Lesson Learned from the Aceh Tsunami of 2004
A Digital Multimedia Display of the Aceh Archive Using an Open-Source Platform for Sustainable Disaster Risk Reduction and Global Information

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Abstract: We developed the Aceh Disaster Digital Archive to make information about past disasters more accessible to communities. It employs an open-source data platform, allows free access, and is interactive and easy to use, which is essential for engaging the younger generation. Similar disasters can occur anywhere in the world, and by collecting multimedia data related pre-and post-tsunami Aceh, we have put it into a visual form and linked it with Social Network Services (SNSs) to facilitate the transfer of information and knowledge about earthquake and tsunami experiences in Aceh to promote sustainable disaster mitigation (Disaster Risk Reduction (DRR)). The materials were evaluated in local university to enhance tsunami learning.

Keywords: GAP information, digital archive, dissemination, Community-Disaster Risk Reduction, global information

1. Introduction

Indonesia is a disaster-prone area. The Indian Ocean tsunami of 2004 was one of the biggest catastrophes in a century. The Indian Ocean tsunami caused damage to infrastructures, individual properties, and the environment in many coastal areas around the Indian Ocean. The tsunami was estimated to have caused over 165,000 people lost their lost (BRR, 2005). This paper describes how the Disaster Digital Archive of tsunami was built and utilized as described in Figure 1.

![Figure 1: Framework of Aceh Disaster Digital Archive](image)

1.1 An information gap on past disasters

Researches shows that tsunamis in Aceh, shows in the Figure 2, were relatively rare, but not for the first time. On the seismic history and seismotectonic of the Sunda Arc (K.R Newcomb & W.R McCann, 1987), found (by Monecke et al., 2008), that historic Indonesian seismic records described one of major earthquakes or tsunamis affecting the west coast of Aceh in the last 400 years. Even (Candace A., et al, 2012, Kelsey H., et al, 2011) found pre-historic tsunami since more than 5000 years ago. One exception was the 1907 earthquake, which generated a tsunami that devastated the coastal areas of Simeulue Island, but reached only minimum heights along the Acehnese mainland (McAdoo et al., 2006). Although tsunamis are not new and have occurred several times in Aceh, lessons from the past have been ignored. A loss of knowledge about earthquakes and tsunamis has led to an information gap in the Aceh region. As an international trading port since the 14th century. (D. Perret 2011), Aceh has historical records related to earthquake and tsunami history in the region. The manuscripts are an invaluable record of Acehnese indigenous local wisdom and could be crucial in communicating relevant lessons to current and future generations. As Indigenous Knowledge Saved Lives during 2007 Solomon Island Tsunami (McAdoo et al, 2008). The loss of information in Aceh, due to a long history of war, began during the Dutch Colonial period from 1873 to 1903, and continued with conflicts between religious leaders known as the “Sabil War” (Edward Aspinall, 2007) from 1903 to 1946. In this era, every manuscript that produced has its own purpose mainly to spread Islam to follow the atmosphere and a specific place to

![Figure 2: Map of Aceh, Indonesia.](image)
read to the public (Ali. W., Mamat, 1998). Unfortunately, however, the long period of war and conflict in Aceh over the last century has led to the destruction of many valuable manuscripts (http://kebudayaan.kemdikbud.go.id/bpbarche/2013/10/01/ulama-ulama-penyiar-islam-awal-di-aceh-abad-16-17m/, accessed, October 8, 2017). The surviving manuscripts are preserved at institutions-Dayah (Islamic Boarding School) or by individuals. Such as Dayah Tanah Abe in Aceh Besar, and Ali Hamsy (Faturachman et al., 2010, 2007). Because of these events, the information from the manuscripts has not yet been transmitted to current generations, which has resulted in a major information gap about past natural disasters. To ascertain whether people have knowledge and experience related to past earthquake and tsunami disasters, I conducted interviews in six disaster-affected districts along the west coast of Aceh.

### 1.2 A historical account of Aceh tsunami

Some tsunami scientists argued that tsunami did not leave deposits, and many geologists were skeptical (Bourgeois J., 2009). After scientist found the track of tsunami in the past. Tsunami have mapped boulder and other coral fragment deposits along the coast (Scheffers S., et.al 2009). Tsunami waves transport sandy sediments from offshore areas and the beach and deposit sediments on the inundated land surface. Tsunami deposits are very characteristic for tsunami affected areas (Wagner Jean-Frank and Srisutam Chanchai, 2011). But today, there are several ways to explore and track historical tsunami records. One of these is called paleotsunami. Paleotsunami is an approach to tracking past tsunami events, either through scientific or historical data. In Samatiga Region, West Aceh (Monecke 2008, 2015) found layers of carbon dating to tsunami deposits at 780–990 1000–1170, 1290–1400, and 1510–1959. And (Meilianda 2009) mentioned tsunami events which might affect Aceh in 1907 based on an NOAA report with validity of 4 (valid) and in 1964, in a report with a validity 3 (valid). The current study was supplemented by a geographical map of Aceh, which assumed can offer interesting information if overlaid with earth interface data on the open-source platform.

The records of ancient manuscripts mentioned earthquake occurrences in Aceh dating to 1000 years ago. "The island is washed by two seas. Harkand and that of Salahit" (Bay of Bengal and the Malacca Strait), Lambri Archeological Manuscripts, 1000 Before Present (BP - around 9 Century), Some Aceh Manuscript related to the earthquake and tsunami disaster in the past shows in the Table 1.

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1.3 An alternative medium for educating young generations to learn about historical disasters

Movie is an effective alternative medium for learning about past disasters. (D Buckingham, 1998). It results in changing young people’s relationships with the media, and with classroom-based research. In this study, I outline the conceptual framework for contemporary media education and address unresolved questions about learning and pedagogy. (Hobbs & Renee 1998) reviewed some characteristics of video - based educational materials by describing the intellectual heritage of the movement as including media analysis and media productions as basic skills for the information age.
1.4 Using disaster heritage to develop disaster tourism and an economic base

The Indian Ocean tsunami of 2004 resulted in over 165,000 casualties (BRR, 2005). However, the affected area has become a target for the phenomenon of Dark Tourism. Dark tourism (also known as black tourism or grief tourism) has been defined as tourism involving travel to sites historically associated with death and tragedy. At the same time, this disaster also left a heritage of disaster that has attracted disaster tourism. I discuss this history and the questions raised about the nature of tourism in such “attractions” in the individual context. (John Lennon and Malcolm Foley, 2010). Today, numerous sites of the death and disaster attract millions from all around the world. While many believe that an interest in death and disaster simply stems from morbidity, the range of factors involved extends from an interest in history and heritage to education to remembrance (Yuill, 2003). Although it is only in recent years that it has been collectively referred to as dark tourism, travel to places associated with death, disaster and destruction has, occurred as long as people have been able to travel. In other words, it has always been an identifiable form of tourism (Sharpley & Stone 2009). Preserving the heritage of disaster and the testimony of tsunami survivors on the site lets it serve as a Dark Tourism attraction.

1.5 A lesson learned from the rehabilitation and reconstruction of the housing program

After the 2004 tsunami, Aceh underwent one of the largest reconstruction projects ever seen in the developing world. International response to the tsunami was unprecedented, and billions of dollars flowed into reconstruction along with the largest number of actors ever witnessed. With nearly 500 participating actors on the ground, results were achieved in a remarkably short time, (Harry Masyrafah and Jock MJA McKeon, 2008). Decision making in post disaster housing reconstruction (Caroline S.H., 2010). Visualizing the data on the housing reconstruction process proved to be an effective way to document the lessons learned and disaster risk reduction for future use (Nurjanah, Ichiko T., Hidenori W., 2015).

1.6 A built community based on Disaster Risk Reduction for global information

During disasters, people at the community level have the most to lose because they are most directly impacted by disasters, whether major or minor. On the other hand, they have the most to gain if they can reduce the impact of disasters on their community. This concept gave rise to the idea of community-based disaster management (CBDM), where communities are put at the forefront. Through the CBDM, the capacity of the general public to respond to emergencies was increased by providing them with four additional avenues of access and control over resources and basic social services. Using a community-based approach to managing disasters thus has definitive advantages. CBDM strives to empower communities to undertake any development program, including disaster preparedness and mitigation (Bishnu Pandey, Kenji Okazaki, UN, 2005). Code for All in the link https://codeforall.org, is an international network of organizations who believe that digital technology opens new channels for citizens to more meaningfully engage in the public sphere and make a more positive impact on their communities (Codeforall.org, 2017).

One of the things that should not be overlooked for sustainable disaster mitigation is the development of community-based disaster risk reduction. Disaster-responsive communities, who understand the threats within their
territories, make efforts to share disaster information, experiences, and mitigation strategies by, from, and for the community.

Social Network Services (SNSs) are an essential part of contemporary life. Thus, digitalizing, visualizing, compiling, and displaying open-source data and linking them to SNSs is a means of making information from past disasters accessible and transferring knowledge about sustainable disaster risk reduction and global information.

2. About this Study
2.1 Objectives

The objectives of this study are (1) to collect data related to pre- and post-tsunami Aceh 2004; (2) to use alternative media for disaster risk reduction (DRR) education; (3) to transform those data onto a user-friendly visual open-source data platform, the Aceh Tsunami Archive to teach about pre- and post-tsunami events; and (4) to link the Aceh Disaster Digital Archive to SNSs to facilitate the transfer of information and knowledge about earthquake and tsunami experiences in Aceh for sustainable DRR and global information.

Study areas for this research included several locations along the southwest coast of Aceh, which were particularly affected by the tsunami. The locations are situated at the border of the Indian Ocean subduction zone, which includes Banda Aceh, Aceh Besar, Aceh Jaya, Aceh Barat, Simeulue, and Singkil as shown in the Figure 3.

2.2 Previous Studies

Nurjanah, Nazli Ismail, Husaini Ibrahim: *Aceh Paleotsunami for Disaster Risk Reduction*, (Thesis, Disaster Science & Management, Post Graduate Program of Syiah Kuala University, Banda Aceh, 2013). Based on some reviews, the tsunami disaster in Aceh is not new and it has happened several times. Nevertheless, when tsunami happened in Aceh, it is still powerful to pose some significant destructive impacts and it caused human casualties. It seems as a recurrence event of the same history that disregards lessons from the past. Many factors contributed to the low awareness of the disaster. One of them is tsunami period that is a low-frequent event. It may range between 30-600 years of return period. Due to its low-frequency, people tend to forget about it and lessons from past experiences were not being transferred to other community or generation. Today, there are several ways to explore and to track tsunami record in the past, they called it paleotsunami with science by tsunami deposit and coastal geomorphology, and historical base by prose and manuscripts. By integrating and synchronizing paleotsunami Aceh, the validity of Aceh tsunami records reconstruction will be more precise. This research is a qualitative descriptive approach using historical and science literatures. By this research, lesson learned from tsunami experience in the past can be more useful for Aceh’s sustainable disaster risk reduction in the future.

Nurjanah, Hidenori Watanave. *Historical Digital Archive for Disaster Risk Reduction and Global Information*. (ADADA, 2014). Information is the most important issue in Disaster Risk Reduction (DRR). Information transfer and dissemination is needed, sustainability from generation to generation. Indian Ocean tsunami in 2004 was occur in Aceh. The tsunami was estimated to cause more than 166,000 dead. One of the big reasons is GAP information from the past disaster. Today, information could be delivered to the world as soon as possible by internet. In this millennium era, used historical digital archive and display in Google earth contents is one of solution to fill in the GAP information for Disaster Risk Reduction and spread it up to the world as a global information.


http://conf2014.jadh.org/sites/conf2014.jadh.org/files/jadh2014abstracts.pdf. Indian Ocean Tsunami 2004 is one of the biggest catastrophe incidents over the last 100 years. Although the tsunami is not new and it had happened several times in Aceh, that disregards lessons from the past. Paleotsunami is a theory to track the record of tsunami events in the past, either through scientific or historical approaches. Based on the interview, it reveals that Aceh communities already had knowledge in relation to the earthquake and
tsunami under their own local terminology, i.e. "Gelor", "Smong" and "Ie Beuna". Banda Aceh as the capital of Aceh Province and the Centre of Aceh Government kept a biggest gap of information in relation to the earthquake and tsunami incidents in the past. Cultural changes had made the ancestors and coastal communities forgot to share the information and knowledge about the tsunami phenomena to the next generation. Such facts had affected to less disaster awareness of Banda Aceh as the region with the largest number of casualties and the extent of damage when compared to other parts of Aceh in earthquake and tsunami in December 2004. *Aceh Paleotsunami Digital Archive* is one of the ways to fill in the gap of information from the past disaster and global information.

2.3 Related Studies

Data visualization products have been implemented in many fields such as disaster and historical studies and the weather forecasting system created by Hidenori Watanabe et al (2010, 2011, 2012, 2013). Creating a digital archive that provides a multipronged, general understanding of an archived event requires a well-designed method (Watanabe, H. et al 2011). Data visualization that utilizes an online virtual globe makes it easier for researchers to find new historical information and disseminate knowledge widely on the internet (Watanabe, H. et al 2010). The Japan Disasters Archive (JDA), in the link [http://jdarchive.org/](http://jdarchive.org/), is an online portal to digital materials documenting the cascading series of natural and human-made disasters that began in Japan on March 11, 2011, designed and maintained by the Reischauer Institute of Japanese Studies at Harvard University. The JDA relies on the support of partner organizations around the world to supply digital contents including websites, tweets, video, audio, news articles, and much more. This portal provides information Great East Japan Disaster on how to use the archive interface for information retrieval (Website Japan Digital Archive, 2017). Building a community to improve the quality of life. Technical and design talents can be combined to transform government and impact lives and work on local matter. The portal shows how developers, designers, and product managers can work with governments to solve major challenges, such as disaster issues (Code for All, 2017).

3. Methods and Results

1) This study employed two research methods: (1) Qualitative research was used to collect data from several sources. Using primary data for the questionnaire, in-depth interviews and observations were conducted by purposive sampling. In addition, secondary data from the literature were used. (Cohen L., et al, 2005, Moleong L., 2001, Narbuko C., 2007, Nazir M., 2003, Miles M.B., 1992); and (2) Quantitative research was used for the creation of the archive. We used cesium for open-source data through the github platform ([https://github.com/about/](https://github.com/about/), accessed July 15, 2017), along with visualized data. We upload the link on the Facebook Fan-Page of Community. As an effective social media in Indonesia especially in Aceh.

3.1 Collecting Data

3.1.1 Interviews

Acehnese has had prose forms including rhymes, poetry, and stories, known as *Hikayat*. *Hikayat* with the title "Earthquake in Aceh" describe the earthquake and tsunami of 1964 and describe boats tossed around and high surging seawater, "Ali Head Village trembling body, running and standing to the flat ground, boat in the sea is shaking, tossed around here and there."

The authors conducted interviews between March 10 to 25, 2012, in the six tsunami-affected districts in Aceh that border the Indian Ocean subduction zone with their own local terminology such as "Gelor" in Singkil Language, "Smong" in Simeulue, and "Ie Beuna" in Aceh, all of which are the local words for "tsunami.":

(1) Singkil, March 25, 2012, Narrated by Safrijal Amni: "The first geloro was around the 18th century, which drowned Old Singkil Town, then around the 19th century, there was a second geloro, which forced people to move from Kayu Menang to Singkil."

(2a) (Rachmalia, 2012.), Teupah Barat, Simeulue. Narrated by Rukiyah: "In 1907, an earthquake occurred before Friday prayer. I was a small child and did not know anything. The ground cracked open, and my father took me and we fled to the mountains. After prayer, many people visited the low tide sea, then the smong arrived, and the water entered the land and many people died. At that time, we were eating sago and using bark cloth (bairak)."

(2b) (Ilyas, 2012), When the earthquake happened in the early morning in December 2004 and the river water (estuarine) receded quickly, I knew that the sea water would rise, because of the sound like *pandan* leaves burning. So, I shouted "smong!" and everyone ran to the mountains. When my grandson was born in the mountains, I called
him “Son of Smong.”

(3) Aceh Barat, March 23, 2012, Meulaboh-Padang Village. Narated by Cut Dian Putri: “According to a story from my grandmother, my grandfather was born at the time of the incident Ie Beuna. On that morning, the water in the sea looked very high. The religious leaders approached the coast and sounded the Azan. The sea water broke on the beach and a small amount of water came onto the land. That’s why my grandfather was named Teuku Leupek Ie Beuna. During the earthquake in the morning of December 2004, my grandmother said, “The sea water will rise soon!” We were thinking that my grandmother was very old and just senile. When the sea water came, we tried to reach her, as she could not get out of bed. I lost my grandmother and my husband, but my son was saved.”

(4) Aceh Jaya, Krueng Sabe, Bunta Village, March 20, 2012. Narated by Hamidah: “When I was a girl, Ie Beuna happened (reconstructed by The authors, based on year of her birth, around 1907). In the morning, the water in the Krueng Sabe River was spilling over, which was close to the Dragon Cave (Geni Village, around 7–8 KM from the coastline). I also felt earthquakes for 7 days and 7 nights during the DI/TII war (reconstructed by the same authors based on the history of other regions, around 1964); the earthquakes started in the morning, and consequently Gunung Sawah collapsed.” [Hamidah, 120 years old, Bunta Village, Krueng Sabe, Aceh Jaya].

(5) Aceh Besar, Lambaro Nejid Village, March 17, 2012. Narated by Abdul Majid: “According to a story from my mother, in the same year as my birth, there were Ie Beuna events; the sea level rose about 2 feet in 1936. I also experienced earthquakes in 1945 and morning earthquakes for 7 days and 7 nights in 1964.” [Abdul Majid, 77 years old, Lambaro Nejid Village, Aceh Besar].

(6) Banda Aceh, Lampulo, March 10, 2012. Narated by Ayi: “My great-grandfather, my grandfather, and my father were fishermen, brought up from childhood in the coastal environment, but I never heard stories from my parents or grandparents related to tsunamis before 2004. So, the tsunami event in 2004 was a new experience for us, especially when it happened. A lot of people died, nearly 80% of them were old people. So, it was impossible to trace back information related to earthquakes and tsunamis from them.”

3.2 An Aceh paleotsunami documentary film

The authors, produced The “Aceh Paleotsunami” documentary film in 2015 about Aceh’s tsunami history was made into documentary film as an alternative medium of disaster education with the collaboration funding from Tokyo Metropolitan University Japan, Wellesley College USA and Yayasan Kemaslahatan Ummat, Indonesia.

It began with the terrible scene of the 2004 earthquake that killed more than 166,000 people. It then showed the basic facts of the history of the earthquake and tsunami disaster in Aceh, the number of researchers who came to study the tsunami, and the paleotsunami research of Katrin Monocke, who discovered a tsunami layer dating back 1000 years in the Samatiga region of West Aceh. From Candace and Nazli Ismail et al. discovered a tsunami layer in a cave located in the Layeun area of Aceh Besar.

The film then shows a historic Jawi language manuscript describing a past earthquake-related tsunami disaster, and was translated by the Aceh manuscript expert, Hermansyah (2012). This work should also be disseminated to the younger generation. This was followed by community interviews about past knowledge and experience of earthquake and tsunami disasters in some districts of Aceh. This added insight to the term geloro, which in the local language in Singkil means “tsunami.” Tsunamis have occurred since the 18th century and drowned the Old Singkil City. The core of the film is to encourage young people to re-learn the history of the disaster, respond to disasters, and participate in disaster reduction activities, learning from the disaster-prone regions of Aceh.

3.3 The Aceh Archive for Disaster Risk Reduction (DRR)

The author along with the member of Network Design Laboratory of Tokyo metropolitan University, Hiroki Inoue, has collaboration scientific research to develop "Aceh Archive for DRR". The author collecting several types of data, overlaying maps into the open source platform by kml and html data, and the collaborator created the new platform by github. It provides additional valuable information about past disasters. Use of an open-source data platform with free access is essential for giving the younger generation an engaging and interactive first impression of the earth interface. With these tools, they can access geographical information ranging from a macro-global space perspective to the micro-space of Aceh, shows in the Figure 4.
Displaying old manuscripts related to the earthquake and tsunami in Aceh, can make better understanding for young generation, there are some of local knowledge from the past to get lesson learn for disaster mitigation, shows in the Figure 5.

Personal testimonials about Aceh tsunami experiences can be accessed by face icons. This information will remind people around the world that local knowledge from past disasters offers the best lessons for DRR and global knowledge, since disasters and similar experiences can be happen anywhere in the world, shows in the Figure 6.

The Visualization of Aceh Digital Archive for DRR serves to fill the information gap about past disasters for disaster risk reduction - mitigation and global information, present in the link below: https://wtnv-lab.github.io/aceh_archive_for_drr/

Any major catastrophe will leave many relics. After the 2004 tsunami, many houses and infrastructures were destroyed or half destroyed. In many disaster areas, most of them were cleaned up because seeing the damage made disaster victims felt sad. But in Aceh, the opposite occurred. Tsunami survivors on the boat on the top of houses in Lampulo area decided to keep the relics. The community even made a book of testimonials from the local community that shared the experiences of 10 survivors in the book of “Mereka Bersaksi”, (2012), or “Their Testimonies”, printed by an independent tourism program. More complete testimonials are available through the Dark Tourism archive link. The following passages come from these testimonials:

Abasiah: “On Sunday, December 26, 2004, exactly a year ago, the day that we will never forget in our lifetimes, in the time in which there was a great disaster, never before seen or heard or imagined. Allah (The Majesty and Almighty) was showing some signs of his greatness and power, ALLAHU AKBAR.”

Preserving disaster heritage and displaying the testimonials of tsunami survivors is important. It could serve as a lesson for other disaster areas such as Japan, where many disaster relics have been destroyed. From the experience of Aceh, we know that the heritage of disaster does not only include sorrow, but education and other benefits. The authors included into the Aceh Tsunami Archive visualizing mechanism of disaster heritage sites to enhance such tourism. It is not only to teach the history of disasters to young people, but also to attract foreign tourists to visit Aceh’s disaster history sites, as well as to improve the economics of communities surrounding historical sites, shows in the Figure 7. The link of archive can be found in the link below: https://wtnv-lab.github.io/aceh_archive_for_drr/dark_tourism

3.4 Code4Aceh

The authors is the founder of Community Base on Disaster Risk Reduction called Code4Aceh in collaboration with an international technology designer from Japan and Aceh governmental agencies such as the Tourism Board and Tsunami Museum. It creates an annual digital archive every year to engage the community to create simple, user-friendly digital interfaces to attract public participation to develop sustainable Community base on Disaster Risk Reduction (DRR). Code4Aceh built a Facebook fan page to provide access to analysis of and research related to the earthquake and the tsunami disaster’s experience, in Aceh and Japan.
Code4Aceh also undertook post-disaster response measures in both countries, such as following the 2015 Kumamoto Earthquake in Japan and the 2016 Pidie Jaya Earthquake in Aceh. The Code4Aceh Community leveraged both nations’ knowledge and resources through an interactive Talk Show in Radio Republik Of Indonesia (RRI-Aceh) on their daily program as an invited expert sources, shows in the Figure 8.

![Figure 8: Radio used as an interactive DRRR medium for international collaboration.](image)


![Figure 9: (left) Asahi Shimbun, (right) Iwate Nippo. Code4Aceh Facebook Fan Page](image)

So far, the data show that the Code4Aceh Facebook fan page has had a positive impact and attracted positive attention from audiences as an alternative medium for learning about disaster, more than 1,700 people reach the link and the information spread up, shows in the Figure 10. The link of Facebook fan page can be found in the link below: https://www.facebook.com/code4aceh/

![Figure 10: Code4Aceh promotes global information.](image)

3.5 Visualization of the GRC Housing Project

Explore the key challenges facing non-governmental organisations (NGOs) during decision making in post disaster housing reconstruction is needed (Caroline Hayes, 2010). The German Red Cross (GRC) Housing Project implemented programs for different housing types in two selected districts of Aceh. One housing program was inland, in the Calang Region of Aceh Jaya. The other was in Sabang Island. Differences between the two areas were compared. The Aceh Jaya District got two-story, semi-traditional style houses with sanitary facilities including toilets. The housing program in Sabang District constructed single-story houses in a semi-modern style with toilets but no wells (German Red Cross, 2013).

Typical hazards in the two districts areas are common threats to the general area of Aceh: hydrometeorological hazards (floods and typhoons) and geological hazards (earthquakes and tsunamis). Earthquakes and tsunamis remain the two major types of disasters affecting both areas. Frequent floods and typhoons are the third hazard shown in the Figure 11.

![Figure 11: The characteristics of structures from the GRC Housing Project in the Aceh Jaya District found that building structures increased community disaster preparedness for floods with two-story houses, and they used the first-floor to self-initiatives for enhancing economic growth by making](image)
small trading businesses such as, vegetable-fruit and fish stores, sewing shops, pharmacies, etc. For geological hazards (earthquakes), the community preferred evacuation to open space or higher land. One hundred percent of the communities confirmed that no structural damage occurred during the 2012 earthquake. The structure of gable houses is neither permanent nor strong enough to withstand typhoons without risk shows in the Figure 12.

Final study results showed an encouraging situation for the housing program, confirming the usefulness of the program and of community self-initiatives for enhancing economic growth for housing and disaster mitigation.

The authors developed digital archive of visualization data from a housing program for disaster victims in Aceh, which can provide a better understanding to represent a concrete and overall of housing program post disaster 2004 in Aceh, base on German Red Cross End-line Survey after 5 years using the houses. It provides a real and attractive display offering access to information such as ground-to-top views, the number of occupied houses, their elevation, the kinds of materials used in the housing program, the appearance of landscaping in the areas, how close the areas are to the ocean, the effect of distance from the ocean on housing, and images showing the degree of damage to houses or materials.

By visualization of the landscape, additional hazards were discovered: (1) the location of houses near the slope poses a risk for landslides, (2) the location of houses near the ocean can lead to problems for water sanitation, and (3) poor materials can come loose during the monsoons/typhoons, shows in the Figure 13. The link of archive can be found in the link below: http://code4aceh.github.io/DigitalEarthArchive/

4. Outreaching and Acceptance

4.1 The Aceh paleotsunami documentary film

We uploaded The Aceh paleotsunami documentary film as discussed in chapter 3.1 above, uploaded on June 24, 2015 to YouTube and linked to the web and SNSs such as Facebook Fan-page of community that we will discuss in the chapter 3.1.5, ensure accessibility in the era of social media. Film cover shows in the Figure 14.

The Aceh paleotsunami film has attracted a good start to pay attention as a global information dissemination tool for dissemination information to young generation. Besides, it gets 77% of its audience from YouTube searches, with 87% of its audience being American citizens, shows in the Figure 15.

The authors provided the Inamura no Yakata, Tsunami Educational Museum, in Wakayama Prefecture, Japan a copy of the Aceh paleotsunami documentary film. The film is permanently displayed in the museum as an education tools for DRR education, sharing knowledge of past disasters in Aceh with Japanese society, can be found in the link http://www.town.hirogawa.wakayama.jp/inamuranohi/tunami_2f.html (Nurjanah, Monecke K., Hidenori W., 2015).
4.2 Workshop using the Archive

The authors presented the archive in a one-hour workshop in Aceh to fifty-two 1st year students from Syiah Kuala University on date/month/year to test its attractiveness and its ability to inform young people about the past.

The workshop was divided into two parts. In the first 30 minutes, the participants were asked to research the history of tsunamis in Aceh using traditional methods; that is, by consulting historical sources and other related literature such as paper journal and books. The first 10 minutes were spent introducing the theme, and the following 20 minutes were spent on manual research, with the last 5 minutes dedicated to completing the first questionnaire.

The second 30 minutes were spent learning about the history of tsunamis in Aceh using the digital archive on the Aceh disaster open-source platform. The first 10 minutes of the second session were spent on the introduction. Participants were then asked to access the Aceh disaster archive on their mobile phones, and the last 5 minutes were spent completing the second questionnaire, as shown in the figures below.

Figure 16 shows students get 54% lesson to learn by digital archive, even 5.76% get lesson in the range 80–100%.

Figure 17 shows 46% of the students were interested in learning with the digital archive, but 38.46% get interest increase to learn related disaster in the range 60–80% and more than 9% in the range 80–100%.

Figure 18 shows student get 63% knowledge increase to learn related disaster by digital archive in the range 60–80%, even 21% get knowledge increase in the range 80–100%.

Figure 19 shows, 44% of the students gave their impressions by learning from each media. They enjoyed and exited learning about the disaster more with the digital archive than by learning the traditional manual way.

Figures 20 and show that student felt that learning with the Aceh Disaster Digital Archive was easier and more interesting, efficient, ideal, helpful than traditional learning, and it also improved their skills and knowledge.
Figure 20: Students agree it is easier to learn about disasters with the Aceh digital archive.

5. Discussion and Conclusion

This paper discussed the accomplishments of the authors as follows:

1. Collecting the disaster victims’ voice through interviews.
2. Developing a movie film about the Aceh tsunami.
3. Developing the Aceh Tsunami Archive.
4. Establishing a Aceh Tsunami Community site, Code4Aceh.
5. Developing a visualization site for the GRC Housing Project

The Aceh Tsunami Archive, which employs global information from open-source data for DRR. It also explained how this archive can contribute to the transfer of information and knowledge about earthquake and tsunami experiences to future generations.

The 2004 Aceh tsunami experiences offer meaningful lessons. Aceh local knowledge must be transferred to others to mitigate future disasters. In the future, developing the Aceh Aceh Disaster Digital Archive will serve to make information on past disasters more accessible to communities in which it is needed. Using open-source data, free access, and interactivity make the platform easy to use for the younger generation and handy, its accessible by mobile phone shown in the Figure 21. The Aceh Disaster Digital Archive, will remind people all over the world that local knowledge of past disasters offers valuable lessons for DRR.

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2004年アチェ津波からの教訓
オープン・ソース・プラットフォームを用いた持続可能な災害リスク低減とグローバル情報のためのアチェ・アーカイブのデジタル・マルチメディア表現

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抄録：コミュニティが災害情報にもってアクセスしやすくするために、過去の災害情報を作成するためのアチェ災害デジタルアーカイブを開発した。オープンソースのデータプラットフォームを採用しており、アクセスは無料で、古い世代をターゲットに、インタラクティブで使いやすく開発した。世界各地で同様の災害が発生する可能性があり、アチェの津波後のさまざまなメディアでのマルチメディアデータを収集することで、可視化を進める、これをソーシャルネットワークサービス (SNS) にリンクすることにより、アチェでの地震と津波の経験に関する情報と知識その情報と知識を広範に伝達し、持続可能な災害低減対策 (災害リスク低減 (DRR)) を期する。

キーワード：GAP情報、デジタルアーカイブ、配信、コミュニティの災害リスク低減、グローバル情報


