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DISASTER RELIEF SUPPLY CHAINS: ADDRESSING CHALLENGES IN ROBUSTNESS AND RESILIENCE TO ENABLE EFFICIENCY AND EFFECTIVENESS IN HUMANITARIAN RESPONSE

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Executive Summary

This paper discusses challenges and opportunities of using pre-positioned strategic stockpiles as a logistics preparedness practice to enhance disaster risk reduction and improve disaster response efficiency in heavily disasters impacted countries around ASEAN region. More specifically, this paper focuses on two of the main challenges faced by decision makers in the design phase of a network of emergency response facilities – 1) the definition of optimal network size (number of warehouses) and 2) the identification of facility locations. This piece of work also presents four prospective approaches that could be included in the research framework, followed by a discussion of the approach and methodology identified to support an exploratory study for establishing a network of strategic stockpiles in Indonesia, one of the world's most disaster prone countries. The framework discussed in this manuscript has been designed to be extendable and applicable to any country of ASEAN region, and the aforementioned case of Indonesia represents only a pilot study. Eventually, the findings of this research may be of interest to decision-makers of National Disasters Management Office (NDMO) as this methodology is capable of assisting them in making effective and efficient decisions related with facility location and stock-prepositioning.

Introduction

Due to number of factors such as climate change, unplanned urbanization, subsequent struggles for distribution of resources, etc., it has been predicted that the number of humanitarian crisis, both man-made and natural, will rise continuously during the coming decades. The multitude of stakeholders present in those crises, the mass deployment of goods and personnel, and the specific nature of the financial flows will lead to the emergence of complex supply networks with unique restrictions (Blecken, 2010). Ranging from small localized events (e.g. Pakistan's recurrent floods, cyclones in the Philippines, Bangladesh and Myanmar, etc.), to major catastrophes (e.g. 2011 Japan earthquake and tsunami, 2004 Indian Ocean tsunami etc.), Asia has one of the most incidences of reported disasters and highest reported number of victims. Within Asia, the Pacific region is one of the most disasters prone areas. According to the latest report by UN ESCAP, during the past decade, the region was stricken by 4,625 disasters – over 40% of the global total – claiming the lives of nearly half million people (UN ESCAP, 2015).

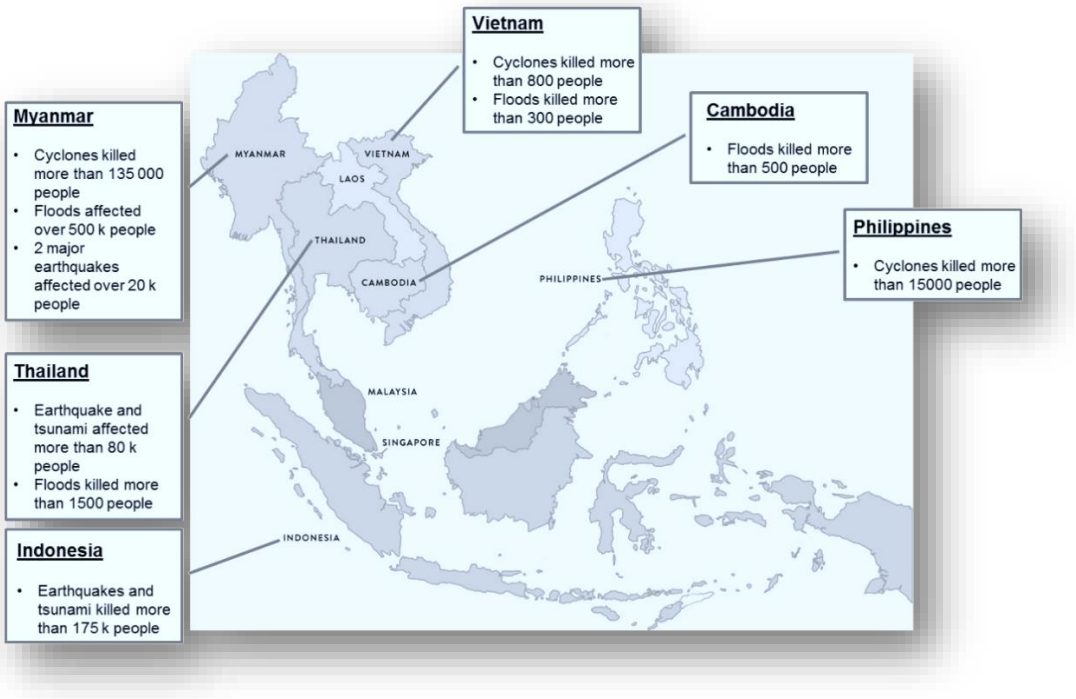


FIGURE 1. Humanitarian response (major events) in Asia-Pacific (2002-2015)

The trends in the number and impact of disasters, and the massive scale of recent global relief efforts have brought growing attention to the need for effective and efficient disaster relief operations.

The objective of disaster response in the humanitarian supply chain is to provide relief (emergency food, water, medicine, shelter, supplies etc.) to affected areas by emergencies, to minimize human suffering (Beamon, 2004). Therefore, the design and operation of relief supply chain play a key role in achieving an effective and efficient response. Although only recently, the humanitarian community

began to recognize logistics as one of most critical factors significantly affecting the success of disaster relief operations (Van Wassenhove, 2006) – from resource planning, procurement, delivery and storage of critical disaster products to its last mile transportation and distribution. In terms of humanitarian supply chain management, organizations are nowadays facing new challenges in the delivery of relief items, some of which are linked to the sheer increase in the needs of the affected populations, others to the changes in the environment in which they operate, while others to the increased expectations of compliance to donors and accountability to beneficiaries (Rafter, 2012). Relief organizations are faced with a unique blend of challenges characterizing the relief chain design and management, such as unpredictability of demand, suddenly-occurring big scale demand and short lead times for a wide range of supplies, lack of resources such as supply, people, technology, transportation capacity and money (Balcik & Beamon, 2008). This is further complicated by unpredictable factors such wild urbanization, big climate change, big political, social and economic change and communication technology and innovations in information. Hence, relief organizations and governments need to engage in preparatory activities that enhance their logistics capabilities when responding to emergency.

Lessons learnt from previous worldwide large scale emergency responses indicate that pre-positioning critical relief supplies in strategic locations can be an effective strategy to increase robustness and resiliency of humanitarian supply chains. Facility location decisions affect the performance of relief operations, since the number of locations of the distribution centers (DCs) and the amount of relief supply stocks held will significantly impact on both speed of response and its sustainability (Balcik & Beamon, 2008).

In this exploratory study, we discuss facility location and stock pre-positioning decisions making processes in a humanitarian relief chain, focusing on challenges and opportunities particular to ASEAN region. This will provide an analytical approach to assist decision-makers in making effective and efficient facility location and stock-prepositioning decisions.

The rest of the paper is organized as follows. In the next section, the advantages of pre-positioning strategic stockpiles for enhancing efficiency of disaster relief operations are discussed. Then, we discuss two of the main challenges faced by decision makers at embryonal stage of the design of a network of emergency response facilities: definition of optimal network size (how many nodes) and identification of most appropriate locations for the DCs. Each of the challenges is presented with a problem description, a solution approach, and some initial results from research to date. We then introduce four prospective approaches that could be included to further enhance the research framework. Finally, we present the approach and the methodology identified to support an exploratory study for establishing a network of emergency response facilities in Indonesia.

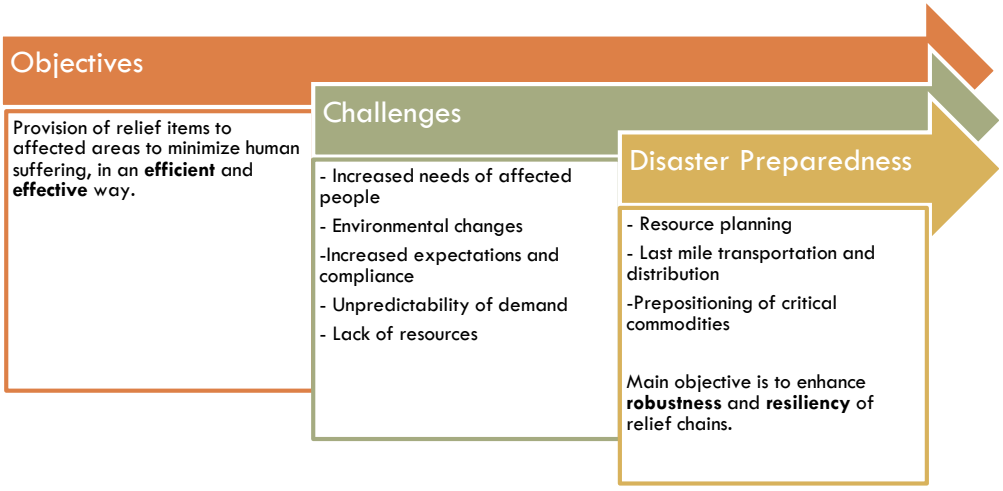


FIGURE 2. Humanitarian Supply Chain: Objectives, Challenges and Preparedness Activities

Efficiency Of Disaster Relief Operation: Pre-Positioning Strategic Stockpiles

Lessons from earlier worldwide large scale emergency responses indicate that pre-positioning critical relief supplies in strategic locations can be an effective strategy to improve the capacities in delivering sufficient relief aid within a relatively short timeframe, including improvement of logistics infrastructures and processes.

Besides covering the basic function of safeguarding relief commodities (e.g. to be used in the immediate aftermath of a disaster), these emergency response facilities will be capable of providing further supporting needful services such as handling and consolidation of humanitarian cargo for distribution of relief goods in the disaster affected areas. The main functional benefits provided by an established network of DCs include:

- Improvement of capacity of governments (through their National Disaster Management Agencies, if any) and all humanitarian actors to respond to emergencies in a timely and cost-effective manner;
- Enablement of timely and coordinated receipt and dispatch of relief assistance via air, sea and surface transport;
- Improvement of the immediate availability of relief items (e.g. emergency food, water, medicine, shelter etc.), eliminating else needed long lead times for the mobilization of resources, and minimizing potential risk of supply disruptions, increasing the overall resilience of the disaster relief supply chain;
- Enhancement of capacity building to support operations of repackaging;
- Establishment of practical training venues for logistics stakeholders and emergency responders;
- Reduction of operational costs.

CHALLENGE I – What Is The Optimal Size Of A Network Of Emergency Response Facilities In a Heavily Disasters Impacted Country In ASEAN?

Problem Description: When a major disaster hits, governments and relief organizations may experience relief chains disruptions if preparedness initiatives to increase robustness of relief supply chains are not undertaken. In this context, pre-positioning of critical relief supplies in strategic locations is considered as one of the most effective preparedness strategies. Decisions making on DCs network sizing (optimal number of warehouses) has a significant impact on sustainability and speed of humanitarian logistics operations. Thus, it is valuable for relevant stakeholders to determine appropriately the number of DCs composing the network of emergency response facilities as this has an integral relation with logistics costs related with humanitarian operations.

Solution Approach: To overcome the limitations of traditional Decision Support System (DSS) tools designed to tackle similar problems, but targeted mainly at private sector entities, we developed an innovative methodology taking into account both speed of operations and economic affordability:

- Given a set of in-country probable large scale disasters scenarios, the first objective of the network size optimization problem encompasses the demand coverage component through the minimization of the total distribution cost constrained over maximum distance between the emergency response facilities and their assigned potentially affected areas- demand point.

- In order to merge responsiveness and economic affordability, efficient distribution strategies that reduce logistics cost are required to be taken into account. This comprises several factors such as transportation costs, warehouse operating cost, and more importantly, warehouse-retailers echelon inventory replenishment cost. Minimizing the total distribution cost function will support the decision making in terms of optimal number of warehouses.

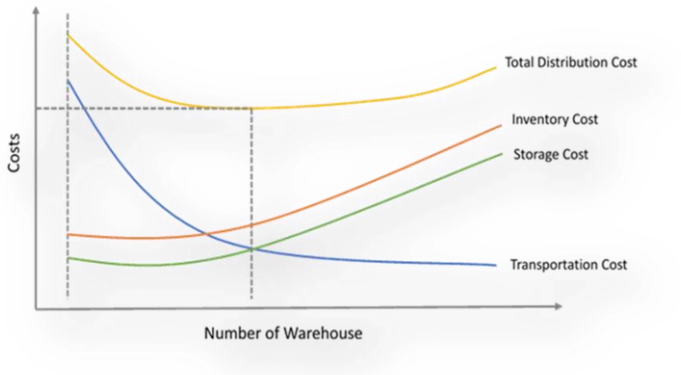


FIGURE 3. Impact of number of distribution centers on logistics cost

Results: The methodology will support the determination of the optimal number of warehouses to compose a network of emergency response facilities. It also covers aspects related with optimal inventory policies aiming at minimization of response time.

CHALLENGE II – How To Identify The Most Appropriate Locations For Establishing An Efficient Network Of Emergency Response Facilities?

Problem Description: In the series of problems to consider in the decision making process concerning emergency logistics preparedness, the determination of the most appropriate locations for the DCs composing a network of emergency response facilities can be considered a key activity, given its significant impact on effectiveness and efficiency of disasters relief operations. Thus, it is critical for National Disaster Management Agencies and relief organizations to optimally determine the locations for their emergency response facilities, as this has an integral relation with the security and protection of the society.

Solution Approach: To overcome the limitations of traditional approaches on tackling multi-criteria supply chain decision making, we developed an innovative framework for addressing the location problem for a network of emergency response facilities. Geographic Information System (GIS) technology is used to integrate key information such as National Master Plan for the Economic Development, natural disaster hazard zones, population densities, strategic logistics infrastructure, and industrial cluster. The combination of this information with inputs of local logistics experts will enable the identification of candidate locations to further investigate. Then several location criteria are considered and relatively weighted, leading to a hierarchical structure of the previously-identified location candidates.

FIGURE 4. GIS platform showing several layers of key logistics infrastructures for Indonesia

Results: Several layer of information both quantitative and qualitative in nature are integrated into a mapping platform, and key logistics information such as shortest paths and routings, flows of relief items, drive time or distance rings can be produced and visualized. This platform will eventually enable to pre-assess the performances of relief operations, while allowing to compare several network setups to identify the optimum that will guarantee maximum speed of response and its economic affordability (given a set of constraints)

Networked Humanitarian Supply Chains - Prospective Approaches For Enhancing Robustness Of Emergency Facilities Network

In order to enhance the research framework, we have identified four prospective approaches to be further explored and discussed.

1. Spatial Decision Support System (SDSS): An Efficient Strategic Planning Platform For Site Selection

Background: SDSS is an analytical platform that allows user to visualize key information along with the evaluation modules in order to provide better insight into the strategic problems and challenges and also to be able to support the decision making process (Lindawati, et al., 2014). The platform has been successfully used for developing efficient strategic freight distribution planning to locate freight logistics facility in Java Island, Indonesia. A holistic framework of the SDSS platform has systematically been sketched, followed by the recommendations of interesting modules and approaches to be equipped on the platform (SMCE, MOFL and discrete simulation-based approach)

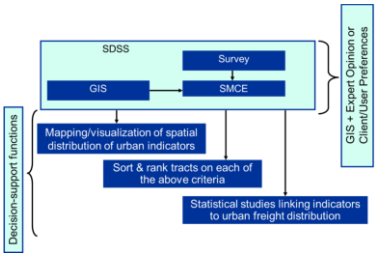


Figure 5. Feature of SMCE

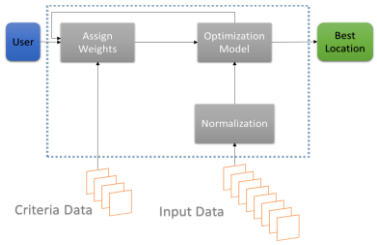


Figure 6. Feature of MOFL

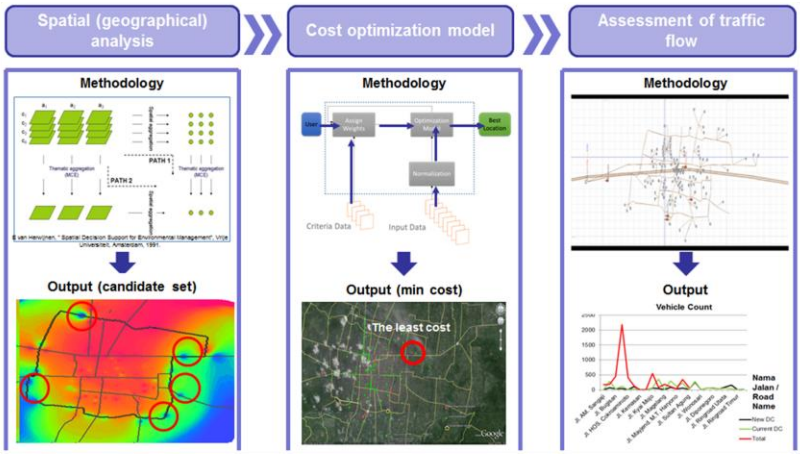


FIGURE 7. SDSS Platform equipped with three features – SMCE, MOFL and Discrete Simulation-based Approach

Potential Approach: A "customized" SDSS platform could be developed for the humanitarian community to support urban logistics facility determination.

2. The Risk Index Strategy: An Effective Tool To Preselect Locations With Minimal Risk Exposure

Background: When selecting locations for pre-positioning strategic stockpiles, only sites with minimal risk exposure level can be selected as nodes for the emergency response network. A risk index is a parameter representing all most relevant risk factors for a certain geographic area, such as natural disasters (droughts, floods, earthquakes, cyclones and tsunamis), macroeconomic and political changes, or even the locations of suppliers. To be analytically quantified, it requires key risk factors to be identified and described in terms of probability distribution with the support of i) Databases like EM-DAT, ii) Domain experts, iii) Businesses databases, and iv) Available Literature.

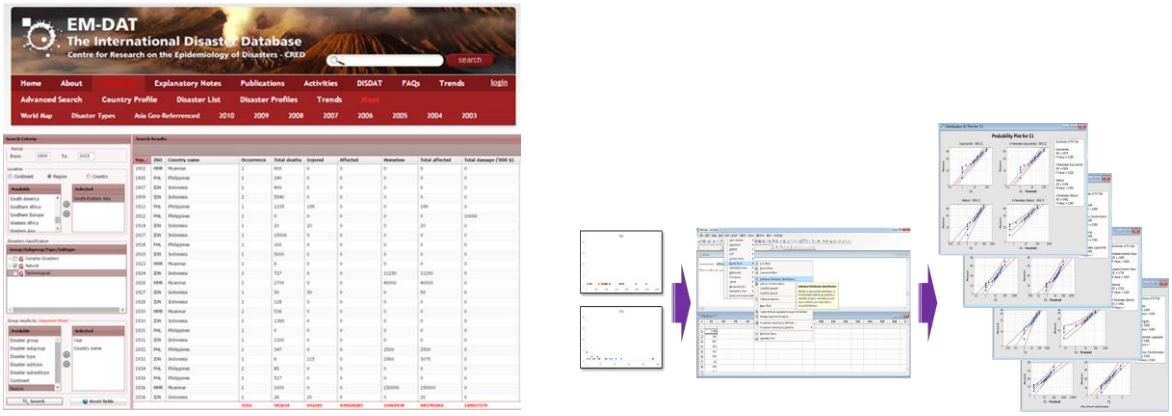


FIGURE 8. EM-DAT database to extract natural disasters historical data and risk index calculation

Potential Approach: A risk index representing the risk exposure level of different localities can potentially be defined for the humanitarian community by identifying the most relevant risk factors to be included in the risk index framework. The risk profile of each potential location can then be derived and used to compare the selected sites.

3. Flow Of Goods Across Marine Supply Chain For Resilient Intermodal Network

Background: Around 90% of world trade is carried by the international shipping industry without which, the current volume of worldwide import and export activities could not be covered. Seaborne trade continues to expand, bringing benefits for consumers across the world through competitive freight costs. Literature on maritime supply chain management highlights the critical role that ports play as key nodes of businesses' supply chains through upstream and downstream linkages, especially referring to those processes and activities that add significant value to the final client. Ports have been considered as the integral part of agile supply chain strategy (Paixão & Marlow, 2003).

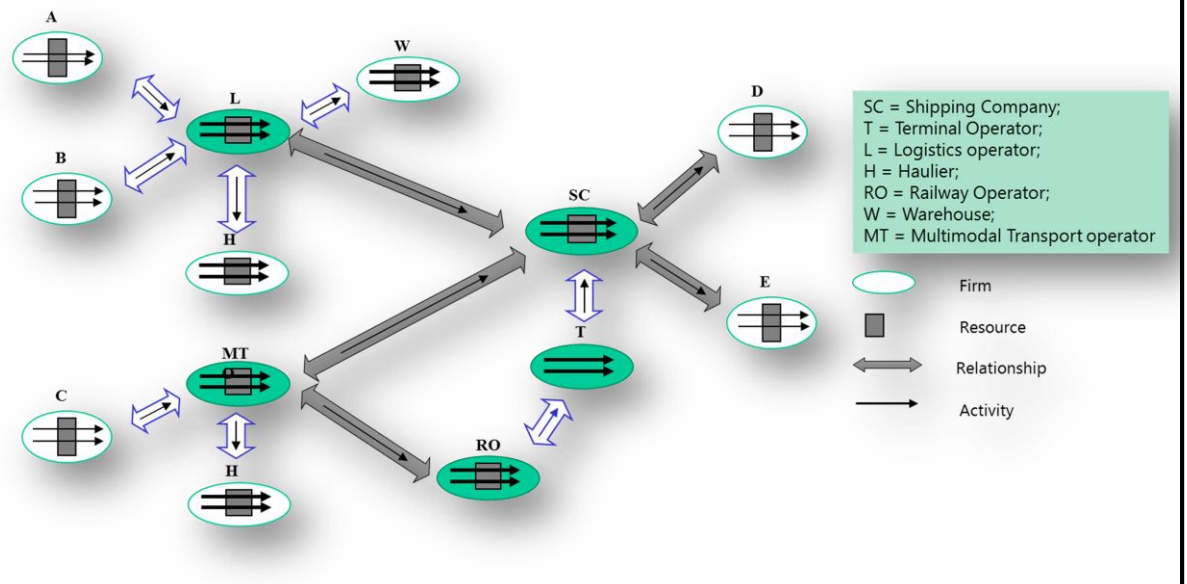


FIGURE 9. Intermodal supply chain network for resilient humanitarian relief management

Potential Approach: Indonesia is the World's largest archipelago made of 18,000 islands, with a complex network of ports and related transport systems. Resilient marine supply chain provides strong foundation for robust inventory management. It also provides a great support across different countries and long distance transport, and hence reducing costs across the network. For the humanitarian community, it becomes critical to recognize the crucial role played by ports within the supply chains framework and, with the contribution of large terminal operators, promoting the process of integration of all stakeholders of disaster relief chains. In the context of this research, it is important to understand the impact of the marine supply chain and its optimization and on the humanitarian relief operations. The integrative approach to undertake marine companies for supply of complex relief goods from intermodal transport to distribution of network will provide a robust framework.

4. Big Data To Support Disaster Preparedness And Response

Background: Innovations in technology and greater affordability of digital devices have created the basis for the explosion in the quantity and diversity of high frequency digital data (UN Global Pulse, 2012). These data hold the potential to provide a robust framework to support decision making processes, constituting a good opportunity to enhance the fight against natural calamities through the development of powerful new tools. The crowdsourcing power of social media for disaster management for instance has been harnessed especially in the area of management of slow-onset disasters (e.g. Kansai Region on August 2012 (Fujitsu Journal, 2015), forest and peat fire management in Indonesia (UN Global Pulse, 2014)) and the model has provided interesting insights.

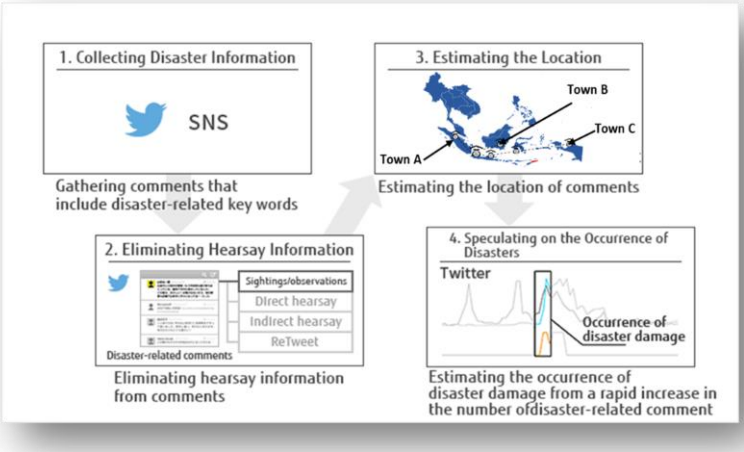


FIGURE 10. Example of system for estimating the occurrence of disasters
Source. *Own adaptation from Fujitsu Journal (Fujitsu Journal, 2015)*

Potential Approach: A pilot explorative study addressing the identification of the types of new, digital data sources to be potentially used for disasters preparedness and response, including an analysis of the challenges posed by the potential of using such in disaster management work, and specific applications of "Big data" in the field of humanitarian logistics could be designed and implemented.

Case Study: Indonesian National Network Of Emergency Response Facilities

Indonesia is the world's largest archipelago with a population of over 252 million people spread out across some 18,000 islands. Located at the intersection of three tectonic plates, Indonesia is one of the world's most disaster prone countries; having more than 500 volcanoes (128 of which are active) and more earthquakes per year than any other country on earth, where much of this activity is offshore bringing the added risk of tsunamis. Additionally flash floods, mudslides, forest fires, disease outbreaks, and droughts cause civilian casualties, population displacement, loss livelihoods, property destruction and environmental damage. This high frequency of severe disasters is accompanied by an associated risk of catastrophic natural disasters of a scale necessitating system-wide ('Level 3') international humanitarian response.

In order to enhance efficiency of disaster relief operations and reduce risk and vulnerability of disaster relief supply chain through facilitating safeguarding of commodities, we are investigating the possibility to establish a network of DCs throughout the country, covering definition of optimal network size as well as locations identification for the logistics hubs. This will significantly modernize and upgrade national emergency preparedness and disaster response capabilities, as well as improve effectiveness and efficiencies of routine dispatching activities of relief items and equipment to remote areas of country.

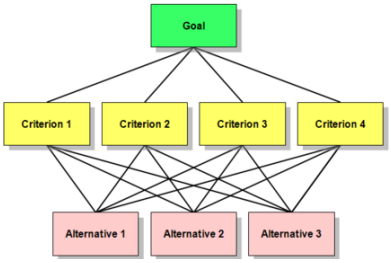
RESEARCH METHOD

The principal goal and rationale of this research are inspired by the need of improving the national disaster response capacity. To achieve this goal, in this study we utilized the combination of different technologies and tools such as Geographic Information System (GIS) technology and Analytical Hierarchy Process (AHP).

The first step consists of the identification of suitable cities to locate the nodes of the network of emergency response facilities. This phase is supported by a GIS platform which is used to integrate key information such as:

1. Indonesian Master Plan for the Economic Development
2. Natural disaster hazard zones
3. Population densities
4. Strategic logistics infrastructure (airports, heliports, ports, highways, railways)
5. Industrial cluster

AHP (analytical hierarchy process) is a multi-criteria decision-making tool widely used for applications related with engineering sciences. The tool has been successfully applied to a wide range of complex industrial engineering problems whose final decision is based on the evaluation of a number of alternatives in terms of a number of criteria. The method is proved to provide the advantage of permitting a hierarchical structure of the criteria (which can be expressed in different units or the pertinent data are difficult to be quantified). In other words, AHP process makes it possible to determine the relative importance of a set of attributes for humanitarian warehouse location, incorporating judgements on intangible qualitative criteria alongside with tangible quantitative criteria



This information (examples see Figures 4 and 5) will be integrated with a set of localities recommended by experts through semi-structured interview to support the identification of localities for further investigation. These semi-structured interviews with practitioners will also support the validation, classification, and ranking of the warehouse location selection attributes.

Next, through the application of AHP methodology, a hierarchical structure of the identified localities based on location criteria and their weightage, will be derived.

FIGURE 11. GIS platform allows to visualize key logistics infrastructure (e.g. airports –civil and military) along with tectonic plates and fault lines

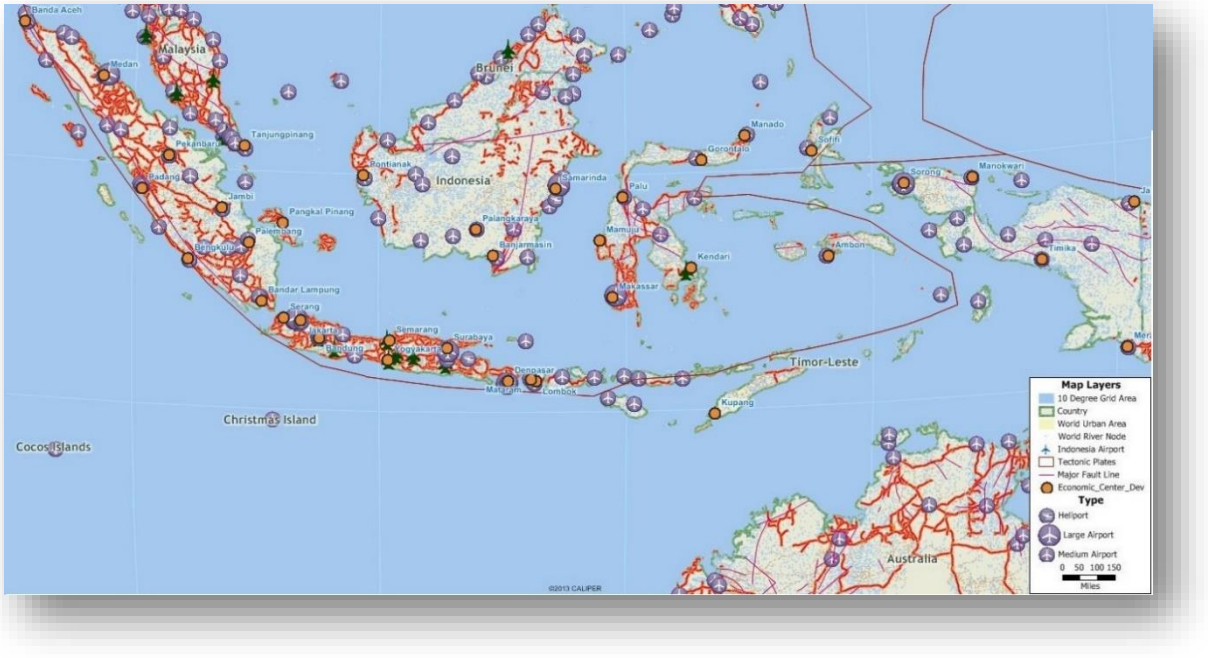


FIGURE 12. GIS platform allows to visualize key logistics infrastructure (e.g. airports –civil and military, and highways), tectonic plates, and fault lines, along with information on Master Plan for the Economic Development of Indonesia

WAREHOUSE LOCATION DECISION CRITERIA

This exercise of determining the optimum network setup in terms of DCs location identification requires consideration of several location attributes (else called location decision criteria) making it a Multi Criteria Decision Making Problem. A list of potential criteria to be used to identify the DCs locations throughout Indonesia are here listed and described

TABLE 1. Sample of warehouse location selection attributes defined through available literature

Serial No.	Criterion	Description
C1	Coverage	Total districts allocated to the DC
C2	Distance	Closeness to major logistics infrastructure, main logistics services hubs (including logistics service providers), and major healthcare centers.
C3	Risk	It consists of two parts: Natural (natural calamities) and manmade
C4	Congestion	It consists of congestion, emissions (CO_2, NO_x, etc.)
C5	Infrastructure development plan (IDP)	Expansion of roads, high speed corridors (rails and roads), and related logistics supporting infrastructures
C6	Cost	Includes installation cost (land buying and construction costs); Reconstruction costs (maintenance, purchase of goods); and Transmission costs (includes costs of sending goods from DC to affected area)
C7	Security	Humanitarian warehouse stores a variety of valuable goods. This criteria includes security of the warehouse, road safety, and related facilities around the area (fire stations, police stations, hospitals).

POTENTIAL ALTERNATIVE LOCATIONS

The cities of Jakarta, Makassar and Medan have been identified, at this stage of the research, as potential locations for locating Distribution Centers within Indonesia. However, further analysis need to be undertaken to prove the suitability of the aforementioned locations, as well as further locations need to be identified through semi-structured interviews with practitioners. The application of the AHP methodology will support the identification of the most suitable nodes of the DCs network, and provide a suitability rank for the candidate locations.

Conclusions

In this white paper, we have presented two main challenges faced in the designing phase of a network of emergency response facilities aim at increasing robustness and resiliency of emergency supply chains, and identified several approaches to address these challenges. These challenges have arisen from a grand set of many other challenges that will be in turn addressed. Work is ongoing. However, in this initial phase of the study, we especially invite collaboration from leading institutions of the humanitarian community in ASEAN region such as UN OCHA and AHA Centre. This would elevate the strategic impact of this study, which ultimately aims to reinforce the architecture of the humanitarian response through a well-coordinated framework within which all humanitarian stakeholders can significantly contribute.

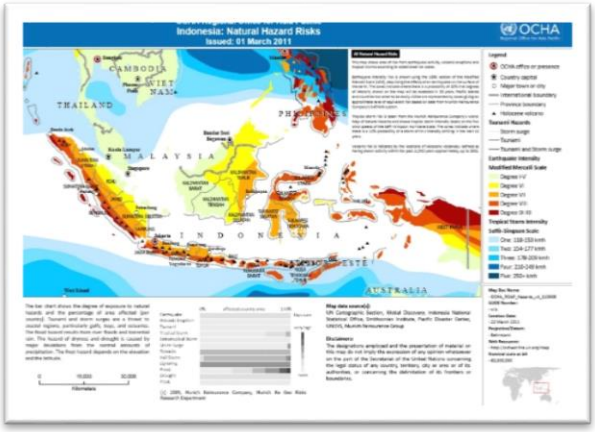


FIGURE 13. Natural hazard risks in ASEAN

Source. *UN OCHA*

FIGURE 14. AHA presence across ASEAN

Source. *AHA Centre*

After completing this exploratory study of tackling the design of a network of Distribution Centers, further 5 challenges will be investigated, including:

- **Challenge 3** – How to mitigate emergency supply chain nodes vulnerabilities and risk of network failure through redundancy of emergency response facilities?
- **Challenge 4** – How will the business community be affected by a major calamity? The importance of understanding the future risk of infrastructure failure to enhance business recovery
- **Challenge 5** - Can a national network of emergency response facilities be designed to respond beyond national boundaries?
- **Challenge 6** - Can a national network of emergency response facilities be designed to serve the business community during peaceful times?
- **Challenge 7** – Can shared capacity policies in the Pacific region be implemented?

Indonesia: the Way Forward - The perspective of UN World Food Programme, the lead agency for the Logistics Cluster

In its Medium-Term Development Plan (RPJMN) 2015 – 19 the Government of Indonesia has made a highly commendable commitment to "Develop Logistics Capacity and Distribution Management during Disaster occurrence, through establishing Logistics Humanitarian Hubs on each Island, which are reachable to support a post disaster occurrence in remote areas."

These assurances pertain to a highly laudable venture aimed at saving lives and alleviating the suffering caused by natural disasters and is based upon well-established best practices for emergency preparedness through the strategic prepositioning of emergency stockpiles in disaster prone areas.

This move in-itself can significantly enhance BNPB (Indonesian National Board for Disaster Management – Bahasa Indonesia: Badan Nasional Penanggulangan Bencana) capacities to reach populations affect by natural disasters, herein WFP proposes a supporting package of technical assistance projects which will ensure that the logistics hubs themselves are effectively developed and managed utilizing state of the art systems for data analysis identifying the most strategic locations, warehouse management, commodity tracking and operational procedures (during both emergency and normal situations).

In the worst case scenario; excellent facilities and assets which are ineffectively operated (due to lack of appropriate management systems and trained staff for example) can do more to hinder than help during an emergency response. Consequently WFP proposes to ensure that these facilities adopt the highest standards for operational management and support systems in order to safeguard the functional operability and indeed protect the significant investment to which the Government funds are devoted.

The overarching approaches are focused creating independent sustainability through ensuring BNPB possess sufficient internal capabilities both for effective operational implementation and to training their own staff to the same high standards. The successful development of innovative modernistic solutions benchmarked equivalent international projects adopting cutting edge technologies operated by skilled personnel and supported by in house training competencies is a vision which will endow BNPB with a distinguished renown for prominent levels of emergency preparedness.

Components

The overarching programme is best presented through a series of constituent components each of which directly align to WFP comparative advantages benefiting from decades of international experience and lessons learnt from responding to emergencies:

1. Emergency Response Planning
2. Physical Facility Development
3. Supply Chain Management Systems
4. Dedicated Training Programmes

1. *Emergency Response Planning*

Operational planning is a critical aspect of emergency preparedness, and would develop the government's response capabilities for disaster scenarios through enhanced preparedness levels. Key advantages include enhanced timeliness, appropriateness and efficiency of local, national and international humanitarian emergency response in Indonesia through:

- Strengthened government leadership in response planning;
- Improved coordination between provincial, national and international agencies via joint planning for emergency logistics activation, including logistical hubs and transport corridors;
- Identification of gaps in sub-national and national response capacities;
- Joint work planning at provincial and national levels to address prioritised gaps;
- Response options analysis delineating pre-agreed modalities of in-kind food, cash or voucher assistance to be rendered in the event of large-scale emergencies, activation procedures and delivery mechanisms.

The scenario-based Concepts of Operations (CONOPS) delineates air, sea and land-transport corridors and logistics hubs to receive and consolidate international humanitarian assistance and provides a detailed yet flexible plan for international support to the national response scenario. Furthermore this planning tool addresses multi-stakeholder requirements and involves stipulating multi modal transportation and defines a series of key operational infrastructures.

The establishment of these Humanitarian Response Facilities provides a key opportunity to enhance logistics coordination (clearly essential for effective responses) by enabling the initiation of regional logistics clusters within their respective coverage areas.

2. *Physical Facility Development*

Essentially this project belongs to the Government of Indonesia (supported by WFP); therefore all matters related to procurement (of land, construction services, etc.) and realization of construction would be conducted using standard process and procedures in line with their standard financial and procurement systems etc. WFP can however provide technical assistance within the design and planning aspects.

Professional specialists within WFP HQ Engineering Unit possess a wealth of technical experience in functional design and construction of large scale hubs for humanitarian requirements providing oversight and expertise throughout a series of specific phases, including:

I. Definition of technical requirements and project scope
II. Compilation of technical specifications for architect blueprints
III. Ensuring suitability of functional designs

3. *Supply Chain Mangement Systems*

The ability to provide supplies quickly and cost effectively can be a considerable challenge in an emergency operation; detailed up to date accurate data on locations and details of available

stockpiles and completed distributions is the essential basic requirement to enable operational implementation. It will be essential to ensure that these components are seamlessly integrated within an overarching Supply Chain Management system in order to ensure synchronization from the initial procurement through to the final distribution point.

Correspondingly it is equally necessary to ensure that full details for the practical application of these SOPs are comprehensively incorporated into dedicated training modules.

Three key components are identified as essential for the effective streamlining and delivery of humanitarian aid during an emergency response:

I. Commodity Tracking Systems
II. Inventory Management Systems
III. Warehouse Management Systems

4. Dedicated Training Programmes

The sustainability and application of the Emergency Response Facility operations and emergency responses will be achieved through a dedicated, comprehensive and customized training programme applying to all equipment, facilities, technical, operational, procedural applications established herein. This should include the organization of regular Simulation Exercises, to test the systems, procedures, facilities, and SOPs developed under this project.

The design and implementation of this training curriculum focuses specifically on ensuring effective operability and sustainability of the aforementioned facilities; furthermore strategic level training programmes emphasize disaster response logistics and humanitarian supply chain management. The facilities themselves provide additional opportunity to greatly enhance the effectiveness of training implementation through direct practical application within the facility whilst being specifically designed to support the overarching Supply Chain Management systems and interrelated SOPs.

Outcomes from delivery of the customized training programmes would further enhance direct synergies from simulation exercises and on the job tuition and direct application of content during regular operations within the Emergency Response Facility. The particular training schemes target various profiles and levels of emergency responders within government and non-government humanitarian agencies increasing familiarity with the national level response plans and capacities; this approach significantly contributes to better vertical integration and coordination of the overall response capacity of the government.

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