FIRST AID LOGISTICS OPERATIONS PLAN FOR FLOOD VICTIMS WITHIN AND AFTER 48 HOURS

DUANGPHASTRA Chackrit
Director of Transportation Institute,
Chulalongkorn Universitty
Phone: 02-218-7441
E-mail: chackrit@cbs.chula.ac.th

WONGBUTESRI Prapawee
Researcher of Logistics Projects, Transportation
Institute, Chualongkorn University
Phone: 02-218-7441
Email: prapawee@hotmail.com

TAKENGSAK Chaichan
Assistant Professor
School of Management Technology
Suranaree University of Technology
Phone: 044-224328
E-mail: kerngsak@sut.ac.th

ABSTRACT

The study of first aid logistics operations plan for flood victims within and after 48 hours focused upon the enhancement of current emergency respond system capacity in providing support to the victims in the Northeast of Thailand where sometimes having flood during monsoon period. The study involved two stages of first aid logistics management comprising (a) first aid logistics operations for flood victims during the first 48 hours which the flood victims and related organizations faced unplanned situation and must respond to the incident immediately, (b) first aid logistics operations for flood victims post the first 48 hours which request assistance from organizations outside the affected area, donation collection, disaster remedy, transportation of victims.

The results of the study would improve the existing logistics operation plan to be in terms of time and cost management. The study focused on flood aid mission for victims to survive in the medium to high level of risk violence. Key research informants were seven organizations working on providing emergency aid to flood victims located in Northeastern region. They are (1) disaster prevention and mitigation unit, (2) military unit, (3) Thai Red Cross unit, (4) public health unit, (5) rescue unit and foundation, (6) provincial administrative organization unit, and (7) highway and rural road unit. Questionnaire and in-depth interview were selected to be study method of quality information. Mathematical model program was selected to analyze quantitative data.

Keywords: humanitarian logistics; Emergency logistics

INTRODUCTION

Thailand has been facing flooding more severe and space. The crisis causes the economics loss and people affected; homes destroyed, property damaged, including deaths and injuries. The local agencies involved in flood victim management in the affected district would distribute any available resource at that time and provide other assistance to any flood affected area before request any other resources from other districts. Normally, the agencies are ready and on alert for the mission. In some areas, they go into the area to facilitate the victims even before the flooding. Agencies must urgently allocate resources in a variety of missions. Thus, the emergency relief logistics planning problem were detailed in this research. The goal of this investigation is to develop a model that generates the easy logistics plan and cost for flood victims' reliefs. Specifically, the primary objectives of this research are:

(1) To study steps and processes of logistics management suitable for of flood crisis in areas considered moderate risk and high risk levels to increase the efficiency in assistance and alleviation caused by the flood as well as to decrease the suffering in soonest by gaining access to the flood victims and give help to them quickly including distributing the donations throughout and in time.

(2) To analyze logistics practices and cost, time allocation, and frequency of the transport, including costs in order to deliver and investigate the effective cost.

STUDY METHOD

The research based on interviews of diverse actors of the agencies involving in the operation of flood victims' reliefs. The observation of logistics processes and their issues provided details to frame the research and research questions. Interviews and literature review developed ideas to improve logistics plans. The research team tries to find the case study from the right organization although it's difficulties to access the information. Then adjust their understanding and experience to logistics process.

The study highlighted necessary mission to aid flood victims to survive in the medium to high level of risk violence. The data collected during the field work is qualitative research and survey research. The target group of data collection consisted of agencies, units, or organizations involving in the operation of flood victims' reliefs. The study was conducted by questionnaire survey and in-depth interview from seven organizations located in 20 provinces in northeastern region of Thailand as follows: (1) Disaster prevention and mitigation unit from 20 agencies in 20 provinces, (2) Military unit from 20 agencies in 10 provinces, (3) Thai Red Cross unit from 20 agencies in 20 provinces, (4) Public health unit from 20 agencies in 20 provinces, (5) Rescue unit and foundation from 22 agencies in 20 provinces, (6) Provincial administrative organization unit from 20 agencies in 20 provinces, and (7) Highway and rural road unit from 20 agencies in 20 provinces. Then, the collected data would be analyzed and summarized to align with the objectives. The research procedure is as following: (1) the synthesis of knowledge that already existed by collecting the following statements: (a) data related to the flooding in the Northeast years 2010-2011 with regard to flood area, agencies assist providing, flooding period, flooded roads, and (b) the official meeting documents

regarding the flood assistant in province, (2) initial workshop was arranged for further information and inquiries of the demand for research, (3) field survey of 20 provinces in the northeast of Thailand with in-depth interviews with both government and private agencies for more information on process, problems, case study and preparation to help the flood victims, (4) processing and analyzing all data. Then, concluding the logistics plans for victims. Arranging a seminar on the results of the analysis and synthesis to propose to the stakeholders for opinion exchange, and (5) arranging the logistics plans according to all parties' opinion.

RESULTS OF THE STUDY

During flood crisis, local agencies need to recruit all personnel and resources in search of and to help the victims. Normally, the agencies are ready and on alert for the mission. They send the injured victims for immediate medical treatment and contact the relatives of identified dead victims. However, it requires assessment and preparation including surveys before mobilizing the manpower and vehicles access to the affected area. Besides food that needs to be prepared, flood relief bags packed by vendor would require only one day for delivery. It would need at least two days in case the government agencies pack the flood relief bags themselves. Moreover, only the vehicles based in the province would be available within 48 hours after the flood.

The vehicles necessary for the delivery of assistance to flood victims, in each Tambon or sub district, include a boat and a 4-wheeled truck to deliver meals and flood relief bags as well as sending injured or ill victims to hospitals. In a community with 15,000 residents, at least three 6-wheeled or 10-wheeled trucks are needed. In that case, one truck would be used for people's transportation to and from the affected area (15 kilometers distance on average) while the other two trucks would be used per day for delivery of 6,000 sets of flood relief kits. At least one extra truck is recommended in case the distance between city hall and each district office is longer than 70 kilometers.

In 2011, flooding occurred on some portions of the roads in the Northeast. The long road affected by the flood included the roads in Nakhon Ratchasima's Dankhuntod district (31 kilometers long) and Ubon Ratchathani's Warinchamrab district (47 kilometers long). The flooding prolonged the trip on those roads by between three and four hours longer than what were required in normal situation respectively. Only some districts lack a hospital. Nevertheless, severely injured victims would be sent to a major hospital nearby which should be reached within one hour.

THE USE OF LOGISTICS OPERATIONS TO PROVIDE ASSISTANCE FOR FLOOD VICTIMS IN THE NORTHEAST

1. Allocation of vehicles to provide help

In the first 48 hours, all agencies in the province have to recruit all resources and personnel to help flood victims. In the meantime, situation and information keeps changing all the time so it become difficult to predict. It is especially so when the flood cover large area. Meanwhile, recruiting the resources in such a short period of time often result in inadequate people and supplies. The resources must be allocated to all the affected districts before the resources from adjacent provinces would be sent in for help. It would need assistance from all the agencies including the private sectors in the province and adjacent provinces when the flood is as severe as Level 3 or become too severe for a director in the provincial level to handle.

Estimation of minimum requirement for the vehicles would be useful for preliminary preparation to handle flood in the first 48 hours are as follows.

Table 1: The minimum number of vehicles needed in the first 48 hours of flood disaster

Vehicle Type	First day of Flood		Second day of Flood	
	Minimum vehicle required	Public Service	Minimum-vehicle required	Public Service
4-wheeled truck	1 truck/ Tambon (sub-district)	Rescue victims, transport people to hospital, delivery meal boxes and evacuation.	1 truck/ Tambon (sub-district)	Rescue victims, transport people to hospital, delivery meal boxes and evacuation.
6-wheeled or 10-wheeled trucks	3 trucks/ 15,000 population	Flood evacuation (approx 15km radius) service that can support 30 persons per truck per day.	3 trucks/ 15,000 population	One truck to provide transport Two trucks to deliver relief bags from the district office to areas (within 70km radius).
Boat	1 boat/ Tambon	Rescue victims, transport people to hospital, delivery meal boxes and evacuation.	1 boat/ Tambon	Rescue victims, transport people to hospital, delivery meal boxes and evacuation.

Source : Authors' calculations

2. Logistics operations to give assistance to the flood victims

Over the period of the first 48 hours, the victim faces a number of problems like lack of food, fresh water, clothes, shelter, accident and health problems. The local agencies will need to recruit all personnel and resources to response the various missions. It is difficult to identify the period of time needed for the rescue and operations in searching of the victims due to difficulty in identifying the location and the use of tools varies. Sometimes it needed three days or longer to search unless the relatives say they may stop. It will be only then that the time needed to deliver the victims can be identified according to the distance from the spots to destinations. Meanwhile, some people with severe illness or patients who have appointments with the doctors would need the rescue unit's services for transportation, which would also need extra carefulness depending on the locations and situations.

The main agencies responsible for the rescue operations include the provincial disaster prevention and mitigation office, Narenthorn "1669" Rescue Center, rescue charity organizations and foundations in the province. The disaster prevention and mitigation agencies are better equipped with the tools and expertise in rescue. The tools and equipment include electric torches, diving suits, pulley and ropes.

Following are steps of rescue and delivery procedures:

1. Setting up of field operation centers preparing to handle the flood situation, preparation of tools and equipment in dry areas, higher level than the flooded areas near the affected communities.

2. Receiving requests for help.

3. Preparing teams to search and rescue whose members include local people who well know the locations and routes to the victims' residences.

4. In case of death, the rescuers bring the bodies to designated areas then contact police and other related agencies for autopsy, data and personal identification records.

- In case the dead can be identified, the rescuers contact relatives to retrieve the bodies.
- In case the dead cannot be identified, police or responsible authorities designate the places, such as hospitals or cemeteries, to store the bodies.

5. In case of victims' injuries, rescuers transport them to a safe place or operation center before evaluating the severity of the injuries.

- In case the flood victims are not injured but live in the areas prone to danger, they will be evacuated together with some necessities to designated safe areas via boat and 4-wheeled trucks, 6-wheeled or 10-wheeled trucks depending on different topography.
- In case the flood victims are injured but the injuries were not severe, there was no need to go to hospital. They would receive first-aids on location.
- In case the injured victims could communicate,

1. The officers would ask which hospital they prefer to go to.

2. Contact 1669 Rescue Center to check if the delivery was possible.

3. In case the delivery to the preferred hospital was impossible, the Rescue Center inform which hospitals were available.

- In case the victims are not able to communicate.

1. First aid and cardiopulmonary resuscitation are provided in case the victims were unconscious, have slow breathing or mild pulse.

2. Contact 1669 Rescue Center to take the victims to the contacted hospitals.

Table 2: Capacity of vehicles in to complete the rescue missions, searching and providing transportation for patients, the injured victims and bodies of victims

Vehicles	Loading capacity (person /vehicle/trip)	Service capacity (person/vehicle / day)	Fuel consumption rate (in normal speed) (Km./liter)	Service officials per vehicle (persons)
Rescue vehicle (4 wheels) or ambulance	1-3	Uncertain depending on the missions and distance	11	4
Boat	1-5 depending on the boat's size		1	3

Source: Authors' calculations based on interviewing data from Disaster Prevention and Mitigation Regional Center 14 Udon Thani and 2nd Development Battalion.

Note : Speed of a boat was calculated at 10 km/hour.

Speed of a loaded truck in the water was calculated at 10 km/hour. Meanwhile, the speed of a loaded truck on normal road was calculated at 45 km/hour.

The military is the main agency in charge of evacuation as it has best equipped with proper tools and personnel. In many districts, the residents would be informed in advance and 6-wheeled or 10-wheeled trucks were prepared to evacuate the people before the areas are flooded. However, the residents often refused to move before the flood water came or even after the areas had been flooded for a few days. The routes for evacuation varied: picking up the people from their houses to the community entrance or to evacuation centers. Normally the average distance is 15 kilometers. Nevertheless, many evacuees prefer to set up tents and stay around the community entrance because they were worried about their properties. The victims whose houses are one-storey building would take more time in picking up and transporting their assets. It accordingly required more personnel to help.

The military is also the main agency that in charge of transportation for affected people to and from their residences as the military has best equipped with proper tools and personnel. The local

people who refused to evacuate still needed to travel to do their activities such as going to their farms, market, hospitals or temples. Transportation is usually provided in the areas where the main roads were cut or in economic zones of populated communities. In such areas, the trucks would travel with the speed of 10 kilometer per hour in the water to reduce the impact from the waves to the buildings and the engines of the vehicles. They also had to stop often to take and drop passengers along the way. The routes would be considered according to the areas and density of population. The loading capacity of vehicles to transport people is as follows.

Table 3: Capacity of vehicles in completing the transport people for 15 kilometers

Vehicles	Loading capacity (person /vehicle/trip)	Service capacity (person/vehicle / day)	Fuel consumption rate (in normal speed) (Km./liter)	Service officials per vehicle (persons)
4-wheeled truck	10	30	11	2
6-wheeled or 10-wheeled truck	50	150	3	4
Boat	12	36	1	3

Source: Authors' calculations based on interviewing data from Disaster Prevention and Mitigation Regional Center 14 Udon Thani and 2nd Development Battalion.

Relief bags would come from many sources such as the royally-sponsored kits, Disaster Prevention and Mitigation Provincial Office, the Thai Red Cross Society or private companies. The items in the survival kits would vary resulting in different weight and forms of the kits.The demand for relief bags would be calculated and allocated from the actual number of victims residing in each village, severity level of the flood as well as conditions including the number of children and the elderly are considered to be the first priority.

- Transportation of a big lot of the relief bags should be done using 6-wheeled or 10-wheeled trucks as they could transport more of such bags each trip and would be more cost-effective. Moreover, they could better run in the water. Normally, the transportation of relief bags would start at the city hall where is the center of donation both within and outside the province as well as situated the depots. Disaster Prevention and Mitigation Provincial Office would be responsible for purchasing and receiving relief bags donation. The relief bags then would be distributed to affected districts. We concluded the cases study as follows.
- In case the floods cover wide areas and there were a lot of relief bags to be delivered, all of the survival bags could reach the victims as late as two weeks after receiving.
- In case of inadequate relief bags, village chiefs would allocate the supplies to the flood victims. Some Tambon (sub-district) would be appointed to get their lots of survival kits once every

three days. Villagers would receive the supplies according to their alphabetical name list or unpacked and share the supplies.

- Each bag of survival kits would contain the supplies for a household of 3-4 people.
- In average, a survival kit bag weigh 5-7 kilograms and contain a set of 5 kilogram rice bag, canned food, pickled mustard greens can, mackerel in tomato sauce can, chili pepper, Instant noodles, drinking water, fish sauce, candle, lighter, toothpaste and toothbrush.
- The average distance between the provincial depots to a flood-hit district in the Northeast is 70 kilometers and took about 3 hours to transport. Personnel for each truck include one driver and 5 officers to carry and distribute the supplies. It took about 1 hour to load the supplies to and another hour to unload the supplies from a truck. Each 6-wheeled or 10-wheeled truck can transport 1,500 kits per trip while a 4-wheeled truck can take only 500 kits per trip.
- Village chiefs are responsible for providing vehicles to receive the kits at the community entrance and distribute to the victims at their locations. Their vehicles might include a foam board, boats, Thai farmer's truck and 4-wheeled trucks that can run in the water.

Rescue charity organizations and foundations were the main agencies in providing the ready-to-eat meal to the flood victims. They could quickly recruit volunteers and vehicles in short time. In case the foundations could not adequately provide such food, the provincial administration would hire local restaurants to cook meal for the victims. Meanwhile, military units might be deployed to cook and provide food at the community entrances and let agencies in charge distribute the food.

The ready-to-eat food were usually cooked at a place near the entrance to the flooded areas as it is freshly cooked, not preserved food and can be spoiled easily. Meanwhile, distribution to the victims at their residences by boat might take a long time. Distribution of cooked meal should be done via 4-wheel trucks or boats rather than 6-wheeled or 10-wheeled trucks due to more flexibility. Moreover, the meal boxes should not be piled up as high stacks as the boxes might be damaged. Loading and unloading meal box takes one hour each lot, therefore, the total time spent in loading and unloading the meal box is two hours per trip.

3. Inventory, cross docks and dotation

The latest major flood saw the too severe inundation for provincial director to handle. City hall became the donation center while each of the provinces would get the amount of donated items which needed at least two 10-wheeled trucks to carry. They waited be delivered to the city hall of the flood-affected provinces for 2 weeks. It would need people to collect, move, pack, store, load and unload the supplies. Meanwhile, purchasing the packed supplies using donated money would save at least 4 days of management and help the flood victims get assistance faster.

It is advised not to have any stocked supplies of the flood as some products would expire within 6 months. And there should not be any acceptance of supply donation from the public. The items in the flood relief bags should be bought from logistics-capable suppliers in the province and adjacent provinces. In

this case, price quotation should be done in advance before rainy season, the order should be placed in 'pack', 'set', 'bag' by Disaster Prevention and Mitigation Provincial Office. One day advance notice will be required for next day delivery. This will be better than stocking the supplies then recruiting personnel to pack them. This way can shorten the time needed for preparation, redundancy of moving, loading as well as the need for vehicles and personnel. The time needed for the procedures would be reduced at least two days (one day for the orders or waiting for suppliers and the other day for personnel packing the flood relief kits.) It will also do away the worries about missing stocks, store inventory or damages caused by rats and insects. Moreover, it would reduce the time required for the transfer of the flood relief kits in case of full trucks load can be done directly to the flood-affected districts without the need to transshipment at the provincial depots which are the centers.

The donation center should be at the city hall and preferred donation would be the money donation via bank accounts. Meanwhile, a team of buyers should be assigned to buy ready-packed supplies for the sake of time effectiveness.

Instead of setting up depots, cross docking should be used only as the channel of assistance. In this connection, city hall should be the center for the operations. Meanwhile, Disaster Prevention and Mitigation Provincial Office should be supporting agencies in charge of coordinating appointments for vehicles and flood relief kits delivery. The supplies should not be stored at the cross docks for more than 24 hours.

In case of major floods that would need over 60,000 relief bags per day would need a modern warehouse that is equipped with modern handling equipment as well as dock area for unloading, loading and transhipment. Delivery of 60,000 flood relief bags would need twenty 6-wheeled or 10-wheeled trucks which deliver twice a day to transport for an average distance of 70 kilometers. Using modern and well-equipped warehouse together with cross docks would be beneficial as follows:

- Using standard warehouse as a place to unload, load and transship the flood relief supplies would be convenient with lifting machines and loading dock.
- It can reduce the time to transship the supplies from 6-wheeled or 10-wheeled trucks to pick-up trucks.
- It can reduce the time wasted and the redundance of traffic.

It is recommended that the donation center, mainly the city hall or the government's provincial depot, is the same venue as the cross docks, especially when the severity of the flood is Level 3-out of provincial director to handle- or over. However, there should be a regional donation center in charge of linking and managing the donation within the provincial clusters.

4. The expenses for the logistics in providing assistance to flood victims

In the first 48 hours of flood crisis when having changeable flood situation. It is difficult to evaluate need for help and resources. Therefore, the research tried to summarize the expense of victim service as follows.

Table 4: The expenses in providing services to flood victims per vehicle per day

Mission	Vehicle	Loading capacity per vehicle per trip (person, set)	Distance for victim transport at 15kms and relief bag delivery at 70 kms.	Service capacity per vehicle per day (person)	Time per trip (hour)	Number of trip per day (trip)	Fuel cost/ vehicle / day (Baht) (30.-/Liter)	Fuel consumption (Normal Speed) (km/liter)	Number of service officer per truck (person)			Total expenses / vehicle / day (Baht) excluding vehicle movement charge	Vehicle movement charge from City Hall to the affected area (Baht/vehicle)
									Sergeant /Supervisors	Officer / volunteer	Allowance / vehicle / day (Bt300.-/day)		
Victim rescue	4-wheeled truck	2	15	1-3	2.67	Not certain	102.-/ trip	11	0	4	1,200	1,302	382
Patient transport		2	15	1-3	2.67	Not certain	102.-/ trip	11	0	4	1,200	1,302	382
Transport service in the area		10	15	30	3.00	3	307	11	0	2	600	907	382
Relief bag delivery		500	70	1,000	5.11	2	764	11	0	2	600	1,364	382
Meal box delivery		500	70	1,000	5.11	2	955	11	0	2	600	1,555	382
2nd day Transport service in the area	6-wheeled or 10-wheeled trucks	50	15	150	3.00	3	1,125	3	1	3	1,200	2,325	1,400
2nd day Relief bag delivery		1,500	70	3,000	5.11	2	2,800	3	1	6	2,100	4,900	1,400
1st day Flood evacuation		10	15	30	2.67	3	1,125	3	1	6	2,100	3,225	1,400
Patient transport		2	15	1-5	3.00	Not certain	900.-/ trip	1	0	3	900	1,800	1,400

Transport service in the area	Boat	12	15	36	3.00	3	2,700	1	0	3	900	3,600	1,400
Relief bag delivery		100	15	300	2.67	3	2,700	1	0	3	900	3,600	1,400
Flood evacuation		5	15	15	2.67	3	2,700	1	0	3	900	3,600	1,400

Source : Researcher's calculation

Note : The distances for transporting flood relief bags are average distances from each city hall to the district office.

Speed of a boat was calculated at 10 km/hour.

Speed of a loaded truck in the water was calculated at 10 km/hour. Meanwhile, the speed of a loaded truck on normal road was calculated at 45 km/hour.

Service limitation for each 6-wheeled truck: 560 km/day.

Calculation of diesel cost/ vehicle/ day = diesel price x number of trips x distance x 2/ consumption rate (No cost of lubricant is calculated.)

Diesel price: 30 baht/ litre Allowance for staff: 300 baht/ day.

One Tambon or sub district has a population of about 3,600-30,000 people.

5. The vehicle and transportation services to provide help for the flood victims compared to availability of service vehicles of each province in the Northeast of Thailand.

In 2011, Thailand encountered with the worst floods crisis in 70 years. The researcher team collected data and summarize transportation services ability to provide help for the flood victims in each province as follows.

Table 8: Capacity of vehicles and transportation services to provide help for the flood victims compared to availability of service vehicles in each province.

Province	The first day of the flood: Capacity in service providing			The second day of the flood: Capacity in service providing			
	4-wheeled trucks	6-wheeled trucks for Evacuation (person)	Boats	4-wheeled trucks	6-wheeled trucks for transportation of flood relief bags (person)	The need of a 6-wheeled truck /15,000 people/ the distance to transport flood relief bags (kilometers)	Boats
Average	109%		33%		184%		
Nakhon Ratchasima	153Tambon 55%	8,490	116Tambon 42%	153Tambon 55%	1,415,000 111%	3 Trucks 70 Kms.	116Tambon 42%
Chaiyaphum	119Tambon 106%	4,320	54Tambon 48%	119Tambon 106%	720,000 177%	3 Trucks 61 Kms.	54Tambon 48%
Buriram	61Tambon 36%	6,240	32Tambon 19%	61Tambon 36%	1,040,000 331%	3 Trucks 58 Kms.	32Tambon 19%
Surin	45Tambon 36%	3,990	12Tambon 10%	45Tambon 36%	665,000 558%	3 Trucks 57 Kms.	12Tambon 10%
Khon Kaen	86Tambon 61%	2,400	63Tambon 44%	86Tambon 61%	400,000 84%	3 Trucks 64 Kms.	63Tambon 44%
Kalasin	11Tambon 55%	900	23Tambon 42%	11Tambon 55%	150,000 111%	3 Trucks 70 Kms.	23Tambon 42%
Maha Sarakham	172Tambon 151%	1,290	7 Tambon 6%	172Tambon 151%	215,000 87%	3 Trucks 49 Kms.	7 Tambon 6%
Roi Et	87Tambon 791%	1,650	23Tambon 209%	87Tambon 791%	275,000 841%	3 Trucks 46 Kms.	23Tambon 208%
Udon Thani	54Tambon 35%	1,440	32Tambon 21%	54Tambon 35%	240,000 data is not sufficient	3 Trucks 59 Kms.	32Tambon 21%

Province	The first day of the flood: Capacity in service providing			The second day of the flood: Capacity in service providing			
	4-wheeled trucks	6-wheeled trucks for Evacuation (person)	Boats	4-wheeled trucks	6-wheeled trucks for transportation of flood relief bags (person)	The need of a 6-wheeled truck /15,000 people/ the distance to transport flood relief bags (kilometers)	Boats
Bueng Kan	49 Tambon 92%	1,080	2 Tambon 4%	49 Tambon 92%	180,000 data is not sufficient	4 Trucks 79 Kms.	2 Tambon 4%
Loei	59 Tambon 66%	330	30Tambon 34%	59 Tambon 66%	55,000 9%	3 Trucks 58 Kms.	30 Tambon 34%
Nong Khai	49 Tambon 79%	1,080	2 Tambon 3%	49 Tambon 79%	180,000 data is not sufficient	3 Trucks 55 Kms.	2 Tambon 3%
Nong Bua Lamphu	33 Tambon 56%	1,170	5 Tambon 8%	33 Tambon 56%	195,000 160%	3 Trucks 37 Kms.	5 Tambon 8%
Sakon Nakhon	135 Tambon 110%	3,630	77 Tambon 60%	135 Tambon 110%	605,000 177%	3 Trucks 61 Kms.	77 Tambon 60%
Nakhon Phanom	28 Tambon 30%	2,010	68 Tambon 70%	28 Tambon 30%	335,000 121%	3 Trucks 61 Kms.	68 Tambon 70%
Mukdahan	40 Tambon 77%	300	3 Tambon 6%	40 Tambon 77%	50,000 35%	3 Trucks 38 Kms.	3 Tambon 6%
Ubon Ratchathani	16 Tambon 10%	3,360	22 Tambon 13%	16 Tambon 10%	560,000 142%	3 Trucks 61 Kms.	22 Tambon 13%
Yasothon	245 Tambon 310%	1,410	19 Tambon 24%	245 Tambon 310%	235,000 83%	3 Trucks 41 Kms.	19 Tambon 24%
Sisaket	54 Tambon 29%	2,910	35 Tambon 19%	54 Tambon 29%	485,000 90%	3 Trucks 45 Kms.	35 Tambon 19%
Amnat Charoen	18 Tambon 32%	720	4 Tambon 7%	18 Tambon 32%	120,000 102%	3 Trucks 38 Kms.	4 Tambon 7%

Source : Researcher's calculation from the affected area data on 2011

Note : The distances for transporting flood relief bags are average distances from each city hall to each district office at 70kms and distance for victim transport at 15kms. .

Way Forward

According to the study results, it shows that (1) flood situation keeps changing during the first 48 hours and after 48 hours. Every organization involved in responding to flood victim management should be able to evaluate the situation in real time. In time coordination and collaboration of each organization capacity and capability in providing vehicles, manpower, number of aid trips, dairy operation cost and other related services are very important to provide effective logistics operational work plan to be appropriated to each flooding time length area. (2) City hall should be established as a distribution center. Cross docking is recommended to be the most effectiveness and appropriated distribution center method during emergency situation because of its timely and cost efficiency management. It can manage flood relief bags distribution within 24 hours. (3) The study recommends, none of flood relief kit should be stocked and there should not be any acceptance of supply donation from the public. Preferred donation would be the money donation via bank accounts. The responsive organizations should list specify supporting items for flood victims in advance and purchase requesting support from whole sellers that have high potential in logistics rather than taking donate items and buying each individual items at a time. (4) The research result has shown the diary expense of victim service in each vehicle and each mission. (5) Overall truck is just enough although some areas have too much truck and some have too little. The study suggests the minimum vehicles to help victims, the ability of the vehicle in each mission, number of aid trips, and dairy operation cost. Moreover, type of vehicle causes different cost. The study recommends that the use of vehicle should be appropriate with the situation, and (6) the management of distribution of donation matters and transportation of patients from the flood affected area are key to manage post 48 hours logistics operations.

In terms of the establishment of alleviation centers, goods distribution center, or evacuation centers, including a warehouse management, it was found that these issues should be taken into consideration continuously. Having considered about the establishment of alleviation centers based on the criteria which were defined by official agencies, we used the data from the area which were dependable according to the criteria, number of people affected by the flood, develop appropriate models and use GIS software for processing; it allowed us to know how many alleviation centers should be established, how many main centers there should be for distributing items to the sub-centers, how many flood victims can be assisted in each area. Thus, it is recommended to make a simple, precise, applicable plan in all provinces as there are tools which are ready to use; as a result, those plans should be operated and developed for being used in each

sector. With regard to the management of resources and vehicles, it was suggested that the concepts of the management of resources and vehicles which were applicable in a particular situation should be applied or adapted in other cases.

In terms of supplies management, according to the findings, it was suggested that there should not be storage centers due to constraints and cost increases. Instead, there should be the cooperation of goods distribution and procurement between government and private agencies with a clear and fair agreement so as to reduce agencies' burden in case they needed to devote the necessary help in other missions by monitoring the procurement carefully. In this case, it can be linked that making a donation should be campaigned by giving money instead of things. However, in the present investigation, the data obtained on goods distribution have been calculated. In respect of goods storage in each of the evacuation centers, it was found that there should be a management of frequency of transport in order to transfer goods with the minimum amount needed to be sent per day and to prevent spoilage of goods. This would become a cost for the storage of goods. If the goods cannot be delivered within the very day, it would affect the average cost per project. In case, goods transport has not been sent by the due date, it would unable the donated or prepared items to fully be utilized, including helping the flood victims would not be fully effective.

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