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Project Proposal – TEAM 4

Project Title

A comparative assessment of tsunami evacuation measures and public awareness in the Indian Ocean region – India, Indonesia, and Sri Lanka

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ABSTRACT

As warmer temperatures contribute to the rise in sea levels, it is essential for vulnerable coastal regions to be prepared for events such as the 2004 Indian Ocean tsunami or the 2018 Palu tsunami in Indonesia. 15 years after the Indian Ocean tsunami, several international standards have been created and initiatives taken, both internationally and nationally, to be more prepared in such an event. However, there are still instances where efforts have shown to not been enough and there are gaps that still to be addressed. A major part of tsunami preparedness is public awareness and capacity building. Accurate dissemination of information to concerned authorities and the general public is crucial in the event of a tsunami. Literature provides instances of assessments done on national or sub-national levels to determine tsunami preparedness, but only in a few specific locations. However, tsunamis do not consider international boundaries, which is why a holistic and unified system needs to be maintained. Therefore, this study aims to comparatively assess tsunami evacuation preparedness as per national and international policy and measures among the general masses in the nations of the Indian Ocean region. This will be done using mixed method approach using questionnaires and interviews among various sectors of the public, i.e., residents, schools, and government officials in charge of disaster related activities.

1. Introduction

A large earthquake measuring a 9.0 magnitude on the Richter scale set off a massive tsunami in the Indian Ocean in December of 2004, causing enormous damage to the region across countries that border the ocean (USGS, 2004). The number of dead and missing is estimated at about 300,000 and almost 1.2 million people were affected by the event (OCHA, 2005). The scale of damage that occurred was attributed to the absence of an integrated Indian Ocean early warning system and the lack of knowledge about tsunamis. 15 years since the 2004 tsunami, there have been several international collaborative research projects and initiatives implemented to try and make the region more resilient to natural disasters and coastal hazards such as tsunamis. However, empirical evidence to demonstrate people's level of disaster awareness, disaster management systems, and evacuation measures that meet international standards are still lacking in the Indian Ocean region. With the seismological active nature of the Burma-Andaman-Sumatra subduction zone constantly posing a tsunami threat to the region, an effective evacuation plan and the correct knowledge of what to do in the event of a tsunami could drastically reduce the magnitude of damage from the natural disasters (Roshan, Basu, & Jangid, 2016). Despite efforts of capacity building and preparedness, coastal populations largely remain unaware of basic tsunami knowledge and evacuation measures (Esteban et al., 2013). Though there have been a few studies conducted in Indonesia on the topic, a comparative study on the countries which were most affected by the 2004 tsunami is lacking. Therefore, it is important to assess the level of awareness of the general public across the countries that border the Indian Ocean in order to address gaps in the dissemination of knowledge to make the region more resilient to tsunamis. We suppose that if integrated disaster mitigation efforts are viable, the potential of human risk due to tsunamis can be significantly reduced by continuously educating people in tsunami prone areas.

2. Background

International efforts and collaborations have brought about many initiatives and measures to make coastal regions more resilient to natural disasters. Notable treaties such as the Hyogo Framework and Sendai Framework for Disaster Risk Reduction have led to major advances in early warning systems throughout the world. The Intergovernmental Oceanographic Commission's Indian Ocean Tsunami Warning and Mitigation System (IOC-IOTWMS) is perhaps the most prominent development in the post-2004 era, wherein an integrated warning system has been created, including all countries that border the Indian Ocean. In the aftermath of the 2004 tsunami, an 'end-to-end' tsunami early warning system was designed and developed in Indonesia which can issue warning within 5 minutes of the event (Rudloff et al. 2009, Lauterjung et al. 2010, Pariatmono, 2012).

Nevertheless, this system mostly focuses on the technocratic side of early warning systems (EWS) while less addressed are the human aspects (Garcia & Fearnley, 2012; Hettige & Haigh, 2016; Spahn, Hoppe, Vidiarina, & Usdianto, 2010). The process of disseminating information to the public about what to do when a tsunami warning is triggered seems to be the priority problem to address in the near future. Haydenetal (2007) said that the role of warning dissemination is a key part in the success of such large-scale evacuations and it's inadequacy in certain cases has been a 'primary contribution to deaths and injuries.' While some Indian Ocean countries have built monitoring seashore systems to mitigate oncoming tsunami (Levy, Hipel, &Howard, 2009) and India and Sri Lanka have signed a computing data agreement for observing tsunami inundation and arrival time (Arcas & Titov, 2006), a study conducted by Thomalla and Larsen (2010) shows that EWS policy in Thailand, Sri Lanka, and Indonesia has not yet been sufficiently translated into action. On the other hand, a few policies pertaining to evacuation have been implemented in some areas (Mauro, Megawati, Cedillos, & Tucker, 2013) or with some limitations (Suppasri et al., 2015). Hence, this study aims to holistically and comparatively look at the policies and measures on evacuation preparedness implemented in the countries bordering the Indian Ocean in order to find gaps and address them in order to make the region more tsunami resilient.

Apart from an effective early warning system, increasing the capacity of local communities in the event of a tsunami can prove to be a more long-term solution to effective preparedness (Muttarak, Rayaand Lutz & Wolfgang, 2014).Inappropriate responses of people to a tsunami and limited structural facilities for dealing with evacuation increases a tsunami's impact. Awareness of tsunami evacuation measures could save lives in the event of a tsunami. For example, when the tsunami of 2012 hit Banda Ache, tsunami vertical evacuations or TVEs were in place. However, when the tsunami hit, only 26 percent of the affected population used TVEs while most of the rest chose horizontal elevation (McCaughey et al., 2017). Results of the questionnaire survey after the doublet outer-rise earthquake in April 2012 off Simelue Island in Indonesia stated that people in Banda Aceh are still demonstrating inadequate behavior in responding adequately to the warning and to evacuation (I-RAPID. 2012). Apart from the general public, studies indicate that even local government bodies lack the understanding of their roles in the event of an emergency such as tsunamis (Spahn, et al, 2010). Despite policy measures and plans in place, it is important to assess and understand how effective these measures are down to the local communities in order to understand whether information gets correctly passed on to the general public and is creating awareness. Due to these gaps, this study aims to assess the public awareness of local coastal communities in India, Indonesia, and Sri Lanka in order to determine their level of tsunami preparedness as per respective national policies.

3. Research Question and Study Objectives

Table 1: RESEARCH QUESTION

AREA/FIELD OF RESEARCH: Comparatively assessing tsunami public awareness and evacuations measures in the most affected countries of the 2004 Indian Ocean tsunami – India, Indonesia, and Sri Lanka.

STATEMENT OF THE PROBLEM: While several international and national measures and plans have been undertaken by countries bordering the Indian Ocean region for tsunami preparedness, research is yet to be conducted on how aware the general public is about these measures and plans.

PURPOSE: This study aims to comparatively assess the evacuation preparedness measures in place in the countries bordering the Indian Ocean and the capacity of a local communities to respond to a tsunami, and to propose recommendations for the better dissemination of tsunami evacuation knowledge.

RESEARCH QUESTION:

How aware are local coastal communities of tsunami evacuation plans and measures drawn out by policies and initiative to make the coast of Indian Ocean countries more prepared for events such as the 2004 tsunami?

Table 2: PROJECT OBJECTIVES

Research Objectives	Specific Research questions
	<p>1.1. What are the major national disaster management documents in the respective study areas?</p>

1. To assess and compare tsunami evacuation preparedness measures as per national and sub-national policy	1.2. What are the various changes, initiatives and collaborations that have occurred since the 2004 tsunami at an international and the national level?
	1.3. What are the national and sub-national institutions responsible for tsunami preparedness and awareness in the study areas?
2. To assess and compare public awareness of these measures and plans and the given communities' capacity to respond in the event of a tsunami	2.1. What is the level of tsunami evacuation knowledge and awareness of evacuation plans among the local coastal communities of the study areas?
	2.2. What are the gaps in the dissemination of tsunami awareness process?
	2.3. How do the 3 study areas compare with each other with respect to tsunami evacuation awareness?
3. To provide recommendations to address policy gaps and gaps in dissemination of information on evacuation measures to the local communities	3.1. What are the gaps and/or differences in DM and evacuation policy measures among the 3 study areas?
	3.2. What specific recommendations are best for each country to improve the given evacuation policy can these be undertaken?
	3.3. What can the 3 countries learn from each other and other nations with respect to tsunami evacuation awareness?

4. Methodology

Study areas

This study will be carried out in three locations considering three geographic location severely affected by the 2004 tsunami. The locations are as follows:

- India–Andaman and Nicobar Islands (Districts of South Andaman and Great Nicobar)
- Indonesia – Banda Ache

- Sri Lanka – Eastern Province (District of Ampara – South Eastern Coastal areas)

Research Framework

In order to achieve the objectives mentioned above, this study will be conducted in two phases as shown in Figure 1. Phase I will analyze and compare evacuation initiatives and measures noted in national and sub-national policy in the study areas. Phase II will assess public awareness of these measures and plans in the event of a tsunami as well as understand the general awareness of tsunami knowledge among local communities.

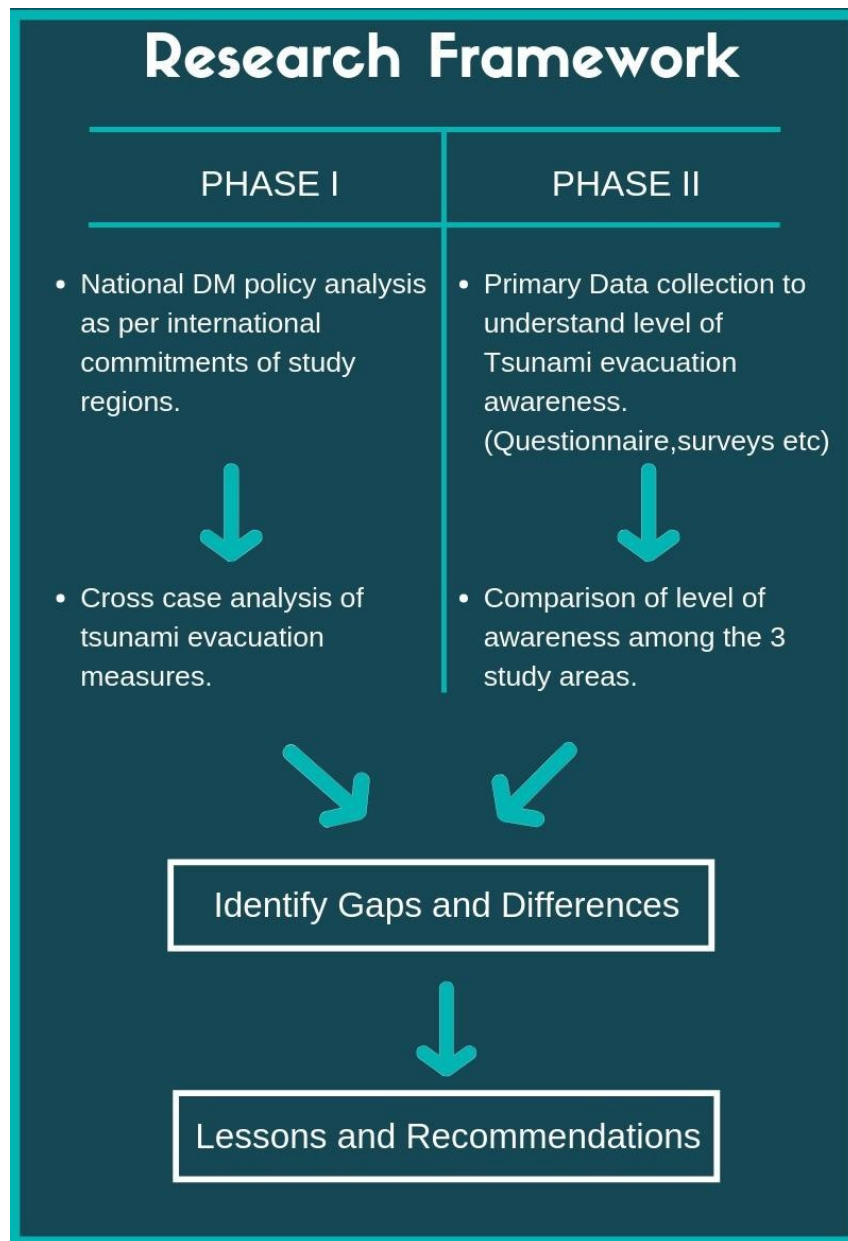


Fig. 1. Research methodology for the proposed study

PHASE I

While conducting policy analysis in the 3 countries, key factors of evacuation planning as stated by UNESCO-IOC (Fig.2) will be used as indicators of effective measures taken toward tsunami preparedness. The respective national disaster management documents to be analyzed are stated in Figure3. Any relevant sub-national documents applying to the region will also be analyzed. The policy similarities and differences along with gaps in each of the case study areas will be studied through cross-case synthesis. A set of lessons, good practices, and recommendations will be drawn from this study.

UNESCO-IOC's Key Factors for Tsunami Evacuation				
Feasibility of Evacuation	Warning & Communication System	Promoting Public Awareness	Evacuation Organizations	Evacuation of Residents
<ul style="list-style-type: none"> Determining evacuation sites and safety zones. Estimating evacuation time 	<ul style="list-style-type: none"> Monitoring Tsunami Warning System Building and improving the warning system. 	<ul style="list-style-type: none"> Education programs Developing safety manual Safety Drills 	<ul style="list-style-type: none"> Organizational Structures Roles and Responsibilities Capacity & Resource Base 	<ul style="list-style-type: none"> Evacuation routes Evacuation Sites Caring of vulnerable people Transportation systems

Fig. 2. Factors for tsunami evacuation considered for policy analysis

National Disaster Management Documents		
India	Indonesia	Sri Lanka
Act 53 / 2005	Act 24 / 2007	Act 13 / 2005
The Disaster Management Act 2005	Law of the republic of Indonesia no. 24 / 2007 concerning Disaster Management	Sri Lanka Disaster Management Act, no.13 of 2005

Fig. 3. Respective national DM documents for policy analysis in proposed study areas

PHASE II

To assess public awareness on tsunamis, questionnaire surveys are to be carried out among residents, school children, fishermen and government officials in the study areas. In-depth interviews and focus-group discussions will be conducted in order to supplement the questionnaires. Schools and residents closer to the coast will be given precedence and will be the targeted population.

Data collection and study tools

This study will follow a mixed method approach using both quantitative and qualitative data to fulfill its research objectives with the help of both primary and secondary data collection methods. Key data collection methods include:

1. Secondary data collection – All accessible disaster management plans and reports will be analyzed to explore answers for the research questions
2. Primary data collection–
 - a. Questionnaire survey among residents, fishermen, school children, and government officials.
 - b. Focus Group Discussions (FGD) in each case study location will be done with the sub-national level disaster management policy makers and practitioners working in state and non-state organizations.
 - c. Key Informant Interviews – One-on-one semi-structured interviews will be done with identified stakeholders.
 - d. Stakeholder analysis will help us understand who policies need to keep in mind and how to go about forming inclusive decision making in regards to tsunami awareness information initiatives.

Table 3: Research Plan

Plan for data collection and analysis to provide evidence for answering the research questions defined for each objective				
R.Q NO.	Specific Research Question from T2	Techniques of data collection	Source of data	Techniques of data analysis
1.1	What are the major national and sub-national disaster management documents in the respective study areas?	Secondary data analysis	DM plans Government reports/plans	Content analysis
1.2	What are the various changes, initiatives and collaborations taken after the 2004 tsunami at an	Secondary data analysis	DM initiatives/plans International and national	Content analysis

	international and national level?		reports and publications	
1.3	What are the national and sub-national institutions responsible for tsunami preparedness and awareness?	Secondary data analysis Semi-structures interviews	DM plans DM policy makers/practitioners	Content analysis
2.1	What is the level of tsunami evacuation knowledge and awareness of evacuation plans among the local coastal communities of the study areas?	Questionnaire survey Interviews Focused group discussions	Local communities (residents, school children and gov. Practitioners)	Content analysis Case study
2.2	What are the gaps in the dissemination of tsunami awareness processes?	Questionnaire survey Interviews	Local communities and other major stakeholders	Content analysis Case study
2.3	How do the 3 study areas compare with each other with respect to tsunami evacuation awareness?	Questionnaire survey	Local communities	Case study Cross-case analysis
3.1	What are the gaps and differences in DM and evacuation policy measures among the 3 study areas?	Questionnaire survey Interviews Secondary data analysis	Local communities Policy practitioners/experts	Content analysis Cross-case analysis Theme development
3.2	What are specific recommendations for each country to improve the evacuation policy that can be undertaken?	Interview Secondary data analysis	DM policy makers/practitioner Frameworks and guidelines for tsunami evacuation	Content analysis
3.3	What can the 3 countries learn off each other and other nations with respect to tsunami evacuation awareness?	Secondary data analysis Interviews	DM policy makers/practitioners/experts Reports and lessons	Content analysis Theme mapping

5. Expected outcomes and deliverables

The expected outcomes of this study will:

- Comparative table on evacuation policy measures across three countries (Sri Lanka, India, and Indonesia - SLII). Provide information on the existing policy gaps for effective Tsunami evacuation in the Indian Ocean region by assessing tsunami evacuation mechanisms that already exist in SLII with the help of cross-national policy analysis.
- Develop a good practice guideline for tsunami evacuation policy, drawing from the experiences from SLII which will be helpful for the policy makers in these countries to consider in planning and managing tsunami evacuation in the event of an Indian Ocean tsunami in the future.
- Provide a set of key recommendations specific to countries as well as for the Indian Ocean region as a whole. These will be helpful for policy makers working on regional collaborative efforts to improve tsunami early warning systems and subsequent evacuation policy measures.
- Understanding the level of tsunami awareness among the local communities will identify gaps in dissemination of tsunami knowledge from which recommendations for capacity building will be proposed.

As deliverables,

- A review paper will be published titled “A review of evacuation policy measures for Indian Ocean tsunamis”
- One original research paper will be published titled “A comparative assessment of tsunami evacuation measures and public awareness in the Indian Ocean region – India, Indonesia and Sri Lanka”
- Three conference papers will be submitted - one in each country – on analyzing the tsunami evacuation policy and public awareness gaps in each country through case study data.
- A possibility will be explored to publish the study recommendations and good practices in the Indian Ocean Regional Tsunami Disaster Working Groups and Platforms or any regional advocacy and policy forums as appropriate.

6. Conclusion

The existing literature on tsunami evacuation policy studies and public awareness is mostly country specific and does not discuss regional good practices, policy gaps, nor gaps in

dissemination of tsunami knowledge to local coastal communities. 15 years after the 2004 tsunami, there is a need to comparatively assess different policy measures and initiatives that exist in these countries in order to identify gaps and learn from each other to make the entire Indian Ocean coast more resilient to tsunamis. The study will directly contribute to the Sendai Framework for Disaster Risk Reduction – priority action 4 on strengthening disaster preparedness for building back better. The study will also aim to contribute to the UNESCO lead Intergovernmental Oceanographic Commission Medium Term Strategy 2014-2021 under the high level priority two - “*Effective early warning systems and preparedness for tsunamis and other ocean-related hazards*”.

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