had been killed (Schulze, 2004), some estimated more than that's number. As a consequence, the Indonesian government declared martial law and restricted travel. The violence overwhelmed the stability and security of the Province.

Here, it is fundamental to understand people's response to the disaster. Even the conflict not much affected the development of Simeuluean culture if compared to the situation in the mainland of Aceh (Rahman et al., 2017), the influenced of conflict still could be identified in the Simeulue island. For example, some of the inhabitants associated the sound of the tsunami to the sound of a gun. This probably answers why the *Smong* story survived in most Simeuluean people's memories (Rahman et al., 2017).

#### **4.3 The History of Disasters through the *Smong* Story**

The 2004 earthquake and tsunami was not the first event to strike Simeulue. There were some big events before, some of them being similar to the 2004 earthquake and tsunami (Rubin et al., 2017; Whitlow, 2008). Simeulue Island experienced tsunamis in 2005, 2004, 1907, and 1881 (Whitlow, 2008). Surprisingly Rubin et al. (2017) describe an extraordinary 7,400-year stratigraphic sequence of prehistoric tsunami deposit from a coastal cave in Aceh. His study record demonstrates that at last 11 prehistoric tsunamis struck the Aceh coastline between 7,400 and 2,900 years ago.

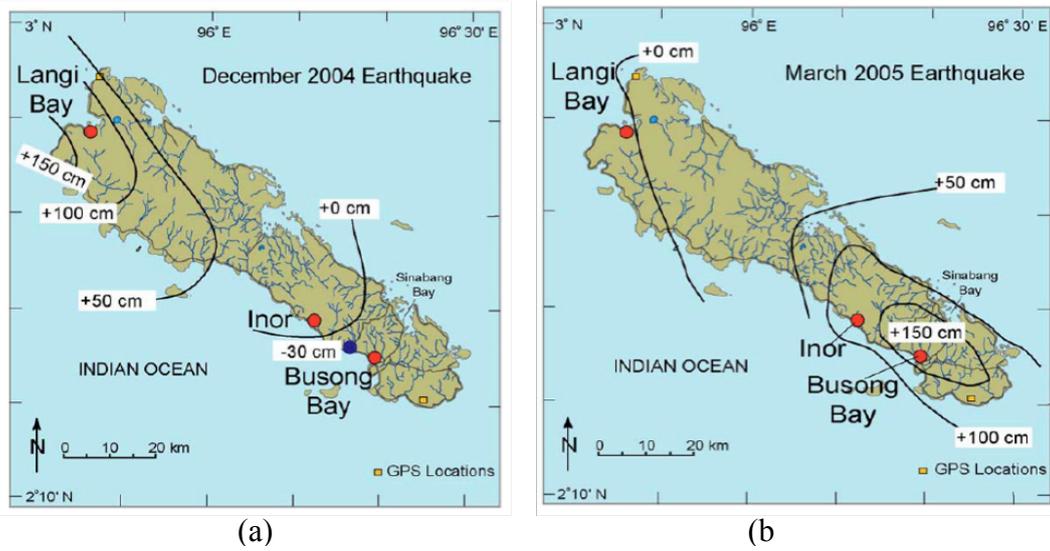


Figure 20. The uplifts caused by Earthquakes in Simeulue Island (a) Uplift associated with the December 26, 2004, (b) Uplift associated with the March 28, 2005, earthquake on the island. Adapted from Briggs et al. (2006) in Whitlow (2008).

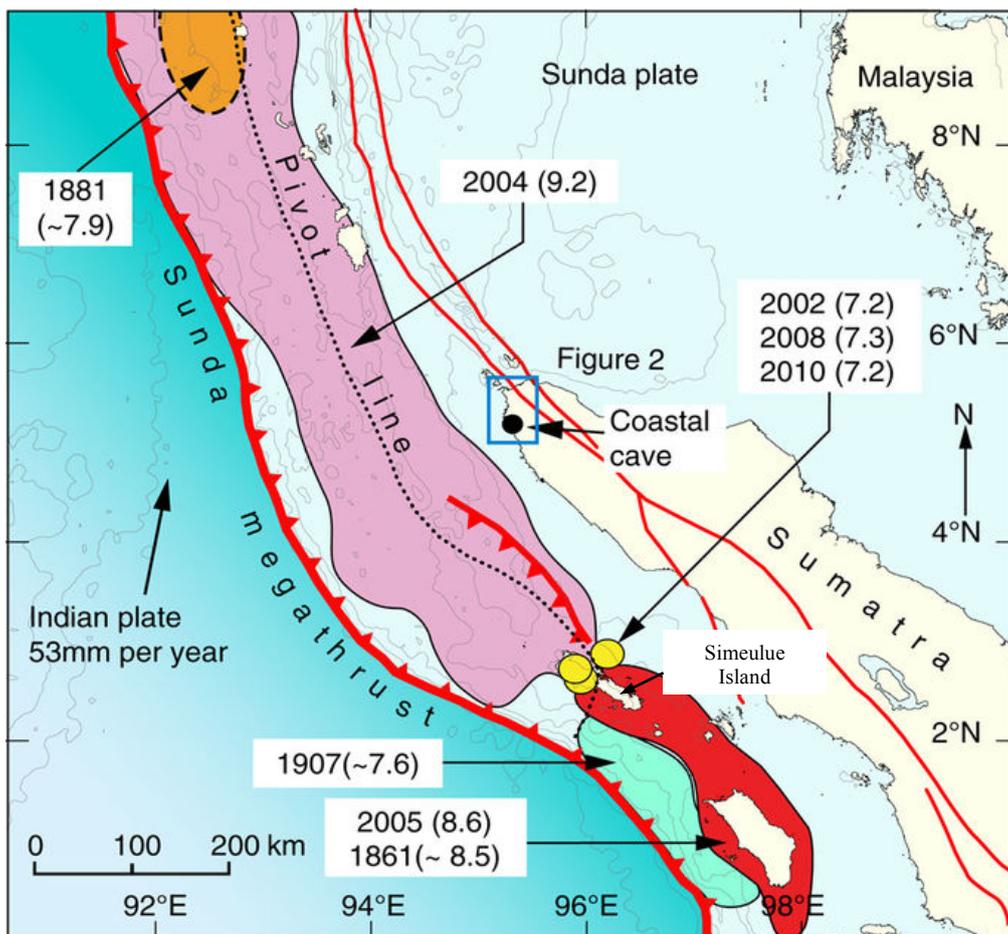


Figure 21. Tectonic setting and ruptures of major earthquakes along the Simeulue Island. Source: Rubin et al. (2017).

Table 9. Summary of Megathrust Earthquakes Near Simeulue Island between 1800 and 2005

Date	Latitude (°)	Longitude (°)	$M_w$	Rupture Length (km)	Description
Monday, 28 March 2005	2	96.8	8.7	~400	The estimated tsunami's highest level was 1.5 meters, no victims (BRR, 2005, 2009c; Whitlow, 2008)
Sunday, 26 December 2004	3.2	95.8	9.2	~1600	The earthquake and tsunami occurred, and three people were killed. The estimated highest level of the tsunami was 10–20 m (Sanny, 2007; Whitlow, 2008)
Saturday, 2 November 2002	2.8	96.1	7.3	~70	Many people prepared to evacuate. However, they did not see the seawater recede, so the people remained in their homes (no tsunami) (Baumwoll, 2008; Whitlow, 2008)
Thursday, 26 June 1941	12.1	92.5	7.7	-	-
December 1935	0.3	98.3	7.7	-	-
Friday, 4 January 1907	2	96.8	7.6	~65	The estimated highest level of the tsunami was 10–20 meters. It devastated almost all of Simeulue's coastal area and 50–70% of the population died (Sanny, 2007; Whitlow, 2008)
31 December 1881	9.3	92.5	7.9	-	-
16 February 1861	2	96.8	8.3–8.5	~400	The tsunami's deposit was found in several areas around Simeulue Island (Whitlow, 2008)
31 October 1847	7	-	> 7.5	-	-

*Note.* Adapted from Whitlow (2008)

The average period between tsunamis is about 450 years. The multiple tsunamis have been devastated along the Indian Ocean including Simeulue Island (see Figure 21).

On March 28, 2005, another major earthquake  $M_w$  of 8.7 struck the nearby islands of Nias in the Indonesian province of North Sumatera. The proximity of this earthquake, a result of two tectonic plates rupturing and slipping a length of 350 km directly beneath Simeulue Island, resulted in massive damage to infrastructure (BRR, 2005). Simeulue Island is alleged to have sunk 1 meter as a result of the 2004 earthquake and tsunami and then risen (uplift) 2 meters because of the 2005 earthquake (BRR, 2005; Whitlow, 2008).

The history of the *Smong* story begun when an earthquake  $M_w$  of 7.6 hit Aceh in 1907; the following tsunami devastated the Simeulue coastal area. Some assumed that the word *Smong* had been recognized before the 1907 tsunami (see Table 9) but failed to save Simeuluean people. As a result, only 30% of the population survived. The 1907 tsunami is categorized as a dark period in Simeuluean history. The Simeuluean ancestors decided to memorize the *Smong* as lessons learned in interpreting natural phenomena.

The word formation for *Smong* might have been achieved by an onomatopoeic linguistic technique because it is very close to a nasal sound, which can be associated with the sound of a wave (Sanny, 2007). The word “*Smong*” is derived from the *Devayan* language and means the splash of water or a tidal wave. *Smong* has been associated with this type of event or could translate as the seawater rough the land. The word also has been assigned to tsunami.

Most of the Simeuluean people associate the word *Smong* with the phenomena that follows a strong earthquake, the receding sea water, and the big wave that sweeps across the land (Baumwoll, 2008; Syafwina, 2014). After the 2004 tsunami, this phenomena was confirmed by most of Simeuluean people when asked if they knew what the *Smong* was (Baumwoll, 2008; Syafwina, 2014).

## Chapter 5

### Findings

#### 5.1 The Research Group Categorize Results

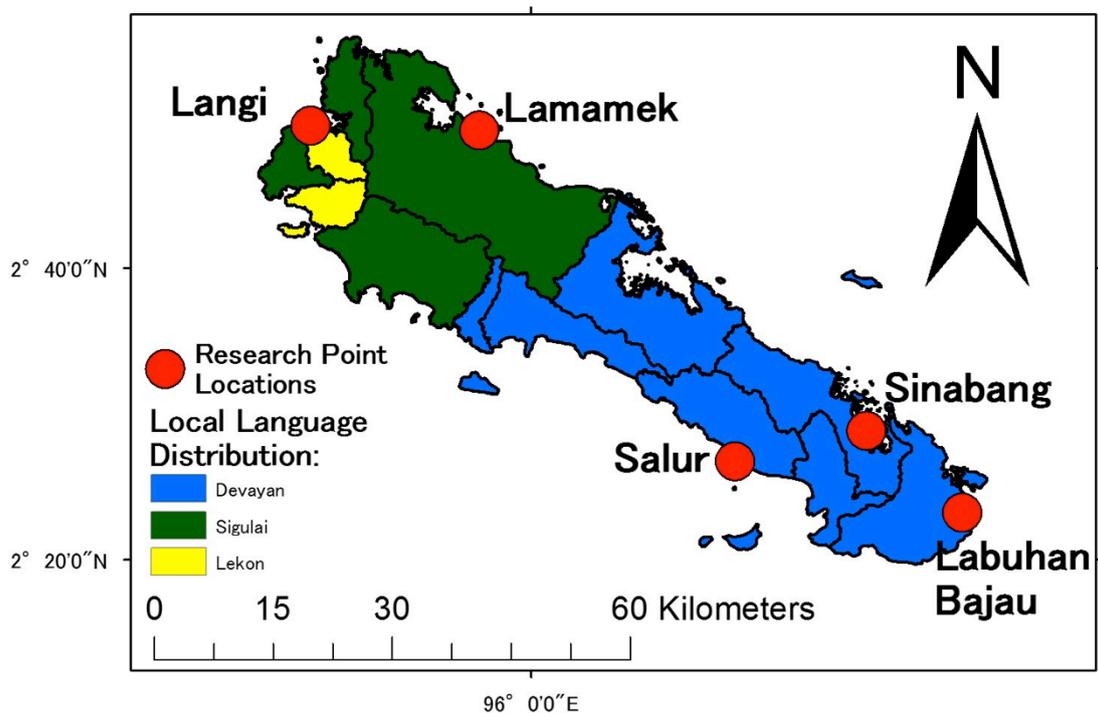


Figure 22. Map of the island of Simeulue showing the research locations of the interviews and the distribution of local languages.

The results shows that Simeuluean people was diversified with several languages, namely *Devayan*, *Lekon*, *Sigulai*, *Bahasa Aceh*, and *Aneuk Jamee*, but the three core languages that have been rooted, recognized, and developed in the Simeuluean people for a long time. First, the Simeuluean people who are using the *Devayan* language can be found in sub-districts of Simeulue Timur, Simeulue Tengah, Simeulue Cut, Teluk

Dalam, Teupah Selatan, Teupah Barat, and Teupah Tengah. Second, the Simeuluean people who are using the *Sigulai* language can be found in the sub-districts of Simeulue Barat, Salang, and Alafan. Third, the group people using the *Lekon* language can be found only in Langi village and Lafakha village, which are sub-districts of Alafan (see Figure 22).

The *Devayan* language has taken a primary role for communication among the local ethnic groups. More than 60% of the population uses the *Devayan* language, 35% uses the *Sigulai* language, and only 5% uses the *Lekon* language. As a result, most of the people who are using the *Sigulai* and *Lekon* languages could speak the *Devayan* language as well. So this is also a reason why the term *Smong*, which comes from the *Devayan* language, is more recognized than the *Emong* in the *Sigulai* language.

Table 10. Categorization of the Groups of Interviewees (N=25) and Respondents (N=100) Their Relationship to the 1907 and 2004 Tsunamis, along with How They Received the *Smong* Story

Group	Description	Gender		Total (N)
		<i>M</i>	<i>F</i>	
A	The interviewees who received the <i>Smong</i> story from a person who experienced the 1907 tsunami	7	3	10
B	The interviewees who received the <i>Smong</i> story from a person who did not experience the 1907 tsunami	12	3	15
C	The respondents who received the <i>Smong</i> story from others channels and did not experience and/or were born after the 2004 tsunami	45	55	100

Note. *M* = Male; *F* = Female.

Table 11. The Number (N=25) of Interviewees Group A and Group B by Location, Age, and Gender

Location	Age Range (Years-old)						Total
	≥49		50-79		80≤		
	<i>M</i>	<i>F</i>	<i>M</i>	<i>F</i>	<i>M</i>	<i>F</i>	
Sinabang	3	1	6	2	1	-	13
Salur	-	-	2	-	-	-	2
Lamamek	2	-	2	1	-	-	5
Langi	1	-	2	-	-	-	3
Labuhan Bajau	-	-	-	1	1	-	2

Note. *M* = Male; *F* = Female.

The result of this study categorized the interviewees and respondents into three groups based on the way they received the *Smong* story. The Group C distinguished from Group A and Group B because they did not experience the 2004 tsunami (See Table 10). The number of interviewees by locations, age and gender could be seen in Table 11.

## 5.2 *Smong* Story Development Processes on the 1907 and 2004 Tsunamis

The first finding showed the narrative consistency of the interviewees when they described their experiences of the 2004 earthquake and tsunami and their knowledge of the 1907 tsunami. The narrative described the interrelation between knowledge of the 1907 tsunami and the process of defining and acting. This is an essential element to access the way that the community defined, recognized, and interpreted risks, and communicated knowledge to community members.

Group A, who received the *Smong* story from a person who experienced the 1907 tsunami, could better describe the stages of the *Smong* phenomena compared to Group

B. Group A also took a role in directing the community to go to the higher places or hills when the 2004 tsunami occurred. The interviewees stated the following:

*... My father and my grandfather had experienced the tsunami in 1907. They originated from Salur village. They told me the sad story of Smong. The 1907 tsunami happened on Friday when most of the men came from several villages gathering in the mosque to perform Friday prayer. The Babussalihin mosque was the biggest and the oldest mosque in the western Simeulue island at the time. We had the pillar of eight (Sandi Salapan) here, which was present from the Aceh Kingdom in the 17th century; the pillars left seven, and one of them disappeared when the 1907 tsunami devastated this area (Sandi Salapan could be seen Fig.6). My grandfather told me if the big earthquake occurred, you must observe the level of seawater. If you find the seawater was receding, you have to go to the hill because something bad will occur from the sea and please ask people to do the same way. When a tsunami again devastated this mosque, we reconstructed it by preserving the pillar in keeping the history... (Male, Group A of the interviewees, 75 years old, the Babusalihin Mosque, Salur village)*

*... My grandmother had experienced the 1907 tsunami. She was still young when the tsunami occurred. She told me a sad story of the Smong that killed her relatives. The story began when the big earthquake, followed by receding seawater level and continuing until the big waves reached the land. She also described that many people and animals were killed. Fish were floundering on the receded seawater after the big earthquake, and many villagers were taking the fish. She continued the story by telling what should I do if the same natural*

*phenomena occurs. Don't pick the floundering fish on the beach; run away from the beach as far as possible...* (Female, Group A of the interviewees, 79 years old, Labuhan Bajau village)

Most of Group B's interviewees knew the word *Smong* but did not understand what the phenomenon was. Some of them failed to interpret the interrelationship between the tsunami phenomena and acting. The 2004 tsunami confirmed their understanding. Some of these participants stated the follow:

*... I got the story of Smong from my grandmother who took care of me; my parents were busy earning money on a daily basis. So from this situation, I had a tighter connection with my grandmother than my parents. As I remembered, my grandmother did not experience the 1907 tsunami because she did not yet exist in the world when the event happened, but her parents experienced the Smong. I think she got the story of Smong from them. I never linked the 2004 tsunami to the Smong of what I heard before. It was a little bit different from what grandmother told me before...* (Male, Group B of the interviewees, 45 years old, Sinabang)

*... The people in Simeulue Barat are using Sigulai language and call a tsunami as the Emong. Before 2004, we defined the Emong not only as the phenomena of the tsunami, but also associated it with other conditions. For example, when the long rainy season came where the water flooded and damaged rice fields, we called it Emong as well. When the wind was too bad seasons that the fishermen were not allowed to go to the sea, we also called the situation the Emong...* (Male, Group B of the interviewees, 45 years old, Lamamek, Simeulue Barat)

After 1907, the Simeuluean people were aware of the tsunami phenomena, but this led to negligence and the deformation of the central meaning of *Smong* by mixing the definition into a superstitious situation or event, which is especially seen in Group B of interviewees. Under this situation, the *Smong* story was not only referring to the tsunami, but also to various natural phenomena. Group B became unable to translate the tsunami phenomena, and the development of the *Smong* story became incompatible with tsunami knowledge and appropriately understanding this even; hence, their vulnerability increased substantially. Fortunately, Group A, who still had a direct connection with their ancestors who experienced the 1907 tsunami and told them the *Smong* story, played a role in saving people by guiding them to take the appropriate action when the 2004 tsunami occurred.

Surprisingly, an interviewee from the Group A, who lived in Meulaboh city in the West Aceh sub-district (the mainland of Aceh province) before the 2004 tsunami described his experience during the event:

*... It was a Sunday morning in 2004. I was on the beach around Meulaboh city, West Aceh when the earthquake shook the land. It was a huge shock that I never felt in my whole life. I found the seawater was receding, and fish were floundering on the beach. Suddenly, my mind jumped to the story that my grandparents had told. My mind recalled the memory in my childhood in Simeulue island that immediately after the shocks, my grandparents took time to talk of the story of Smong to me. He told us if a big earthquake occurred, and you found the seawater receding, immediately run away to a hill because something big will come from the sea. From that story, I tried to make a caution by screaming the word of Smong and asking people around the beach to run away. I*

*thought most of the people were confused, and they didn't understand, or the people thought that I'm a crazy man by shouting and screaming something strange. I decided to go home and picked my family up, run away from the coast, and we survived. Sometimes, I regretted my failure to make people convinced on my words at the time of the 2004 tsunami...* (Male, Group A of the interviewees, 50 years old, Sinabang)

From the text above, the key person who was culturally and emotionally rooted in the community proved that the *Smong* was growing up in particular culture and context. The people around Meulaboh city (the mainland of Aceh) failed to translate the word *Smong* because they never heard the story of *Smong*. This also could explain why the *Smong* story survived in the Simeuluean's memory compared to the people living on the mainland of Aceh. Even though the main ethnic group living on the coastal areas of Aceh, such as Banda Aceh and Singkil, have descriptions of the tsunami as well (Rahman et al., 2017; Syafwina, 2014).

Another dimension to trace the development of the *Smong* is the interrelation of transmission and storage. Because the *Smong* story was conveyed through an oral channel, all the interviewees mentioned that they received the *Smong* story from a story told by an older person. The transformative impact of storytelling on the listener occurs at various levels and resonates over time (Palmer, 2016) through generations.

The repeated experience of earthquakes on Simeulue Island also made the Simeuluean ancestors recount the story of the 1907 earthquake and tsunami. The cyclical pattern of earthquakes, just like other natural events, helped the community remember the *Smong* story. As an example, the earthquake of  $M_w$  of 7.3 hit Simeulue Island in 2002, two years before the 2004 tsunami; the 2002 event was an exercise or

“tsunami drill.” Group A interviewees mentioned that for the 2002 earthquake, they did not see the seawater recede seawater, so people remained in their homes (Baumwoll, 2008).

The narrative analysis also clustered the information in the way the Simeuluean people transmitted and stored the *Smong* story. According to Group A, the *Nafi-nafi* is the main media in communicating the *Smong* story through the community. Only a few people from Group B could recognize the *Nafi-nafi* as a transmitted media while others only mentioned it as a story. The *Nafi-nafi* is Simeuluean traditional storytelling about events that happened in the past. The *Nafi-nafi* is delivered in a non-particular time and context.

The story of the *Nafi-nafi* could be the story of a Simeuluean ancestor or important events that happened. At the end of the *Nafi-nafi*, the story must give insight or lessons learned as a reflection for the audience members if they face a similar situation. There are many kinds of story could be found in the *Nafi-nafi* and the *Smong* story is one of it. The story delivers in many ways for instance, after the children finish reciting the Quran, the oldest person will take the time to address the *Nafi-nafi*. An example of the *Nafi-nafi* can be seen in Figure 23.

The *Smong* story in the *Nafi-nafi* proved not only that an action should be taken when the tsunami occurs, but also that the people should bring items with them when they retreat to the hills. The items, for example, rice, sugar, light, knife, matches, and clothes, could help them. All of the interviewees in Group A identified and recognized the *Nafi-nafi* as the primary media with which to transmit the *Smong* story.

Devayan	English	Information
<p><i>Nga sao nafi nafi, Inang maso nang ere, waktu iye taon tuju. Ra angkume singa marasokan, rasesewan mek dia mai, fani manjadi pengalaman orep. Maso iye falal rima'at ngahae termasuk melafek ae. Sahuli fesang linon, mek mek lli ne ata ado raik sia ra aidek. sefelne ata ere la o da me kota, sebayang rima'at alek balanjo. fesang sa a Linon sebel. Unen unen mali Linon, saa ra enak owek asen ngang suruik, sagalo nae ngang mafete fete etakangkal angkal iyee. Daram nae iya sebagian ata ere me tot ra aleko. Araya saa ado ran tek iye meram bakat sebel toro i teden asen, menandan menan alefo. Sagalo tu a tu a hampong ranau u maong, Smong! Smong! Smong! Minau humodong mek delok! Minau humodong mek delok! sakajap Fesang Smong sebel, sao saone hampong ranap. Sefelne ata ere ado sempat sia manyalamatkan diri, fahae pengalaman.</i></p> <p><i>Matuai smongia, ranau tot bebalek mek hampong, da asekk asekk uluda, nga singa singa umenggek, maraong simahawali anak, si mahawali lafe, simahawali tu a tu a da. Anga ata ngang be gelimpangan ek iye mowi. Te en sol ata tapi marek hebao matae, manok matae. Ngang ulagu kiamat iya anga singa maninggal afel mowi lebi satenga satiok hampong iya fa eng ata. Smongia taekne nida 10-15 meter. Mek mek tae ne smongia afel ata, hebao atos tasanguik ek detak ayo ayo. sahek nga singa nilewan mek delok.</i></p>	<p>This is the story of our ancestors' experience that happened a long time ago, around year seven. They passed this story to us for remembering what had happened in the past as a reflection of our life. On Friday morning, when most of the people were preparing to go to the mosque and some to the market, suddenly, a strong earthquake occurred, and people cannot stand upright. People found the seawater was receding, and fish were floundering on the beach. Unfortunately, many villagers ran to the beach to collect the fish. The big wave came from the sea and reached the land. The older person started shouting <i>Smong</i> repeatedly. But, many people did not have much time to run up to the hill.</p> <p>After the <i>Smong</i> had calmed, people tried to go back to the village and found many people had died. More than half of population from each of the villages was killed. The estimation of the <i>Smong</i>'s water level was about 10–15 meters; we discovered that many people, buffaloes, and chickens died, and some were stuck on the top of a tree, and some stranded on the hill, which was the height of 10–15 meters.</p>	
<p><i>Jadi, singa harus teher mi redem, anga alek Linon sebel, mi aheya mi enak owek asen, anga suruik, minau lanjar humodong mek delok atao omae fanon singa atae. Aifak ame malibu mangabek falon foraek, gulo, asila, enen, sulot, fisok. Nue nue so ere miredeman teher, mi sesewan mek anakme mobome, atang railla.</i></p>	<p>When the big earthquake occurs, immediately observe the changing of sea water level at the beach or the river; if you find the water receding, please be in a hurry to run away from the beach or flee to the higher places. Please bring rice, sugar, light, knife, matches, and clothes. Please remember this story and pass it to the next generations.</p>	<p>Know-ledge through action</p>

Figure 23. An example of the *Smong* story of tsunami risk from *Nafi-nafi*. Constructed and reformatted from the interviewee's story in January 2017.

The study showed that the *Smong* had probably been recognized before the 1907 tsunami. The story referred to the situation of the 1907 tsunami, where the older people were shouting the word *Smong* repeatedly when they saw the seawater recede from the land. Unfortunately, the *Smong* story had not been captured as a DRR message for saving lives. Dutch records indicate that the 1907 tsunami killed a significant number of Simeuluean people (McAdoo et al., 2006). The earthquake  $M_w$  of 7.3 that occurred in 2002 had functioned as a tsunami drill for the Simeulueans to recount the *Smong* story. Compared to the 1907 tsunami, there was no the big earthquake before that time that could have functioned as a tsunami drill.

The current study found that there were no significant differences between the *Smong* story in the *Devayan* and *Sigulai* languages. The *Smong* story in the Sigulai and the *Lekon* language has also mentioned the stages of the tsunami and the instructions for avoiding it.

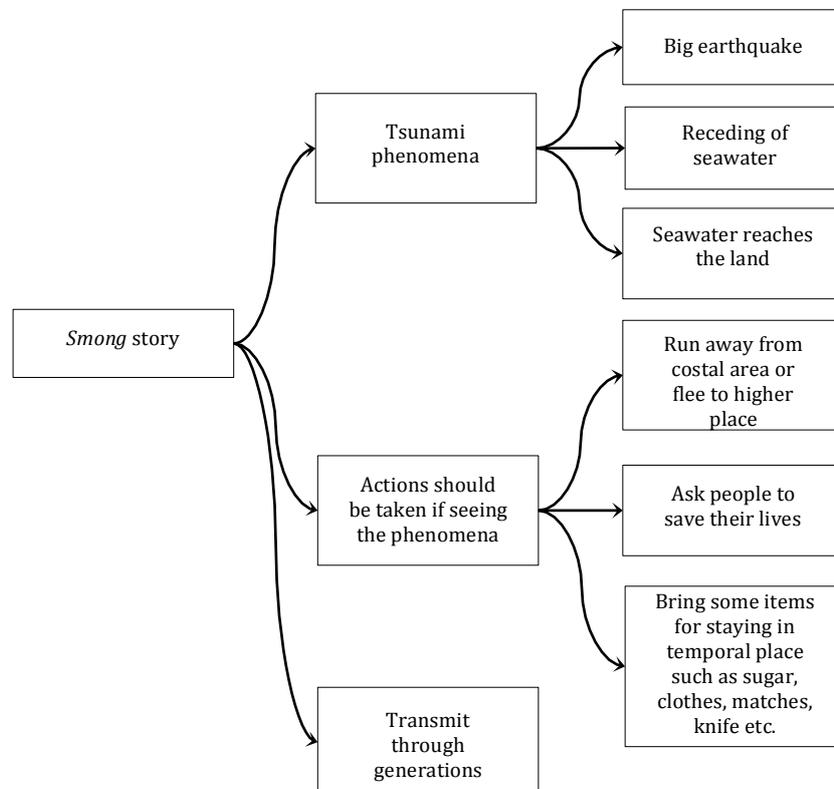


Figure 24. The summary of the *Smong* story that related to DRR in *Nafi-nafi*

Figure 24 shows the *Smong* story contents related to DRR in the *Nafi-nafi* divided into three main contents are: the three stages of the tsunami, the action should be taken if seeing the phenomena, and the command to transmit through generations.

The *Smong* story in the *Nafi-nafi* which evolved from the 1907 Indian Ocean tsunami, has been translated into the community actions in several events after that. In example that describes how the *Smong* converted through the action in the 2002 earthquake and the 2004 earthquake followed by the tsunami could be seen in Figure 25. The *Smong* contents that could be extracted from the analysis of the development process that presented above show several steps should be taken after the big earthquake and before the tsunami occurred as represented in Figure 25 (see 3, 4, 5 and 6).

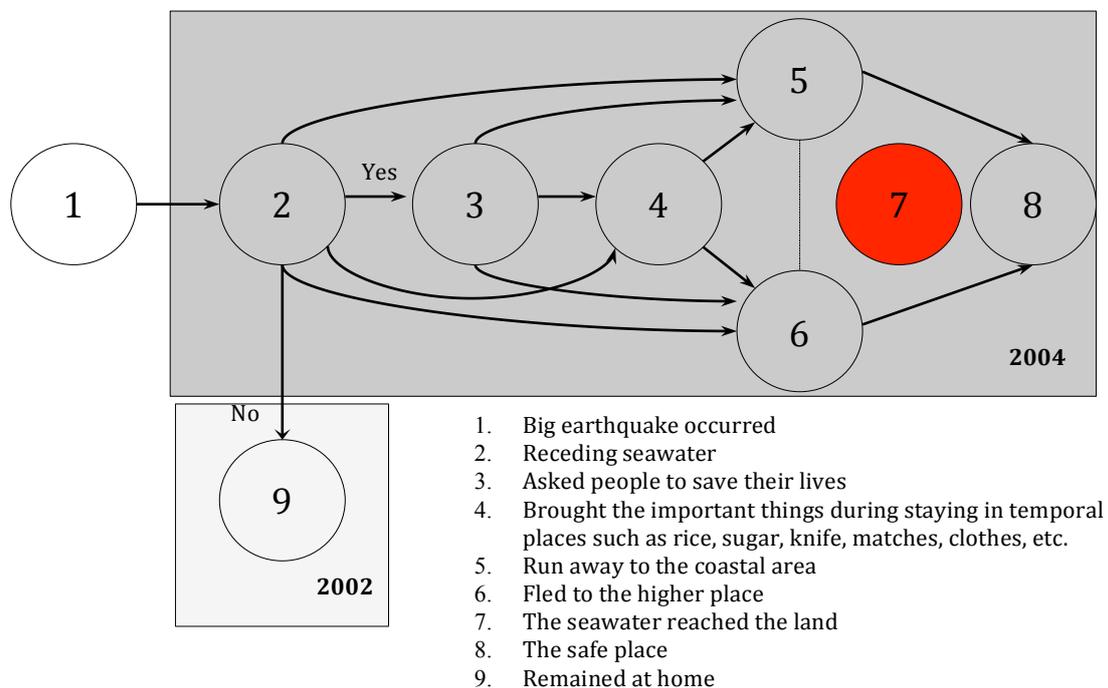


Figure 25. The Simeuluean responded and reacted on the 2002 earthquake and the 2004 earthquake followed the tsunami.

The 2002 earthquake did not follow the receding of seawater and Simeuluan people decided to remain in their homes. In the disaster management discourses, the 2002 earthquake functioned as “a tsunami drill” that the community could be reaffirmed their recognition to the *Smong*.

The 2004 earthquake followed by the receding of seawater has been made the Simeuluan people take the actions on their knowledge for the *Smong* story. Figure 27 shows that the possible steps that Simeuluan people did. The Group A played the leading role in observing the receding seawater (2) and taking the direction of the people to act the appropriate actions (3,4).

Group A directed Group B in taking action almost in the whole phase. These flow happened naturally based on the level of each Group in recognizing and translating the natural phenomena through the action. The direct link to the source of the *Smong* story implemented in different role between Group A and Group B.

### **5.3 Post the 2004 Indian Ocean Improvement and its Implication to the Development of *Smong***

The situational analysis was used in this study in order to capture the improvement of their life condition, people's appreciation on traditional values after reconstruction and rehabilitation phase and post the Aceh conflict.

Immediately, post the 2004 Indian Ocean tsunami, the recovery and rehabilitation launched. This situation also brought Free Aceh Movement (FAM) and Indonesian Government to sign the Memorandum of Understanding (MoU) and stop the conflict. The International attention and aids workers were the main contributors in helping

Aceh including Simeulue Island recover and Aceh was not situated as a restricted area to visit by the outsiders. However, this situation not only brings the improvement to Simeulue recovery in many aspects but also the acculturation of culture and value could be probably influenced local community.

The protracted conflict between the FAM and the Indonesian armed military in the province of Aceh, Indonesia, constitutes one of the longest and bloodiest conflicts in Southeast Asia. The tsunami that struck the province brought about an opportunity for ending the conflict. On August 15, 2005, the Government of Indonesia and FAM signed a peace agreement in Helsinki, referred to as the Memorandum of Understanding (MoU). A new ray of hope resurfaced among the Acehnese that peace is after all still possible in Aceh (Sukma, 2012). Post the signed MoU has been made Simeulue Island open for the outsiders to come to many purposes.

The head of the Majelis Adat Aceh, MAA (Acehnese Adat Board) at the province level, who was interviewed on September 14, 2016, mentioned that the armed conflict and massive military presence before the 2004 tsunami. The conflict between the FAM and the Indonesian Military continued for more than 30 years and created cultural changes on the Aceh mainland that have only slightly affected Simeulue. He suggested this could explain why the *Smong* story survived in the Simeulueans' memory and successful alerted them to danger compared to the people in mainland of Aceh Province when the 2004 tsunami occurred.

An example of the *Smong* song in *Devayan* language that created post the 2004 Indian Ocean could be found in one of the *Nandong* lyric (See Figure 26). According to a former Simeulue regency leader who ruled from 2001–2006, the *Nandong* is also used as a media for transmitting the *Smong* story post the 2004 tsunami.

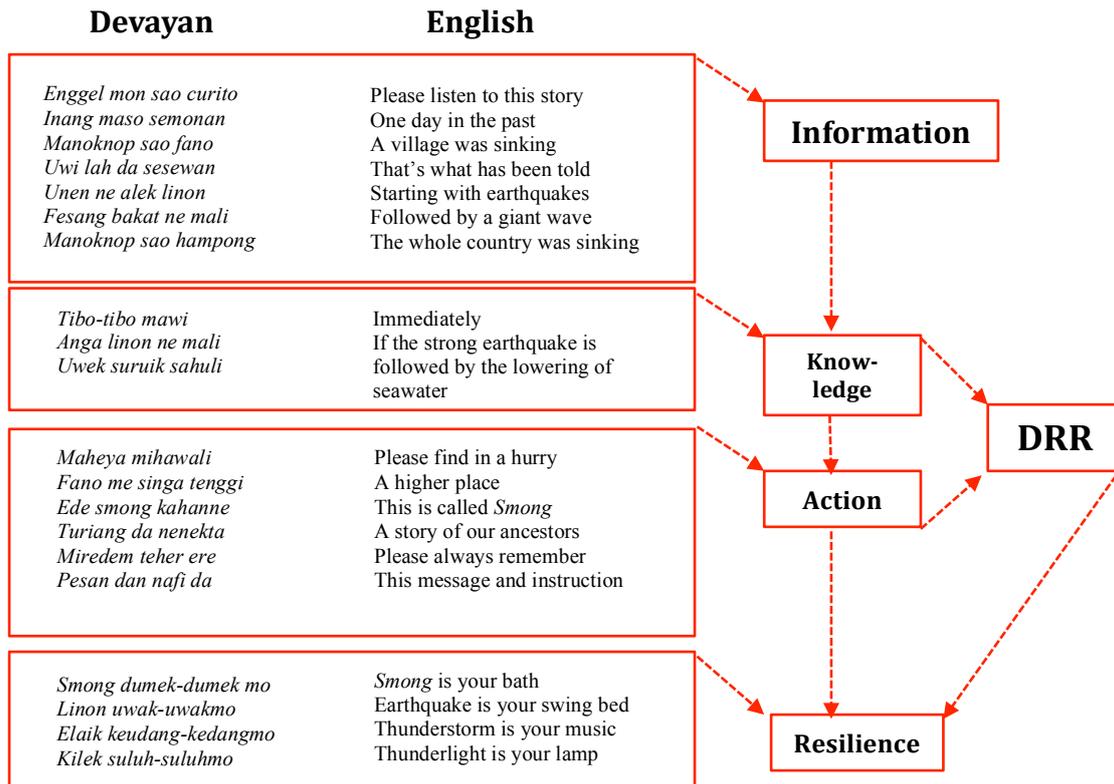


Figure 26. An example of Smong lyrics to tell of tsunami risk from Nandong. Adapted and modified from Sanny (2007) and Baumwoll (2008) and also re-performed on January 8, 2017 by a Simeulue District leader who served from 2001–2006.

The *Nandong* is also embedded and rooted, as a Simeuluean oral traditional culture for over generations but not specifically mentioned the *Smong*. The *Nandong* means reciting a song or poem and performing it with a *Gendang* (traditional drum) and violin or just singing it without any kind of instruments. The *Nandong* is played during leisure time, wedding party, harvesting, or fishing (see Figure 27)



Figure 27. The Simeuluean traditional fishermen were singing *Nandong* while fishing. The photo was taken on January 15, 2017.

The former leader also mentioned that a big challenge in protecting the *Smong* story through the community was that the young people are no longer interested in using the traditional channels. He added that the globalization has contributed the changes of culture. The transformation of the *Smong* story into the *Nandong* is a continuing development of the *Smong* story to attract the community's attention. The local government was also held annual the *Nandong* competition in preserving the message of the *Smong*. After the 2004 tsunami, many poets also created and modified the *Smong* story into other traditional cultural channels by adding disaster reduction messages, but this was only done by individual and small group initiatives.

The transformation of the *Smong* story into another channel such as *Nandong* can also be interpreted as strengthening the Simeuluean community against disasters. For example the *Smong* lyrics in the *Nandong* that mentions: “*Smong* is your bath/ Earthquake is your swing bed/ Thunderstorm is your music/ Thunderlight is your lamp” could be seen as messages for a community to be more resilient by adapting something scary into something that can be played with (see Figure 26). According to

Simeulue former leader, the *Smong* lyric in *Nandong* addresses to deliver a message that we have to strengthening our community by enriching the disaster knowledge to face the possibility of future disaster.

The successful of the *Smong* story was also attracted the international attention. The United Nations International Strategy for Disaster Reduction (UNISDR) awarded the Simeuluean people the UN Sasakawa Award in appreciation for their encouraging effort to contribute to a global culture of prevention, thereby furthering the goals of the international strategy for disaster reduction (ISDR, 2006). The award was given on October 12, 2005, in Bangkok Thailand.

The reconstruction and rehabilitation of Simeulue Island post the 2004 Indian Ocean tsunami improved significantly. The 496-kilometer road ringing Simeulue, the 122-kilometer alternative road, and the 750-meter local airport were developed and reconstructed (Sanny, 2007). The physical changes such as the uplift of higher ground created by the 2004 earthquake and the 2005 earthquake affected the coastal areas of Simeulue Island (see Figure 28). Consequently, several villagers relocated to new places, and this influenced their society and values.

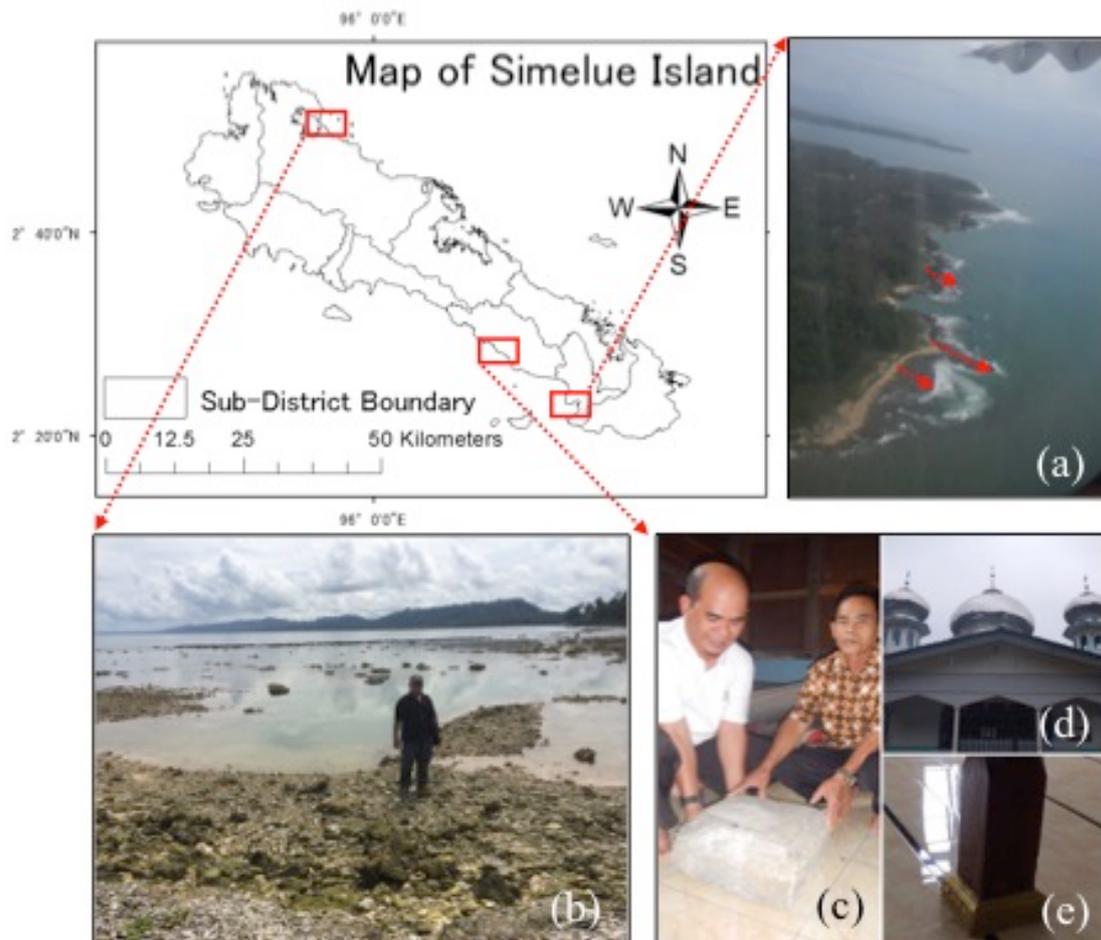


Figure 28. The physical evidence of 1907, 2004, and 2005 earthquakes and tsunamis on Simeulue Island. (a) The uplift associated with the March 28, 2005, earthquake in the south of the island. The photo was taken on October 29, 2016; (b) The uplift associated with the December 26, 2004 earthquake in the north of island. The photo was taken on January 15, 2017; (c) One of eight pillars (Sandi Salapan) of the Babussalihin mosque that survived the 1907 and 2004 tsunamis. The photo was taken on October 31, 2016; (d) The Babussalihin Mosque in Salur village affected by the 1907 and 2004 earthquake and tsunamis. The photo was taken on October 31, 2016; (e) One of the Sandi Salapan inside Babussalihin Mosque that was reconstructed after the 2004 tsunami. The photo was taken on October 31, 2016.

One participant stated the following:

*...We decided to relocate; we came from different villages had been made us struggle to understand each other. After the 2004 tsunami, there was some real improvement here; we have the ring road which was connected almost all villages in Simeulue Island. We also have a daily flight from Medan and Banda Aceh. Simeulue Island was not yet isolated from the outside. Before the 2004*

*tsunami, it took one or two days to reach the mainland of Aceh from Sinabang by boat. We struggled to find the best weather to move. Now, it takes less than hours to reach Medan from Sinabang by plane. Before the 2004 tsunami, the Simeulue culture was not much affected by the outside. I may say that Simeulue is very peaceful. But now, I found our children no longer interested in traditional values.*

(Male, Group B of the interviewees, 50 years old, Sinabang)

From the situational analysis, the remaining physical evidence from 1907, 2004, and 2005 earthquakes and tsunamis (see Figure 28) has the potential to be used for disaster education purposes.



Figure 29. Lasikin airport in Simeulue Island constructed post the 2004 Indian Ocean tsunami. The photo was taken on August 2, 2017 by Aiko Sakurai.

According to the interviewees, not much work has done in recent years regarding determining the sustainability of the *Smong* story in the community. Twelve years after the 2004 tsunami, the group of Simeuluean people who have no knowledge of the *Smong* story but experienced the 2004 tsunami, including the group of people who were born after the 2004 tsunami, has increased significantly.

According to the head of Department of Education of Simeulue who was interviewed on October 15, 2016 mentioned that the local government has received and collaborated with some of local and international NGOs in disaster education programs including promoting the Story of *Smong*. But, the initiatives came from the NGOs rather than local government.

#### **5.4 *Smong* Story Recognition Development on the Group C Categorize**

The *Nafi-nafi* is the main media in delivering the *Smong* story from the 1907 and successful in saving lives in the 2004 Indian Ocean tsunami. Post the 2004 Indian Ocean tsunami there were some efforts in preserving *Smong* story such as *Smong* lyric in *Nandong*. However this study extracted the *Smong* story contents only from the *Nafi-nafi* by constructing the questioner survey. This study focused on the recognition of two main contents that are describing there the tsunami phenomena and three actions should be taken when seeing the phenomena. Event though most of the Group C categorize did not know if the *Nafi-nafi* is the *Smong* story channels, but they heard the *Smong* as story before.

Table 12. The Frequency Table Group C Categorize (N=100)

Variable	Description	Frequency	Percent	
Schools	SMPIT Ruhul Islam	25	25	
	MTSN 2 Sinabang	25	25	
	SMPN 1 Teupah Barat	25	25	
	SMPN 7 Teupah Selatan	25	25	
	Total	100	100	
Gender	Male	45	45	
	Female	55	55	
	Total	100	100	
The location of schools by the 2004 tsunami affected area	Located at the tsunami non-affected area	25	25	
	Located at the tsunami affected area	75	75	
	Total	100	100	
The location of schools by access	City	50	50	
	Remote area	50	50	
	Total	100	100	
The period that respondents has stayed in Simeulue Island	More than five yeas	95	95	
	Less than five years	5	5	
	Total	100	100	
Local language that respondents use in daily communication	Devayan	37	37	
	Aneuk jamee	22	22	
	Do not speak any local language	41	41	
	Total	100	100	
The <i>Smong</i> story channels	1 channel	48	48	
	1. Family;	2 channels	20	20
	2. Community;	3 channels	17	17
	3. School;	4 channels	15	15
	4. Media.	Total	100	100
The recognition of the <i>Smong</i> story content which describes three natural tsunami phenomena	Could not recognize phenomena	4	4	
	Recognized one from three phenomena	28	28	
	1. Big earthquake;	Recognized two from three phenomena	41	41
	2. The receding of seawater;	Recognized three phenomena	27	27
	3. Seawater reaches the land	Total	100	100
The recognition on the actions should be taken if seeing the <i>Smong</i> phenomena	Could not recognize what should be acted	10	10	
	1. Run away from the coastal area or to the higher place;	Recognized at least one from three actions	79	79
	2. Encourage people to save their lives;	Recognized two from three actions	10	10
	3. Bring items with such as sugar clothes, knife, matches, etc. for living in temporal place.	Recognized three actions	1	1
	Total	100	100	

Table 13. The Correlation of Variable

		1	2	3
1	The <i>Smong</i> story channels (family, community, schools and media)	1	-	-
2	The recognition of the <i>Smong</i> story content which describes three natural tsunami phenomena (big earthquake, receding seawater, and seawater reaches the land)	0.18	1	-
3	The recognition on the actions should be taken if seeing the <i>Smong</i> phenomena (run away from the coastal area or to the higher place, ask people to save their lives, bring items with such as sugar clothes, knife, matches, etc. for living in temporal place)	.201*	.419**	1

*Note.* \*\* Correlation is significant at the 0.01 level (2-tailed). \* Correlation is significant at the 0.05 level (2-tailed).

The analysis using Pearson's correlation coefficient indicated (see Table 13) that there is no relationship between the *Smong* story channels (family, community, schools and media) and the recognition of the *Smong* story content which describes three natural tsunami phenomena (big earthquake, receding seawater, and seawater reaches the land). But, the positive correlations between the channel the recognition of the actions should be taken if seeing the *Smong* phenomena which means if respondents received the *Smong* story from different channels the recognition will increase.

The data shows the significant correlation between the recognition of the *Smong* story content which describes three natural tsunami phenomena and the recognition on the actions should be taken if seeing the *Smong* phenomena.

More specifically the recognition of the *Smong* story content which describes three natural tsunami phenomena were found to be significantly different between

schools,  $F(3,96) = 6.940$ ,  $p < .001$ . The Tukey multi comparisons performed at the 0.05 significance level found that the recognition of *Smong* story content that describes three tsunami phenomena in SMPIT Ruhul Islam ( $M=3.08$ ,  $SD=0.759$ ,  $N=25$ ) was significantly higher than SMPN 7 Teupah Selatan ( $M=2.36$ ,  $SD=0.907$ ,  $N=25$ ). The same situation was found between MTSN 2 Sinabang ( $M=3.32$ ,  $SD=0.476$ ,  $N=25$ ) was significantly higher than SMPN 7 Teupah Selatan ( $M=2.36$ ,  $SD=0.907$ ,  $N=25$ ).

### **5.5 Finding Summarize**

The *Smong* story had situated IK more strategic that the observation of a natural disaster should record not only the human and material losses but also the attention to the need of development of IK from individual and society perspectives (Bankoff, 2001).

The main message here is the notion that the recorded history of a disaster and the development of IK made the local community powerless by unavoidable changes in society or the lack of the implementation of the DRR program through the community. The Aceh conflict did not much affect the Simeuluean culture has contributed to ensuring the sustainable development of culture patterns through which most the *Smong* knowledge continues to exist.

There were some of efforts to translating the *Smong* story into other channels such as songs, poems and all. This is also could explain the Grup C could still recognise the word of the *Smong* even though missing to translate into appropriate definition as explained above.

After the 2004 tsunami, poets and writers created material that delivers messages to the next generation. Some authors tried to modify traditional song lyrics such as

*Nandong* by adding some DRR messages to the community. But, the initiative to modify the *Smong* through new approaches has only come from individual and small group initiatives.

Table 14. The Summaries of the *Smong* Story Development Processes

Knowledge Acquisition	Knowledge Development	Knowledge Sharing	Knowledge Preservation	Knowledge Application
<u>1907–2004</u>				
<ul style="list-style-type: none"> <li>The <i>Smong</i> story acquisition is predominantly local, from family and old people who had personal experiences with the 1907 tsunami.</li> </ul>	<ul style="list-style-type: none"> <li>The <i>Smong</i> story developed as knowledge in oral stories (<i>Nafi-nafi</i>)</li> </ul>	<ul style="list-style-type: none"> <li>The <i>Nafi-nafi</i> which contained the <i>Smong</i> story transmitted after big earthquake occurred, or after reciting Quran, and others.</li> </ul>	<ul style="list-style-type: none"> <li>Explicit sources were not used to maintain the <i>Smong</i> knowledge.</li> </ul>	<ul style="list-style-type: none"> <li>The right decisions and appropriate actions were made when the 2004 tsunami occurred;</li> <li>The <i>Smong</i> story successfully alerted people when the tsunami occurred.</li> </ul>
<u>2004–present</u>				
<ul style="list-style-type: none"> <li>The 1907 tsunami resonated as common story and the successful the <i>Smong</i> story from the 2004 Indian Ocean tsunami reaffirmed the recognition;</li> <li>Access to the <i>Smong</i> is through a variety of channels.</li> <li>The <i>Smong</i> story recognized by International for DRR.</li> </ul>	<ul style="list-style-type: none"> <li>The word of <i>Smong</i> is recognized within the community;</li> <li>There were a few local initiatives based on the <i>Smong</i> within efforts to raise community awareness of tsunamis.</li> </ul>	<ul style="list-style-type: none"> <li>Access to the <i>Smong</i> story translates into other media such as <i>Nandong</i> song;</li> <li>Few local people were involved in transforming the <i>Smong</i> story into various cultural formats.</li> </ul>	<ul style="list-style-type: none"> <li>Some documentation of the <i>Smong</i> story exists, but it is limited to the <i>Smong</i> success story rather than a plan for ways the <i>Smong</i> could contribute to DRR efforts.</li> </ul>	<ul style="list-style-type: none"> <li>The Simeuluean people recognize the word of <i>Smong</i>, but failure to understand the <i>Smong</i> story that mentioned in <i>Nafi-nafi</i>.</li> </ul>

However songs, stories, and cultural patterns relevant to the *Smong* story already existed, innovation is still needed to spread and ensure knowledge of the *Smong* within the community. This study is concerned about not only transforming tsunami

information into explicit knowledge but also, most importantly, ensuring that the knowledge can be transformed into community attitudes that help make right decisions and take appropriate actions when tsunamis strike. The *Smong* story should be encouraged and spread into formal education, to reinforce this cultural pattern. Some programs are described in this model including, among others, books, drills, lectures, posters, exercises, presentations, survival skills, and community meetings and cultural events.

Its transmission can be encouraged with a combination of standard DRR approaches and the existing knowledge in the cultural material already respected by the community. The term of *Smong* is widely recognized by locals, providing the root historical experiences of tsunamis that frequently devastate the area. *Smong* can be improved into new songs, stories, legends, proverbs, rituals, or ceremonies relating to DRR messages.

Finally, the analysis of the development process of *Smong* in achieving the main goal of enhancing community resilience to tsunami risk could probably be the way to understand the Simeuluean in making a decision in saving lives. This goal can be reached in all phases of disasters. First, in the pre-disaster stage, the community could be willing to mainstream and integrate indigenous knowledge with DRR issues into their regular activities. Second, during disasters, *Smong* could make the community able to think clearly, act based on informed decisions, and protect themselves and others by using their *Smong* knowledge. Last, in the post-disaster phase, the community could be strong enough to face challenges and to support each other and “build back better” efforts, using local resources.

## Chapter 6

### Discussion

In fact, the *Smong* story worked well in saving lives in the 2004 tsunami. It is too early to say that the *Smong* cannot disappear from the community and will help the Simeuluean people to make and to take an appropriate decision and an action when a disaster happens in a future. For example, if cultural globalization leads the erosion of culture (Moahi, 2007) where the *Smong* had stored, it is difficult to imagine if the *Smong* can keep its power to save lives.

There are at least two significant discussions that can be drawn from the findings. First, the overwhelming of the success of the *Smong* story that it saved a lot of lives against the 2004 Indian Ocean tsunami could be due to insufficient understanding about the complexity of natural disaster. In other words, people could survive because they did not understand their situation just after tsunami came. Second, the failure of Simeuluean people in translating the *Smong* story through appropriate actions for the future event of the tsunami due to mixed with the inappropriate stories or myth.

#### **6.1 The Recognition of the *Smong* Story through the Underrated in Translating the Complexity of Tsunami as a Natural Disaster**

The *Smong* story demonstrated the important connections between the DRR and IK. The *Smong* story also showed one practical example that IK provides the information about the tsunami phenomena explicitly, and the actions should be taken

when seeing the phenomena. But, the overwhelming of the success of the *Smong* story could probably be received to neglect the complexity of disaster.

Table 15. The Simeulue Island Circumstances and Its Relationship to the Development of *Smong* story

Time	Descriptions
Before 2004	<ul style="list-style-type: none"> <li>• The <i>Smong</i> story perceived from the previous tsunami and developed as story (<i>Nafi-nafi</i>);</li> <li>• The long time Aceh conflict between FAM and the Indonesian military (1976-2005).</li> </ul>
2004 - 2005	<ul style="list-style-type: none"> <li>• December 26, 2004, tsunami occurred and the <i>Smong</i> story successful alerted people to save their lives and three people killed;</li> <li>• August 15, 2005, the FAM and the Indonesian Government signed the MoU in Helsinki, Finland to stop the conflict.</li> </ul>
2005 - 2009	<ul style="list-style-type: none"> <li>• April 16, 2005 – April 17, 2009 the Indonesian Government established Reconstruction and Rehabilitation of Aceh- Nias (BRR Aceh-Nias) in helping Aceh to recover after the tsunami;</li> <li>• BRR Aceh-Nias received donation in helping Aceh recover including the Simeulue Island;</li> <li>• Simeulue was not isolated and many outsiders came to the Island;</li> <li>• October 12, 2005, the Simeuluean people awarded by United Nations the UN Sasakawa award for their recognition and encouraging the indigenous knowledge for DRR.</li> </ul>
2009 - now	<ul style="list-style-type: none"> <li>• The Simeulue Island recovered and the local government has been strengthened to manage the Island;</li> <li>• The Simeulue Island has been appointed by the Aceh Province government as the main tourist destination;</li> <li>• The word of the <i>Smong</i> is recognized within the community but it is limited the <i>Smong</i> success story rather than a plan for the sustainable in DRR efforts.</li> </ul>

Table 15 shows the timeline record of circumstance changes in the Simeulue Island and the relationship with the development of the *Smong* story. Before 2004, Simeulue Island was isolated from the outsiders due to the conflict between the FAM and the Indonesian military. Under this situation, the *Nafi-nafi* was the primary media in storing the *Smong* story and successfully alerted people to save their lives from the 2004 tsunami. After the 2004 tsunami and Aceh became to be more conducive and gave the opportunity for the outsiders to come to the island. Such new circumstances influenced the people in many aspects including the acculturation of culture.

Even though the *Smong* story is recognized within the community, however, the power of the *Smong* to save one's life after 2004 may partially recognized compared to the days before 2004. An unavoidable of culture sharing was happened after the 2004 tsunami due to Simeulue Island more conducive for outsiders to visit.

In another hand, the Simeuluean people could also be neglected to consider the disaster prevention or mitigation countermeasure which held by the government, or the outsiders because they already have their *Smong* knowledge and felt the *Smong* story could help them in facing the future disaster.

There is a definite metaphysical element that has to be verified to get into "the *Smong* is your bath" that could be referred to the *Nandong* (see Figure 28). It does indeed go on to encourage people that the best thing to do in case of the *Smong* is to run to the mountains. It is hard to imagine people hearing that *Smong* lyric in *Nandong* can fail to translate the *Smong* DRR message.

The Simeuluean people seem very optimistic about the success of the *Smong* story in 2004 and looks ignored the probability the decreasing of the recognition of the *Smong* story and DRR efforts. The DRR efforts in the *Smong* story content are the recognition to observe the tsunami phenomena and translate into the appropriate actions. Even though the *Smong* is much more than a word and it also had an extraordinary experience of saving lives. However, the further development of the *Smong* story as DRR efforts is needed, because it is difficult to believe that the *Smong* story can still be reliable and applicable to a future disaster.

## **6.2 The Failure in Translating and Reacting on the Future of Tsunami Event**

The results show that there were also the confusion of the *Smong* story into superstitious definitions and situations. The possibility of neglecting the tsunami

could have occurred without the natural phenomena that community could be observed. For example, on December 26, 2004, some of the countries along the Indian Ocean did not feel the shock followed by receding of seawater, but the coastal area devastated by the tsunami as well.

The failure to translate the actual situation made scientist aware that tsunami has been underrated as a major hazard, mainly due to the misconception that they occur infrequently compares to other disasters (Bryant, 2014). The probability of failure in responding and reacting for the future event could be seen in Figure 30.

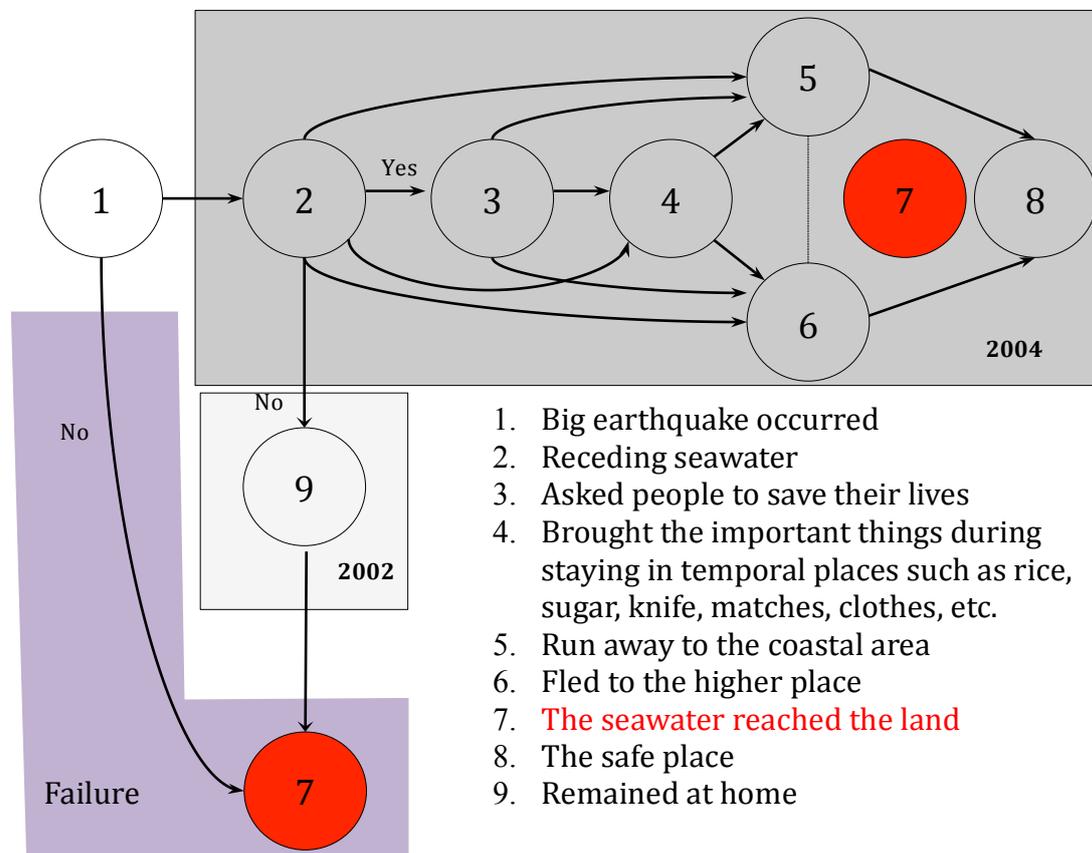


Figure 30. The Simeuluean responded and reacted on the 2002 earthquake and the 2004 earthquake followed the tsunami and the failure probability in responding and reacting to the future disaster.

Alexander (2007) describes the correlation between myths, misconception as a barrier in response to the disaster. The *Smong* story could be mixed with the myth or misconception that the Simeuluean people will fail to translate and make the

appropriate decision and action when the disaster occurs.

Even most interviewees and respondents recognized the word of *Smong*, but they also have another statement to describe the *Smong* that some of that mixed into myth or unrelated stories. Some of typical examples of myths and misconception about the *Smong* could be seen in Table 16.

Table 16. Typical of Myths and Misconception about the *Smong*

No	Myths
1	The <i>Smong</i> is manifesting of people sins and the angry of God
2	The <i>Smong</i> will occur again in 100 years
3	Before the <i>Smong</i> occurs, it should be very hot
4	When a big earthquake occur in the morning, it should be followed by the tsunami
5	One day before tsunami occur, bulls will have moved to the hill or the mountain

Another element in this study which has to be verified that the actions should be taken if seeing the tsunami phenomena which mentioned in the *Smong* story is to bring such as sugar, rice, clothes, knife, matches, etc., for living in the temporal place.

The *Smong* story was not explained in details what, who are dos and don'ts when the phenomena occur? In the real situation, the people could be missed the DRR message because it will take time to bring everything if people did not prepare before. For example what had happened to a victim who was dead in the 2004 tsunami from Labuhan Bajau village. According to interviewees that the person had saved in the mountain but decided to go back to his home for picking the documents, unfortunately, he finally lost his lives at the event.

So, the combination of scientific approaches to DRR efforts and what the local community's knowledge has is the proper strategy in achieving the community resilience against the worst impact of the disaster.

## Chapter 7

### Conclusion, Limitations and Recommendations

#### 7.1 Conclusion

The large amount of information necessary to understand the complexity of the development the *Smong* story through the community recognition on DRR messages and actions. It required the development of an appropriate methodology and the evaluation of the methods and results. Consequently, the ethnographic approach preceded by narrative and situational analysis of the findings of the research turned out to be a meaningful procedure.

So, this study shows that the *Smong* story is an understanding of how the community defines, recognizes, and interprets risk and also communicates the risk to its members. The oral transmission through cultural patterns has been the primary media storage for the *Smong* story in transmitting the *Smong* story from 1907 to 2004. The older residents played a significant role in disseminating and determining community members' actions when the tsunami occurred.

From a DRR point of view, the development of the *Smong* story is a bridge to reduce uncertainty and to move through the appropriate understanding and actions. In the example, although the *Nafi-nafi* used for the *Smong* story exists, innovation is still needed to ensure that the knowledge could reach the community.

Alternatively, others take a different point of view and look narrowly at the *Smong* story. Twelve years after the tsunami, the number of people in Group A

decreased due to old age. If the 2004 tsunami occurred later (probably more than 100 years after the 1907 tsunami), the number of fatalities could have increased. The most important things are the historical record of the earthquake and tsunami and the existing knowledge the community uses as a reliable resource to strengthen its people to be more resilient when managing risk.

Some conclusions from the research questions provided in Chapter 1 are highlighted:

1. The story of the *Smong* has been passed down through the generations via different medias. The 1907 and 2004 Indian Ocean tsunamis have reconstructed and reaffirmed the *Smong* story into the community's collective memory. The direct link to the source of knowledge of the *Smong* has proved effective in helping residents make the right decisions and take appropriate actions during the event of the disaster.
2. The *Smong* story content provide valuable knowledge and gives the appropriate actions to take during tsunamis and enhances the community's resilience by describing the stages of natural phenomena; it also includes instructions for escaping, and encourages people to act, which can save lives.
3. The Simeuluean people who did not experience the 2004 Indian Ocean tsunami had less knowledge of the *Smong* story. Knowledge management for disaster risk reduction could be the one alternative that can contribute to the sustainability of the *Smong* story for future tsunami risk, offering a way to strengthen the community's ability take the best decisions and take appropriate actions before, during, and after disasters.

4. Most importantly, this study recommends that the *Smong* story could be integrated to strengthen the community's resilience by linking and transforming the lessons learned from the analysis of the development of the *Smong* story with a range of DRR efforts, for instance, knowledge management, disaster management, policy, and so forth. The analysis of the development of the *Smong* story is a good opportunity for the community to use intangible resources that can be a source to protect the community against tsunami risk in the future.

## 7.2 Limitations

Several limitations found in this study are:

1. The limited number of interviewees, especially the dearth of people who directly experienced the 1907 tsunami, meant limited source data. It is important to get direct data from persons who experienced the event, but this was not possible. And also, there were limited number of interviewees who represented the *Lekon* language, because they make up less than 5% of the population.
2. This study examined only basic information about the development of the *Smong* story for the group people who did not experience the 2004 Indian Ocean tsunami. The total number of this group is 28,532 (BPS Simeulue, 2016), which means they make up more than 30% the total population. This group of people should be given an intervention to strengthen, promote, and educate their recognition of the *Smong* story comprehensively. They should be shown the history and the development

of the *Smong* story to help them connect to their ancestral pride, which proved to protect people from the 2004 tsunami.

3. The data of earthquakes and tsunamis pre-1907 was not provided, so it was very difficult to trace the development of the *Smong* story before that time.

### **7.3 Recommendations**

The *Smong* story encapsulates the tsunami phenomenon, and the *Smong* story resonates within the Simeuluean people. If the changes after the 2004 Indian Ocean tsunami and the agreement that was signed between the FAM and the Indonesian government regarding disaster policies related to 'tsunami' will there be dilution of the knowledge and interest in *Smong* story?

One way to address this threat is to grant the word *Smong* the world recognition it deserves. As the word that encapsulates the giant destructive wave phenomenon, the *Smong* should be recognized worldwide, at least in Indonesia as its 'home grown' word for the phenomena. The *Smong* story describes the phenomena explicitly now widely referred to a tsunami. In the English-speaking world, the common term for the massive wave event used to be a tidal wave. This was a definite misnomer insofar as the tide did not generate the giant wave. In reality, then, the *Smong* is not simple, but quite profound.

Many Simeuluean people express their undying gratitude to the world who came to their aid to rebuild after their island was devastated. They wish to give something back, but they especially want to show their appreciation to their Indonesian countrymen. They wish to give the gift of the *Smong*.

The government could also take more active interest in supporting and concerning IK and *Smong* policies and formulation of legislature should be a part of the national agenda. Some of local community leaders endorsed the recognition of *Smong* as an alternative for “tsunami” in the Indonesian language.

The provision of the development process of the *Smong* could also be included in DRR efforts when deliberating on how to save the community from natural disaster. From this situation, enhancing the *Smong* story and increasing disaster preparedness to reduce vulnerability should be essential aims of the DRR discourses. The results of this research hope to facilitate the outsiders, government, local authorities and communities to more carefully consider future earthquake and tsunami event.

## References

- Agrawal, A. (1995). Dismantling the Divide Between Indigenous and Scientific Knowledge. *Development and Change*, 26(3), 413–439.  
<https://doi.org/10.1111/j.1467-7660.1995.tb00560.x>
- Agur, A. (2007). *Budaya dan Sejarah Simeulue*. Sinabang.
- Agur, A., Naskah, B. K., Hasbi, E., & Arsin, R. (1996). *Bunga Rampai Sejarah Simeulue*. Sinabang: Panitia Peresmian Kabupaten Simeulue Provinsi Daerah Istimewa Aceh.
- Aitsi-Selmi, A., Egawa, S., Sasaki, H., Wannous, C., & Murray, V. (2015). The Sendai Framework for Disaster Risk Reduction: Renewing the Global Commitment to People’s Resilience, Health, and Well-being. *International Journal of Disaster Risk Science*. <https://doi.org/10.1007/s13753-015-0050-9>
- Alderson, P., & Morrow, V. (2011). *The ethics of research with children and young people: A practical handbook*. Sage Publications Ltd.
- Aldrich, D. P. (2012). *Building resilience: Social capital in post-disaster recovery*. University of Chicago Press.
- Baldick, C. (2015). *The Oxford dictionary of literary terms*. OUP Oxford.
- Bankoff, G. (2001). Rendering the World Unsafe: “Vulnerability” as Western Discourse. *Disasters*, 25(1), 19–35. <https://doi.org/10.1111/1467-7717.00159>
- Baumwoll, J. (2008). *The value of indigenous knowledge for disaster risk reduction*. Webster University.
- Bennet, D., & Bennet, A. (2008). Engaging tacit knowledge in support of

- organizational learning. *VINE*, 38(1), 72–94.
- <https://doi.org/10.1108/03055720810870905>
- Berkes, F. (1993). Traditional ecological knowledge in perspective. In J. Inglis (Ed.), *Traditional ecological knowledge: Concepts and cases* (pp. 1–9). Ottawa, Canada: International Program on Traditional Knowledge, Canada Museum of Nature.
- Berkes, F., Colding, J., & Folke, C. (2000). Rediscovery of Traditional Ecological Knowledge as Adaptive Management. *Ecological Society of America*, 10(5), 1251–1262.
- Bernard, E. N., & Robinson, A. R. (2009). Introduction: Emergent findings and new directions in tsunami science. *The Sea*, 15, 1–22.
- Bohensky, E. L., & Maru, Y. (2011). Indigenous Knowledge, Science, and Resilience: What Have We Learned from a Decade of International Literature on Integration. *Ecology and Society*, 16(4), art6. <https://doi.org/10.5751/ES-04342-160406>
- BPS Simeulue. (2016). *Kabupaten Simeulue dalam Angka 2016*. Badan Pusat Statistik Kabupaten Simeulue.
- Brown, D. D., & Kulig, J. C. (1996). The concepts of resiliency: Theoretical lessons from community research. Retrieved from <https://www.uleth.ca/dspace/handle/10133/1275>
- BRR. (2005). *Aceh and Nias One Year After The Tsunami: The Recovery Effort and Way Forward*.
- BRR. (2009a). *Economy: Turning the Wheel of Life* (BRR Book S). BRR NAD-NIAS.
- BRR. (2009b). *Supervision Eradicating Corruption with No Tolerance* (BRR Book

S). BRR NAD-NIAS.

BRR. (2009c). *Tsunami: From Disaster to the Emergence of Light*. (H. Supit & M.

Agusta, Eds.) (BRR Book S). BRR NAD-NIAS.

Bryant, E. (2014). *Tsunami: the underrated hazard*. Springer.

Cartwright, J. H. E., & Nakamura, H. (2008). Tsunami: a history of the term and of scientific understanding of the phenomenon in Japanese and Western culture.

*Notes and Records of the Royal Society of London*, 62(2), 151–66.

<https://doi.org/10.1098/RSNR.2007.0038>

Chlieh, M., Avouac, J.-P., Hjorleifsdottir, V., Song, T.-R. A., Ji, C., Sieh, K., ...

Galetzka, J. (2007). Coseismic Slip and Afterslip of the Great Mw 9.15 Sumatra-Andaman Earthquake of 2004. *Bulletin of the Seismological Society of America*, 97(1A), S152–S173. <https://doi.org/10.1785/0120050631>

Clarke, A. E. (2003). Situational Analyses: Grounded Theory Mapping After the Postmodern Turn. *Symbolic Interaction*, 26(4), 553–576.

<https://doi.org/10.1525/si.2003.26.4.553>

Clarke, A. E. (2005). *Situational analysis: Grounded theory after the postmodern turn*. Sage.

Coles, E., & Buckle, P. (2004). Developing community resilience as a foundation for effective disaster recovery. *Australian Journal of Emergency Management, The*, 19(4), 6.

Comfort, L. K., Boin, A., & Demchak, C. C. (2010). *Designing resilience: Preparing for extreme events*. University of Pittsburgh Pre.

Cortazzi, M. (2014). *Narrative analysis* (Vol. 12). Routledge.

Creswell, J. W., & Poth, C. N. (2017). *Qualitative inquiry and research design:*

*Choosing among five approaches*. Sage publications.

- Danto, A. C. (1982). Narration and Knowledge. *Philosophy and Literature*, 6(1–2), 17–32. <https://doi.org/10.1353/phl.1982.0023>
- Davenport, T. H., De Long, D. W., & Beers, M. C. (1998). Successful knowledge management projects. *Sloan Management Review*, 39(2), 43.
- Dekens, J. (2007). *Local knowledge for disaster preparedness : a literature review*. International Centre for Integrated Mountain Development (ICIMOD). Retrieved from <http://agris.fao.org/agris-search/search.do?recordID=QZ2013000064>
- Dictionaries, E. O. L. (n.d.). No Title. Retrieved September 20, 2017, from <https://en.oxforddictionaries.com/definition/tsunami>
- Duffin, S. S. (2011). History Of Tsunami: The Word And The Wave. Retrieved September 2, 2017, from <http://www.npr.org/2011/03/18/134600508/history-of-tsunami-the-word-and-the-wave>
- Edwards, J. S. (2001). Knowledge life-cycles: What to keep and what to throw away. *Proceedings of Knowledge Management in OR Groups Farnborough, UK*.
- Edwards, J. S., Ababneh, B., Hall, M., & Shaw, D. (2009). Knowledge management: a review of the field and of OR's contribution. *Journal of the Operational Research Society*, 60, S114–S125. <https://doi.org/10.1057/jors.2008.168>
- Edwards, J. S., & Taborada, E. R. (2016). Using knowledge management to give context to analytics and big data and reduce strategic risk. *Procedia Computer Science*, 99(September), 36–49. <https://doi.org/10.1016/j.procs.2016.09.099>
- Edwards, S. E., & Heinrich, M. (2006). Redressing cultural erosion and ecological decline in a far North Queensland aboriginal community (Australia): the Aurukun ethnobiology database project. *Environment, Development and Sustainability*, 8(4), 569–583. <https://doi.org/10.1007/s10668-006-9056-1>
- Einarsdóttir, J. (2007). Research with children: Methodological and ethical

- challenges. *European Early Childhood Education Research Journal*, 15(2), 197–211.
- Ellis, D., & West, P. (2004). Local History as 'Indigenous Knowledge': Aeroplanes, Conservation and Development in Haia and Maimafu, Papua New Guinea. *Bicker, Alan/Sillitoe, Paul/Pottier, Johan (Hg.): Investigating Lokal Knowledge. New Directions, New Approaches. Ashgate, Aldershot*, 105–127.
- Elo, S., & Kyngäs, H. (2008). The qualitative content analysis process. *Journal of Advanced Nursing*, 62(1), 107–115. <https://doi.org/10.1111/j.1365-2648.2007.04569.x>
- Flick, U. (2014). *An introduction to qualitative research*. Sage.
- Fred, D. (1981). *Knowledge and the Flow of Information*. Cambridge, Massachusetts, MIT Press.
- Gadgil, M., Berkes, F., & Folke, C. (1993). Indigenous knowledge for biodiversity conservation. *Ambio*, 151–156.
- Gaillard, J. C., & Mercer, J. (2013a). From knowledge to action. *Progress in Human Geography*, 37(1), 93–114. <https://doi.org/10.1177/0309132512446717>
- Gaillard, J. C., & Mercer, J. (2013b). From knowledge to action: Bridging gaps in disaster risk reduction. *Progress in Human Geography*, 37(1), 93–114. <https://doi.org/10.1177/0309132512446717>
- George, J. M. (2011). Indigenous knowledge as a component of the school curriculum. In L. M. Semali & J. L. Kincheloe (Eds.), *What is indigenous knowledge? Voice from the Academy* (pp. 79–94). New York: Routledge.
- Greenhalgh, T., & Hurwitz, B. (1998). *Narrative Based Medicine Dialogue and Discourse in Clinical Practice*. London: B M J Books.
- Grenier, L. (1998). *Working with indigenous knowledge: A guide for researchers*.

IDRC.

Gusiakov, V. K. (2009). Tsunami history: recorded. *The Sea*, 15, 23–53.

Hiwasaki, L., Luna, E., Syamsidik, & Shaw, R. (2014). Process for integrating local and indigenous knowledge with science for hydro-meteorological disaster risk reduction and climate change adaptation in coastal and small island communities. *International Journal of Disaster Risk Reduction*, 10, 15–27.  
<https://doi.org/https://doi.org/10.1016/j.ijdr.2014.07.007>

Hsieh, H.-F., & Shannon, S. E. (2005). Three Approaches to Qualitative Content Analysis. *Qualitative Health Research*, 15(9), 1277–1288.  
<https://doi.org/10.1177/1049732305276687>

Inglis, J. (1993). *Traditional ecological knowledge: concepts and cases*. IDRC.

ISDR. (2006). *UNISDR Informs: Disaster Risk Reduction in Asia & Pacific*.

Iwasaki, S., & Rahman, A. (2017). Roles of Traditional Coastal Management Institution for Mangrove Rehabilitation and Restoration in Aceh Province, Indonesia. In R. DasGupta & R. Shaw (Eds.), *Participatory Mangrove Management in a Changing Climate: Perspectives from the Asia-Pacific* (pp. 217–228). Springer. [https://doi.org/10.1007/978-4-431-56481-2\\_14](https://doi.org/10.1007/978-4-431-56481-2_14)

Jørgensen, T. H. (2008). Towards more sustainable management systems: through life cycle management and integration. *Journal of Cleaner Production*, 16(10), 1071–1080. <https://doi.org/10.1016/j.jclepro.2007.06.006>

Kafle, J., Pokhrel, P. R., Khattri, K. B., Kattel, P., Tuladhar, B. M., & Pudasaini, S. P. (2016). Landslide-generated tsunami and particle transport in mountain lakes and reservoirs. *Annals of Glaciology*, 57(71), 232–244.

Kaklauskas, A., Amaratunga, D., & Haigh, R. (2009). Knowledge Model for Post-Disaster Management. *International Journal of Strategic Property Management*,

13, 117–128. <https://doi.org/10.3846/1648-715X.2009.13.117-128>

Kok, J. A. (2005). Can models for knowledge management be successfully implemented to manage the diversity of indigenous knowledge? *South African Journal of Information Management*, 7(December).

<https://doi.org/10.4102/sajim.v7i4.286>

Kreiwirth, M. (2000). Merely Telling Stories? Narrative and Knowledge in the Human Sciences. *Poetics Today*, 21(2), 293–318.

<https://doi.org/10.1215/03335372-21-2-293>

Maxwell, J. A. (2008). Designing a qualitative study. In *The SAGE handbook of applied social research methods* (Vol. 2, pp. 214–253). London: Sage.

McAdoo, B. G., Dengler, L., Prasetya, G., & Titov, V. (2006). Smong: How an oral history saved thousands on Indonesia's Simeulue Island during the December 2004 and March 2005 tsunamis. *Earthquake Spectra*, 22(S3), 661–669.

<https://doi.org/https://doi.org/10.1193/1.2204966>

McInerney, C. (2002). Knowledge management and the dynamic nature of knowledge. *Journal of the American Society for Information Science and Technology*, 53(12), 1009–1018. <https://doi.org/10.1002/asi.10109>

Meltzner, A. J., Sieh, K., Abrams, M., Agnew, D. C., Hudnut, K. W., Avouac, J.-P., & Natawidjaja, D. H. (2006). Uplift and subsidence associated with the great Aceh-Andaman earthquake of 2004. *Journal of Geophysical Research: Solid Earth*, 111(B2), n/a-n/a. <https://doi.org/10.1029/2005JB003891>

Mercer, J., Kelman, I., Taranis, L., & Suchet-Pearson, S. (2010). Framework for integrating indigenous and scientific knowledge for disaster risk reduction. *Disasters*, 34(1), 214–239. <https://doi.org/10.1111/j.1467-7717.2009.01126.x>

Moahi, K. H. (2007). Globalization, knowledge economy and the implication for

- indigenous knowledge. *International Review of Information Ethics*, 7, 55–62.
- Mwadime, R. K. N. (2011). Indigenous knowledge systems for an alternative culture in science: The role of nutritionists in Africa. In L. M. Semali & J. L. Kincheloe (Eds.), *What is indigenous knowledge? Voice from the Academy* (Routledge, pp. 243–267). New York: Routledge.
- Nonaka, I. (1994). A dynamic theory of organizational knowledge creation. *Organization Science*, 5(1), 14–37.  
<https://doi.org/https://doi.org/10.1287/orsc.5.1.14>
- Nonaka, I., & Ayano, H. (2010). *Social Innovation Creating New Knowledge for New Social Value*. Graduate School of International Corporate Strategy.
- Norris, F. H., Stevens, S. P., Pfefferbaum, B., Wyche, K. F., & Pfefferbaum, R. L. (2008). Community resilience as a metaphor, theory, set of capacities, and strategy for disaster readiness. *American Journal of Community Psychology*, 41(1–2), 127–150. <https://doi.org/10.1007/s10464-007-9156-6>
- North, K., & Kumta, G. (2014). *Knowledge management : value creation through organizational learning*. Springer.
- Palmer, J. (2016). Ethnography as transdisciplinary inquiry: two stories of adaptation and resilience from Aceh, Indonesia. In *Transdisciplinary research and practice for sustainability outcomes* (pp. 190–203). Taylor & Francis (Routledge).
- Paton, D., & Johnston, D. (2001). Disasters and communities: vulnerability, resilience and preparedness. *Disaster Prevention and Management: An International Journal*, 10(4), 270–277. <https://doi.org/10.1108/EUM0000000005930>
- Polanyi, M. (2009). *The tacit dimension*. University of Chicago press.
- Posey, D. A., & Dutfield, G. (1996). *Beyond intellectual property: toward traditional resource rights for indigenous peoples and local communities*. IDRC.

- Poterie, A. T. de la, & Baudoin, M. A. (2015). From Yokohama to Sendai: Approaches to Participation in International Disaster Risk Reduction Frameworks. *International Journal of Disaster Risk Science*.  
<https://doi.org/10.1007/s13753-015-0053-6>
- Probst, G., Romhardt, K., & Raub, S. (2000). *Managing knowledge: Building blocks for success*. J. Wiley.
- Rahman, A., Sakurai, A., & Munadi, K. (2017). Indigenous knowledge management to enhance community resilience to tsunami risk: lessons learned from Smong traditions in Simeulue island, Indonesia. *IOP Conference Series: Earth and Environmental Science*, 56(1), 12018. <https://doi.org/10.1088/1755-1315/56/1/012018>
- Raymond, C. M., Fazey, I., Stringer, L. C., Robinson, G. M., & Evely, A. C. (2010). Integrating local and scientific knowledge for environmental management. *Journal of Environmental Management*, 91(8), 1766–1777.  
<https://doi.org/10.1016/J.JENVMAN.2010.03.023>
- Rodriguez, H., Wachtendorf, T., Kendra, J., & Trainor, J. (2006). A snapshot of the 2004 Indian Ocean tsunami: societal impacts and consequences. *Disaster Prevention and Management: An International Journal*, 15(1), 163–177.  
<https://doi.org/10.1108/09653560610654310>
- Rubin, C. M., Horton, B. P., Sieh, K., Pilarczyk, J. E., Daly, P., Ismail, N., & Parnell, A. C. (2017). Highly variable recurrence of tsunamis in the 7,400 years before the 2004 Indian Ocean tsunami. *Nature Communications*, 8, 16019.  
<https://doi.org/10.1038/ncomms16019>
- Sanny, T. A. (2007). *The Smong Wave from Simeulue: Awakening Strategic Development of Regency of Simeulue*. Simeulue: Pemerintah Kabupaten

Simeulue.

- Schulze, K. E. (2004). The free aceh movement (GAM): Anatomy of a separatist organization. *Policy Studies*, (2), 1.
- Semali, L. M., & Kincheloe, J. L. (Eds.). (2011). *What is indigenous knowledge?: Voices from the academy*. New York: Routledge.
- Seneviratne, K., Baldry, D., & Pathirage, C. (2010). Disaster knowledge factors in managing disasters successfully. *International Journal of Strategic Property Management*, 14(4), 376–390.
- Shaw, R., Uy, N., & Baumwoll, J. (2008). Indigenous knowledge for disaster risk reduction: Good practices and lessons learned from experiences in the Asia-Pacific Region. *United Nations International Strategy for Disaster Reduction, Bangkok*.
- Sillitoe, P., & Marzano, M. (2009). Future of indigenous knowledge research in development. *Futures*, 41(1), 13–23.  
<https://doi.org/10.1016/j.futures.2008.07.004>
- Skyrme, D. (2007). *Knowledge networking: Creating the collaborative enterprise*. Routledge.
- Spiekermann, R., Kienberger, S., Norton, J., Briones, F., & Weichselgartner, J. (2015). The Disaster-Knowledge Matrix - Reframing and evaluating the knowledge challenges in disaster risk reduction. *International Journal of Disaster Risk Reduction*, 13, 96–108. <https://doi.org/10.1016/j.ijdrr.2015.05.002>
- Subarya, C., Chlieh, M., Prawirodirdjo, L., Avouac, J.-P., Bock, Y., Sieh, K., ... McCaffrey, R. (2006). Plate-boundary deformation associated with the great Sumatra–Andaman earthquake. *Nature*, 440(7080), 46–51.  
<https://doi.org/10.1038/nature04522>

- Sukma, R. (2012). *Resolving the Aceh conflict: The Helsinki peace agreement*.
- Syafwina. (2014). Recognizing Indigenous Knowledge for Disaster Management: Smong, Early Warning System from Simeulue Island, Aceh. *Procedia Environmental Sciences*, 20, 573–582.  
<https://doi.org/10.1016/j.proenv.2014.03.070>
- Trumble, W. (2007). *Shorten Oxford English Dictionary* (Sixth edit). Oxford University Press.
- Tsoukas, H., & Hatch, M. J. (2001). Complex Thinking, Complex Practice: The Case for a Narrative Approach to Organizational Complexity. *Human Relations*, 54(8), 979–1013. <https://doi.org/10.1177/0018726701548001>
- Twigg, J. (2009). *Characteristics of a disaster-resilient community: a guidance note* (Version 2). London: DFID.
- UNESCO. (n.d.). What is Local and Indigenous Knowledge | United Nations Educational, Scientific and Cultural Organization. Retrieved June 4, 2016, from <http://www.unesco.org/new/en/natural-sciences/priority-areas/links/related-information/what-is-local-and-indigenous-knowledge/>
- UNISDR. (2009). *Terminology on Disaster Risk Reduction*. United Nations International Strategy for Disaster Risk Reduction.
- UNISDR. (2013). Proposed Elements for Consideration in the Post-2015 Framework for Disaster Risk Reduction. Retrieved September 30, 2017, from [http://www.preventionweb.net/files/35888\\_srsgelements.pdf](http://www.preventionweb.net/files/35888_srsgelements.pdf)
- UNISDR. (2015). The Sendai Framework for Disaster Risk Reduction 2015–2030. Retrieved September 2, 2016, from [http://www.preventionweb.net/files/43291\\_sendaiframeworkfordrren.pdf](http://www.preventionweb.net/files/43291_sendaiframeworkfordrren.pdf)
- United Nations. (2015). *GAR: Global Assessment Report on Disaster Risk Reduction*

2015.

- Vaismoradi, M., Turunen, H., & Bondas, T. (2013). Content analysis and thematic analysis: Implications for conducting a qualitative descriptive study. *Nursing & Health Sciences*, *15*(3), 398–405. <https://doi.org/10.1111/nhs.12048>
- Warren, D. M., Slikkerveer, L. J., & Brokensha, D. (1995). *The cultural dimension of development; indigenous knowledge systems*. London: Intermediate Technology Publication.
- Weichselgartner, J., & Pigeon, P. (2015). The Role of Knowledge in Disaster Risk Reduction. *International Journal of Disaster Risk Science*.  
<https://doi.org/10.1007/s13753-015-0052-7>
- Whitlow, K. F. (2008). The 2004 and 1861 Tsunami Deposits on Simeulue Island, Western Sumatra. Central Washington University.
- World Bank. (1998). *Indigenous Knowledge for Development, A Framework for Action*. Knowledge and Learning Center, Africa Region, World Bank.
- Yin, R. K. (2013). *Case study research: Design and methods*. Sage publications.
- Zimmer, B. (n.d.). Visual Thesaurus: tsunامي. Retrieved September 4, 2017, from <https://www.visualthesaurus.com/app/view>
- Zins, C. (2007). Conceptual approaches for defining data, information, and knowledge. *Journal of the Association for Information Science and Technology*, *58*(4), 479–493. <https://doi.org/doi:10.1002/asi.20508>
- Zschocke, T., & de León, J. C. V. (2010). Towards an ontology for the description of learning resources on disaster risk reduction. In *World Summit on Knowledge Society* (pp. 60–74). Springer.