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CHAPTER I

INTRODUCTION

1.1 A disaster is a natural or man-made (or technological) hazard resulting in an event of substantial extent causing significant physical damage or destruction, loss of life or drastic change to the environment. A disaster can be extensively defined as any tragic event stemming from events, which cause damage to life and property and destroy the economic, social and cultural structure of people¹. Specially natural disasters such as floods, cyclones, landslides, tsunami and earthquakes are often prominent in South Asian countries.

1.2 It has been reported that 222 billion dollars had been lost in the year 2010 because of natural disasters and other atrocities in the world². So it is obvious that those occurrences have become an important factor which has adversely affected to the economic development and social stability. To overcome and mitigate their destructive effects, nations throughout the world have formulated plans in order to deal with emergencies and provide assistance to those who are in need. In fact it is standard and common practice for utilization of armed forces, especially navies have major role to address emergencies caused by natural disasters.

1.3 In the year 2005, the government of Sri Lanka established legislative and institutional arrangement for disaster management centres in the country under act no 13 of 2005.

1.4 Sri Lanka is affected by different disasters island wide. Among them flood is a burning issue. Sri Lanka Navy plays a major role in disaster relief management during floods. Even though recently Sri Lanka Navy has formed 4RS (Rapid Response Rescue and Relief Squadron) in order to response floods, it is questionable whether available man- power, equipment and knowledge of naval personnel are adequate to carry out effective and efficient management in flooding disasters. Further, it is observed during the year 2011, The Polonnaruwa District had been experiencing severe floods twice and given huge impact to the economy of people of Polonnaruwa District and for their state of living condition as well. Therefore, it led to number of deaths reported and heavy damage to the properties due non-availability of effective rescue force in close proximity in Polonnaruwa District. In this research, it is expected to study how Sri Lanka Navy would assist to public in case of floods in Polonnaruwa District.

¹ Quarantelli E.L. what is a disaster? London. Rouledge. p, 9 Nov 2012. <http://en.wikipedia.org>

² www.dmc.gov.lk

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OBJECTIVES

1.5 In this research, it is expected to discuss whether the Sri Lanka Navy plays a satisfactory role in providing efficient and effective flood relief operation in a flood situation in Polonnaruwa District and find out recommendations to develop effective disaster management system for Sri Lanka Navy

SIGNIFICANCE

1.6 If the research proves that the Sri Lanka Navy's involvement providing relief and immediate rescue responses are not sufficient during floods in Polonnaruwa district, recommendations of research would be benefited to naval personnel to improve their lapses in order to implement developed disaster management system during floods in Polonnaruwa District.

HYPOTHESIS

1.7 The present operational readiness, adequacy of knowledge, skills and equipment of Sri Lanka Navy are insufficient to provide efficient and effective disaster relief to general public in case of flooding in Polonnaruwa district.

LIMITATIONS

1.8 Time is limited to have comprehensive analysis of the study.

1.8.1 The research was confined to several affected areas in Polonnaruwa District and 50 persons who were involved in this research representing different social classes and different educational levels.

1.8.2 Recorded quantitative data can only be used descriptively.

Terms of definitions

1.9 **Disaster Risk Reduction:** The conceptual framework of elements considered with the possibilities to minimize vulnerabilities and disaster risks throughout a society, to avoid (prevention) or to limit (mitigation and preparedness) adverse impact of hazards, within the broad context of sustainable development.

1.9.1 **Disaster:** A serious disruption of the functioning of a community or a society causing widespread human, material, economic or environmental losses which exceed the ability of the affected community or society to cope using its own resources. A disaster is a function of the risk

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process. It results from the combination of hazards, conditions of vulnerability and insufficient capacity or measures to reduce the potential negative consequences of risk.

1.9.2 **Preparedness:** The capacities and knowledge developed by government, professional response organisations, communities and individuals to anticipate and respond effectively to the impact of likely, imminent or current hazard events or conditions.

1.9.3 **Relief / Response:** The provision of assistance or intervention during or immediately after a disaster to meet the life preservation and basic subsistence needs of those people affected. It can be of an immediate, short-term, or protracted duration.

1.9.4 **Resilience:** The capacity to absorb stress or destructive forces through resistance or adaptation; to manage or maintain certain basic functions and structures during disastrous events; and to recover or ‘bounce back’ after an event.

1.9.5 **Risk:** the probability of harmful consequences, or expected losses (deaths, injuries, property, livelihoods, economic activity disrupted or environmental damage) resulting from interactions between natural or human induced hazards and vulnerable conditions. Risk is often expressed as the equation

$$\text{Risk} = \text{Hazard} \times \text{Vulnerability} / \text{Response Capacity}.$$

1.9.6 **Vulnerability:** The conditions determined by physical, social, economic and environmental factors or processes which increase the susceptibility of community as the impact of hazards³.

³ Public health guide for emergencies, Disaster definitions, 11 Nov 2012, 135

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CHAPTER II

INTRODUCTION OF FLOODS

2 Normal floods can be seen in many parts of the world and generally those are welcomed in view of providing rich soil and water as well as a means of transportation, but when it comes in an unexpected scale (damaging people) occurring with excessive frequency causing damage to life, property and the environment, people are to be more concerned its effects and behaviours. During past decades, the behaviour of floods in all continents have been changing and becoming difference intense and unpredictable scale. Particularly people in developing areas are to be more concerned and are alarmed during flooding. Floods will affect life and livelihoods in human settlements in all areas, e.g., river deltas, coastal zones, and mountains. Especially floods increases in urban areas causing severe damages to poor people. Even though floods occurs naturally, it is a complex event which caused by inappropriate development planning, a range of human vulnerabilities, and climate variability. Floods can be predicted in a reasonable extent except flash floods.

2.1 The magnitude of disaster cannot be determined by floodwater alone but also by the pattern of vulnerability in which people live. The lives and livelihoods of many poor people are hardest hit by floods. These people are often vulnerable to other disasters and stresses such as HIV/AIDS, drought, food insecurity, cyclones and ongoing conflicts, forcing to live in hazardous places, building their homes and growing their food on floodplains⁴.

TYPES OF FLOODS

2.2 Even though world communities have experienced only a few types of floods, it can be categorized according to following status.

- a. Reverting flooding
- b. Improper urban drainage
- c. Ground failure
- d. Fluctuating lake levels
- e. Coastal flooding and erosion

2.3 In addition to above floods, there are several subtypes of floods.

⁴ www.dmc.gov.lk

Surface water run off

2.4 When rainfall occurs, water runs over the surface, infiltrates into the soil and some water evaporates. These actions are proportionate to each other and it depends upon the ground condition. Further, there are different types of cover types. Those cover types are varied according to type of communities and within the communities. Especially urban areas such as city, may have those cover types.

- a. Houses and residential areas
- b. Open spaces (Golf courses, parks)
- c. Streets and roads
- d. Business areas and offices

2.5 When rainfall intensity level exceeds than evaporation rates and states of infiltration capacity of soil, surface water runoff condition may begin. It also occurs when rain falls on impervious surfaces, such as roadways and their paved areas, water flows across the surface as either confined or unconfined flow. Unconfined flow moves in broad sheets of water often causing sheet erosion. It can also pick up and adsorb or carry contaminants from the surface. Water that flows along the surface may become trapped in depressions. Here, the water may either evaporate back into the air, infiltrate into the ground, or spill out of the depression as it fills. If local drainage conditions are inadequate to accommodate rainfall through a combination of evaporation, infiltration into the ground, and surface runoff, accumulation of water in certain areas may cause localized flooding problems⁵.

2.6 If the area becomes more urbanized, the volume of runoff water increases and it results flood condition. When greater population density exists, the amount of impervious area will increase. This reduction in the extent of natural ground that can absorb rainfall, results generating surface runoff. This uncontrolled runoff may cause flooding of structures and roadways. This may be true where the predevelopment land surface had a gently sloping surface with no defined channels. Such areas are subject to shallow sheet flooding during storms, but urbanization and other developments speed the accumulation of floodwater.

2.7 When surface water runoff introduced into streams and rivers exceeds the capacity of the natural or constructed channels to accommodate the flow, water overflows the stream banks, spilling out into adjacent low-lying areas. Reversing flooding occurs consequently⁶.

⁵ Rajesh Anand,ed,Disaster Management and Sustainable Development,(New Delhi:Pentagon press,2009)pp.29-45.

⁶ Ibid.pp.29-45

Revering Flooding

2.8 Significance of revering flooding can be varying according to the terrain. Especially in flat areas, floodwater moves slowly for longer period. (Even more than weeks) in the mountain areas, floods may occur in short notice. Once heavy rain occurs due to above condition, this kind of most dangerous flash floods can be occurred. Common types of revering flooding are:

Overbank Flooding

2.9 These kinds of floods occur due to increasing volume of water in rivers and streams. When increasing the volume of water within a river, the water over flows from the channel in to adjacent floodplain. In fact, these kinds of floods affect people who live in close to riverbanks.

2.10 If Revering floodplains range areas are narrow and confined channels (Hilly and mountainous areas), flood usually occurs very quickly and it is of short duration. That is likely to be rapid and deep. Specially, floodplains areas may be submerge for days or even weeks, but floodwaters are typically slow moving and shallow.

Flash Flood

2.11 Many experts use the term of Flash flood and it define as “A rapid and extreme flow of high water in to a normally dry area, or a rapid rise in a stream or creek above a predetermined flood level, beginning within six hours of the causal event. (Eg. intense rainfall, dam failure, and ice jam) However, in different parts of the countries, the actual time entrance may be varying ongoing intensify to flash flooding, in cases where strong rainfall results in a rapid flow of rising flash waters.

Dam and levee failure

2.12 Due to inadequate construction and poor management of dams and levees, flood control structure can be broken. Observations revealed that many private or locally built levees might provide poor plan of construction and those are leading for occurring floods. Dams and levees are unable to hold the capacity stored by reservoirs and found many have been built without having standard plan. This kind of dams is severely dangerous to people who are in need of immediate evacuation.

Urban drainage

2.13 Natural drainage systems in undeveloped areas are constantly changing according to the ground condition. From one season to another, streams course, soil, and bank erode are varying. It makes new natural accommodation for floods throughout the system.

2.14 In urban area, it is compulsory to have proper drainage system. People are unwilling to suffer inconvenience due to runoff water. Developed drainage system is capable to remove even large runoff water flow. Regulating and controlling urban runoff is called as storm water management. Today, this system is utilized on streets in developed areas. Urban drainage management can be applied both natural and manmade elements. Storm water runoff can be used for two purposes.

2.15 The control of storm water runoff is important to prevent or minimize damage to property and physical injury and loss of life, which may occur during or after a very infrequent or unusual storm.

2.16 The control of storm water to eliminate or minimize inconvenience or disruption of actively as a result of runoff from more frequently occurring less significant storms⁷.

CAUSES OF FLOOD

Natural Causes

a. **High rainfall**

2.17 The amount and intensity of rainfall is the dominant determinant of the flood disaster in the rivers. High intensity and long duration (continuous for more than a day) rainfall in the catchment area result in floods. At times localized cloud burst can also cause flood in a river. Cloud bursts or high intensity precipitations are also associated with deep depression or high cyclonic storms. At times the flood may even occur when catchment had very antecedent moisture conditions.(due to continuous low to moderate intensity precipitation) prior to a high intensity storm event. Normally such high intensity rainfall may not otherwise cause flood due to initial abstraction by the catchment. The high antecedent moisture condition can initiate direct runoff and very high flow conditions in the channel as result of a storm event⁸.

⁷ www.alnap.org/pool/files/ALNAP-ProVention_flood_lessons.pdf

⁸ Ibid.pp.29-45

b. **Snowmelt**

2.18 As far as the global warming is concerned; the temperature of this year is higher than the temperature of previous years. Therefore, ice gets melt in spring, and the water goes into the sea and raises the sea level making the river level rise. When river level rises, flooding will occur.

c. **Low land area**

2.19 Flooding often occurs in lowlands. This is because rivers flow more slowly in low-lying areas. If the water volume increases suddenly, floods occur.

d. **Coastal flooding**

2.20 Flooding can always occurs in coastal areas. High tides or storms affect the water level to get rise. If the water level is higher than the level of the coastal low land, flooding will occur.

Human Causes for Floods

a. **Deforestation**

2.21 Large areas of forests have been cleared near to the rivers. The lands use to make room for settlement such as roads and farmland. Further less vegetation does not protect the soil and then the soil can be quickly eroded towards rivers and the sea. This leads to raise the riverbed, so that the river will overflows its banks easily.

b. **Poor farming**

2.22 Some farming practices can be damaged the vegetation cover, so that the soil will wash into the river easily.

c. **Overgrazing**

2.23 People need more food and money. They graze many animals on the land and the pasture is eaten away quickly. Less vegetation cover leads in soil washed into the rivers easily.

d. **Over cultivation**

2.24 If lands have been used for farming for a long period of time, the soil becomes so infertile and no vegetation can grow on it. The land is used less fertile than before, so the soil will be washed into the rivers more easily

e **Poor water management**

2.25 If the dams are poorly constructed or maintained, this can be resulted to collapse dams easily and this results in flooding.

FLOOD RISK REDUCTION

2.26 During last few decades, many experiments have been carried out in flood risk management, especially readiness supports to response and community preparedness, particularly in South Asian countries. But they produce effective results only when they are employed in an integrated manner and included vulnerability reduction as an additional key element. Structural and non-structural measures should have taken for flood risk reduction as suggested lessons and that should be integral parts of both the overall development process including relief and recovery activities in response to floods or other disasters that occurs along the way.

STRUCTURAL MEASURES FOR FLOOD CONTROL

2.27 An embankment is the one of effective Structural measures, which provides protection against many types of flooding. Flood control does not provide a long-term solution for addressing flood risk every time. Specially, both urban and rural contexts produce limited solutions; it is observed that even exacerbating flooding problems are also shown in isolation from overall policy in the floodplains. However, such kind of structures may provide solutions to critical aspects of the flooding problem if they are used with the coordination of non-structural measures, are planned and implemented with the participation of local people with an understanding of possible consequences, and are integrated in the overall developmental policy⁹.

COMMUNITY PREPAREDNESS AGAINST FLOOD

2.28 Creating functional groups, developing organizational capacities and enabling them to link with the national disaster management mechanisms are effective ways of strengthening preparedness at the community level. Small-scale mitigation, teaching lifesaving skills, contingency planning and even upgrading service provision are some key measures undertaken by non-governmental organizations and governments in Asia. In many cases such good work by agencies on an ad-hoc basis is found to be unsustainable and not often scaled up. Longer-term success requires strong engagement with the community. For many smaller NGOs, continuity of funding support is a critical limiting factor in maintaining their disaster preparedness work. Globally, some funding is available for disaster reduction, but little is left to support concrete

⁹ www.ffwc.gov.bd

action, beyond training and planning. The best way is therefore to enable the communities to organize themselves and link them with the national disaster response mechanisms¹⁰.

STAGES OF DISASTER RELIEF OPERATION

2.29 Disaster relief operation can be broken up into the following four sequential stages

a. **Preparatory Stage** This corresponds to the pre-disaster period and includes disaster prediction, warning and alert system, preventive measures and issue of contingency plans and check lists for potential disasters. During this stage appropriate organisational infrastructure, providing could be set up, standard operating procedure formulated, communication equipment provisioned and rehearsals conducted.

b. **Emergency Stage** This stage commences from the warning of disaster to the period immediately after the disaster strikes and aims at providing immediate succour to the affected people and bringing a semblance of order in the disaster affected area.

c. **Rehabilitation stage** This period covers short term measures restore essential services, communication and normal community life.

d. **Reconstruction Stage** This is a long-term measure aimed at providing adequate relief to the affected people.

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2.30 ACTIONS BY NAVAL FORCES IN VARIOUS STAGES OF DISASTER

a. **Preparatory Stage** During this stage the following activities should be conducted.

- (1) Establishment of liaison with relevant authorities
- (2) Identification of possible areas of deployment
- (3) Understanding the overall disaster relief plan and formulation of own contingency plan
- (4) Tasking and preparation for execution of contingency plan

¹⁰ www.mrcmekong.org

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- (5) Local level liaison and reconnaissance if required
- (6) Briefing of troops and rehearsals if required

b. **Emergency stage** During this stage in case magnitude of the problem is high enough to warrant the requisitioning of the naval forces, the following activities are carried out by the troops.

- (1) On being summoned for disaster relief operations the troops are instructed and prepared for the task.
- (2) Final task and cooperation
- (3) Move to disaster area.
- (4) Establishment of controlling HQ and conduct of relief operation
- (5) Division of area into various segments
- (6) Evacuation of victims for safer places
- (7) Assist in bringing a semblance of order in disaster affected area.
- (8) Provision of medical aid and other relief
- (9) Get assistance of air force helicopters if required

c. **Rehabilitation stage** During this stage, the armed forces should be utilized to assist the civil administration to restore essential services. The armed forces need to be derequisitioned the moment semblance of normalcy is restored.

d. **Reconstruction Stage** The armed forces have limited role to play during this stage, as they would have normally been derequisitioned.

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CHAPTER III

FLOODS IN POLONNARUWA DISTRICT

3 Sri Lanka is one of the most flood-affected countries in south Asia and it occurs frequently in many part of the Polonnaruwa District. The various reasons have caused to occur floods in Sri Lanka. Those are river system, reservoir failure or improper management of high water level condition of reservoirs. Above conditions are occurred due to high to moderate intensity rainfall over sufficiently longer duration. Specially Polonnaruwa District is being experienced above-mentioned condition and severely be affected overflowing reservoirs and tanks in the same area. Further observed, flood is a relatively high flow than the normal flow of water resulting in the inundation of low-lying areas around the reservoirs in Polonnaruwa District. In many occasions, the water is over flowing in view of reducing charring capacity of all tanks with convergent of mud' around the area.

3.1 Despite measures taken to control floods in Polonnaruwa District by relevant authorities, there has been a severe flood over the years and affecting thousands of people annually. Hence, it is impossible to understand the recurring flood, the effect of control measures and damages caused by it. To overcome and mitigate above destruction, the Sri Lanka Government has suggested policy measures to have proper management.

Major reasons which cause for floods in Polonnaruwa

3.2 When it comes to Polonnaruwa District, the possibilities of a flood increases depend open the increase in size of the river and reservoirs. The Mahaweli River is the only major river, which is flown through Polonnaruwa District. The heavy rainfall in the catchment area of Mahaweli River usually affects some areas in Polonnaruwa district. However, it has been reported that the sudden release of water from the reservoirs at the time of high intensity result in floods in low land area of Polonnaruwa District.

Previous experiences during floods in Polonnaruwa District

3.3 During the year 2011, the Polonnaruwa District was severely flooded occurring heavy damage to the civilians as well as property. It is revealed that naval involvement of providing relief to the victim was not sufficient to have efficient and effective feedback with regard to the flood relief operation. On 9th January 2011, first major flood hit on Polonnaruwa District and that severely affected the Polonnaruwa District.

3.4 Due to heavy rain, more than 35 tanks and reservoirs including Parakrama Samudraya, Minneriya, Kaudulla, Girithale and Pimburaththawa were at the spill level. Therefore, that spill

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gates were opened. With the outcome of the heavy floods, Somawathiya road and the Madirigiriya town were fully submerged and it was reported that 6395 people were displaced and inundated many acres of land and paddy fields in the Polonnaruwa District.

3.5 The flood situation in Polonnaruwa district reached dangerous level with the number of affected families within few hours and causing death and property losses.

3.6 Second flood hit on 2nd February 2011 and it gave huge impact to the people who were in Polonnaruwa District. The government estimated that the Polonnaruwa District would need at least Rs. 149 million in relief operations, according to the report of Polonnaruwa District Secretary, five deaths caused by floods were reported from Polonnaruwa. There were 8,320 displaced families living in 67 temporary shelters in Polonnaruwa.

3.7 In January 2013, 30,581 displaced residents in Polonnaruwa were roughing it out in schools and during month of February, 13,314 displaced people have sought shelter. During month of February, the overflowing of six major tanks in Polonnaruwa sent flood water smashing through land amounting to 279,182 acre feet, while another 350,302 acre feet have been flooded the area during same period. All crops on these lands have been destroyed.

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CHAPTER 4

ROLE OF ARMED FORCES

4 Since the early 1990's, Military involvement in relief activities have been continuing and present scenario every world militaries have experienced providing relief activities during disasters. Further it is involved various driving factors with the interest of military in responding to disasters providing efficient and effective relief operation has led to enhance military image as well as training opportunities for all units and assists military to diversity their role away from the their normal pattern of routine. With the globalization, today foreign military in the world have formulated plans and can be expected to play against in an any a large scale of natural disaster.

4.1 The role of the Armed Forces in Disaster situations and for mitigating Disaster is varying according to the type of disaster. The Armed Forces should be well organized and managed to provide support to a full range of public services such as public works, communication, transport, health, emergency medical services, rescue and support activities. They can react quickly and in a self-contained manner. Military personnel are well trained in the individual skills necessary to perform their professional activities. They can also perform efficiently under a collaborative, coordinated, integrated and flexible management system. Thus, there is enormous potential inherent in the Armed Forces to render disaster relief. Invariably, it is to be expected that the local administration would collapse during the initial stages of disaster relief operations, as personnel forming the local administration themselves would be stunned/affected by the calamity. In such situations, the Armed forces would be expected to provide immediate succor and restore normalcy.

4.2 The Armed Forces will be deployed only to support immediate succour and relief efforts In case of major disasters, which are beyond the scope of State Government/ Union Territory In the short and medium term, duration of such assistance should not normally exceed 15 days, however this would largely depend on the situation.

4.3 The range of activities that the Armed Forces can perform to assist in disaster situations is large and varied. These are now shown in the order that these services would be required.

(a) **Restoration of communications.** Loss of communications is invariably the very first Casualty in the wake of a natural disaster.

(b) **Initial and Subsequent Surveillance Assistance.** This is particularly relevant to coastal areas, ports and harbours where relief can best be provided by sea.

(c) **Medical Aid.**

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(d) **Transportation** - Relief Material like logistic backup of aircraft / helicopters /ships / boats / inflatable water crafts / vehicles for transportation etc.

(e) **Establishment of Relief Camps**

(f) **Construction and Repair of Roads and Bridges**

(g) **Maintenance of Essential Services**

(h) **Evacuation of People to Safer Areas.** Armed Forces units may need to assist in evacuation of people to safer places before and after the disaster.

(j) **Diving Assistance to Civil Authorities.** The Armed Forces, especially Navy may be called upon to provide assistance of divers.

(k) **Management of International Relief.** The distribution of international relief will be undertaken by the Services if directed to do so by the Union Government when a request has been made by an affected nation.

4.4 Services Organisation. This is now depicted on the slide.

4.5 Naval Ships are well equipped for rendering assistance in coastal areas, ports and harbours, affected by natural or manmade calamities and may be called upon to provide assistance. The Naval Shore Authorities may also be involved in augmenting the effort.

THE NECESSITY OF NAVAL FORCE

4.6 The naval forces traditionally prepares with a well-oiled structure to be able to rush to the aid of the civil authorities in times of need such as the one witnessed now. The command structure, the infrastructure, the mobility, availability of trained manpower makes it easy to utilise the service of naval force such trying conditions. In addition, an Aid to Civil power is a secondary task assigned to the naval force.

4.7 Considering the history of the disasters, coastal areas and the low lands were mostly affected where the naval force was the only option to be employed for effective relief operation.

4.8 In an island nation country like Sri Lanka, naval platform is the first line of means for active transportation of large amount of relief materials to the affected areas. The role of navy in Tsunami relief operation can be highlighted as a tremendous event with relates to mobility,

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considering plenty of relief material, medical supplies and logistics movement to even remote corners.

4.9 Naval force is equipped with landing facility which can be effectively employed for relief operation inland water ways such as reservoirs and other inundated areas.

4.10 The naval forces are best organised and managed to provide support to a full range of relief services such as public works, communication, transport ,health, emergency medical services, rescue and support activities. They can react quickly and respond rapidly in a self contained and self-sufficient manner and with mobility.

FACTORS HIGHLIGHTING EFFECTIVENESS OF NAVAL FORCE

4.11 Factors highlighting effectiveness of naval force are enumerated below.

- a. Well organized and equipped for primary role.
- b. Highly motivated and disciplined
- c. Quick response time to any given task
- d. Valuable resources and ethos
- e. Naval forces always ready sail
- f. Apolitical character and impartial by nature
- g. Compassionate approach
- h. Ability to operate under adverse condition
- j. Will to serve

ROLE OF SRI LANKA NAVY DURING FLOODS

AIM OF 4RS

4.12 The aim of forming the Rapid Response Rescue and Relief Squadron (4RS) is to deploy same for rescue and relief response during disasters and to employ same personal and resources for other gainful activities when not engaged in disaster relief operations.

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ROLE OF 4RS

4.13 **Primary**

- a. Respond swiftly for rescue and relief duties during floods.
- b. Rescue and relief duties during disasters caused by Landslides, Earthquakes, Cyclones and Tsunami etc.

4.14 **Secondary**

- a. Provide sea lift in aquatic recreation activities in coastal waters and inland water ways such as up river nature cruises, boats for recreational diving, providing boats for angling, Harbour cruisers etc.
- b. provide rescue patrols in reservoirs/rivers/coastal areas when/where necessary.
- c. safety and rescue water patrols to be deployed on request in reservoirs/rivers/water bodies during major events where there is mass gathering of public.
- d. Provide transportation in inland waterways where necessary.
- e. Facilitate Training for outside organizations entrusted with waterborne rescue and boat handling.

4.15 **Strength of 4RS**

Eastern naval area	35
Northern Naval Area	51
Western naval Area	81
Southern naval Area	16
Norwest Naval area	108
North Central Naval Area	41
Course	25
Total	357

4.16 **RESOURCES OF 4RS IN EASTERN NAVAL AREA**

4 RS Dinghy's	19
OBM's	10(25 HP)
	04(40 HP)
Handsets	08

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Mega Phones	04
Helmets	08
Rubber Glues	20
Throw Bags	02
Luminous Jackets	10
GPS	01
Rope Nylon	50m (Each Boat)
Compass Silver	01
Head Mount Touch	10
Night vision	01
Day Vision Binoculars	02

4.17 **COMPOSITION OF 4RS GROUP**

01. 03 4RS Sailors
02. RFD or Dinghy boat
03. 02 OBM s (25HP or 40 HP)
04. Life Line (100M)
05. 10 Life Jackets
06. Drinking Water, Mask and Fins
07. Anchor, 4 x Oars, Through bags, Life Belt
08. Knife, Head touch, Towing ropes, Boat hook
09. Day vision, Night vision, GPS, Compass, Marker buoys, Tool kit, First aid pack, Hand flasher.

SUMMARY OF RELIEF SERVICES BY EASTERN NAVAL COMMAND DURING INUNDATION AREA IN DECEMBER 2012

4.18 On request of personnel affected due to unexpected inundation in polonnaruwa district, Commander Eastern Naval Area compelled to direct SLN relief teams as a preliminary initiative and 05 teams were directed to Polonnaruwa from COMEAST to be deployed in Aralaganwila & Manampitiya areas by a.m. 17th Dec 2012.

4.19 Subsequently messages from Police, Army & DMC were received reporting the flood situation & requested SLN teams for relief services and directed teams to Kiran, sungawil, BCO, Panichakerni, Horawana and padawiya by Comeast. Since the situation was

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getting to a calamity requirement of relief teams were arranged from nearest Naval establishment through AAs in liaison with GAs, District coordinators of DMC & Police in respective areas.

4.20 Total of 08 SLN relief teams were deployed by Eastern naval area comprising 36 personnel with 16 boats on 17th December 2012 and 641 males, 291 females & 95 children (Total 1027 pers) were rescued by SLN teams.

4.21 During this deployment, SLN teams deployed on relief duties had been rescued 11309 pers (68 - Males, 98- Females & 62- Children) .

A DETAIL OF FLOOD RELIEF DUTIES WHICH PROVIDED BY EASTERN NAVAL AREA ACCORDING TO BASE WISE IS AS FOLLOWS.

	BASE	NO OF PERSON		NO OF FGD'S	AREA DEPLOYED	RESC/TFR	REMARKS
		OFFICERS	SAILORS				
01	NAVDOCK	01	7	FGD 01 RFD01 OBM03	POLONNARUWA	NIL	
02	NAVDOCK		6	FGD 01 OBM02	POLONNARUWA	08	
03	VAKAREI	01	05	FGD 01 OBM02	WALIKANDA	05	
04	NAVDOCK	01	05	FGD 01 OBM02	KIRAN	1045	
05	NAVDOCK	01	08	FGD 01 OBM02	POLONNARUWA SUNGAWIL	105	
06	NAVDOCK	01	07	FGD 01 OBM02	POLONNARUWA MANIKKAMPATTI	80	
07	VAKAREI	01	05	FGD 01 OBM02	KIRAN KULIPANCHAKAL	530	
08	BOC	01	05	FGD 01 OBM02	BCO	127	
09	BOC	01	04	FGD 01	BCO	520	
10	NAVDOCK	01	04	FGD 01 OBM01	PANICHAKERNI	2438	
11	NAVDOCK	01	05	FGD 01 OBM02	PANICHAKERNI	135	
12	TISSA	01	07	FGD01 OBM01	HORAWAWA	565	
13	FAF4	01	07	FGD 01 OBM01	STBY	NIL	
14	KINNIYA	01	06	OBM01	MAVILARU NEELAPOLA	02	
15	PARAKUMBA	01	07	FGD01 OBM01	MAVILARU NEELAPOLA	NIL	
16	LANKAPATUNA	01	05	OBM01	MAVADICHENAI THUWAKKU	727	

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					JUNCTION		
17	NRTC SAMPOOR	01	05	FGD01 OBM01	SAMPOOR	NIL	
18	NRTC SAMPOOR	01	05	FGD01 OBM01	ICHCHALAMPATTU	180	
19	NMA	01	05	FGD01 OBM01	UPPARU,KINNIYA	05	
20	NMA	01	06	FGD01 OBM01	KINNIYA KANDALKADU	NIL	
21	KINNIYA	01	05	FGD01 OBM01	KINNIYA KANDALKADU	31	
22	PMD	01	06	FGD01 OBM01	PADAVIYA KAMBILIWAWA	1326	
23	FAF4	01	09	FGD02 OBM02	PADAVIYA PARACKRAMAPURA	09	
24	MLT	01	06	FGD01 OBM01	NAYARU WATTAPPALA	3571	

TABLE-3.1

Source: Incident report sent by Eastern naval area to NHQ during Floods in year 2012.

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CHAPTER 1V

ANALYSIS

Introduction

5 During this chapter it is expected to analyze whether the Sri Lanka Navy plays a satisfactory role in providing efficient and effective relief operation in a flood situation in Polonnaruwa District and find out recommendations to enhance effective disaster management system for Sri Lanka Navy. Analysis is compiled according to the answers given to the questionnaire by the general public and professionals in related fields with regard to under mention selected sample.

Characteristics of the study population:

5.1 The population sample for the study is represented various locations which are in Polonnaruwa District and Cluster sampling method will be selected. The Research consists in Population sample is 50 civilians and it is as follows.

a	District Secretary and Officers of District Secretariat Office	3 no's
b	Head of Irrigation Director, Engineers and other Board of directors of Irrigation Department in Polonnaruwa District	3 no's
c	Relevant Divisional Secretaries in Polonnaruwa District	5 no's
d	Staff of Disaster Management Centre in Polonnaruwa District	3 no's
e	Directors of Mahaweli Authority	5 no's
f	District Medical Officer and Hospital Staff	1 no's
g	Other Rescue Forces in Polonnaruwa District (Police, Ammy, Red Cross)	3 no's
h	Thamankaduwa (General public)	3 no's
i	Dimbulagala (General public)	3 no's
j	Welikanda (General public)	3 no's
k	Elahera (General public)	3 no's
l	Hingurakgoda (General public)	3 no's
m	Madirigiriya (General public)	3 no's
n	Lankapura (General public)	3 no's
p	SLN Officers and Sailors (Involve in Disaster Management)	5 no's

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5.2 **Sample design and procedure:** Questions designed and structured according to the hypotheses and to cover the objectives of this research.

5.3 **Data collection instrument:** The required data for this study collected from the structured questionnaire that distributed among conveniently selected people who were influenced by floods and officers and sailors of Sri Lanka Navy too.

5.4 **Data processing procedure:** Gathered data was analyzed by using statistical analysis methods and MS Excel software package as a quantitative approach. The descriptive statistics used in the study which included mean and standard deviation in describing the responses for each variable. Bar and pie charts illustrated the responses for each variable. 24 numbers of total questions were designed for this study and among them, question no 1 to 7, question no 8 to 15 and question no 16 to 24 were designed according to biological data of population sample, existing flood relief capabilities of Sri Lanka Navy and productivity of Sri Lanka Navy respectively when providing flood relief to victims in Polonnaruwa District.

Analysis for the demographic data

5.5 **Average of gender status for selected sample is as follows.**

Gender	No of People	Percentage
Male	44	88%
Female	6	12%
Total	50	

TABLE 4.1

5.5.1 Selected sample is limited to 50 civilians and observed, many of women were reluctant to answer due to existing flood disastrous condition. As per the above table, 88% of men and 12% of female answered for all questions. Further, the research reveals that the highest number of people selected for the study have been affected by floods.

5.6 **A percentage of flood-affected areas as per the answers given by the selected sample are as follows. (Q-4)**

Areas	No of People	percentage
Thamankaduwa	06	12%
Dimbulagala	05	10%
Welikanda	05	10%
Elahera	05	10%
Hingurakgoda	06	12%

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Madirigiriya	15	30%
Lankapura	08	16%

TABLE 4.2

5.6.1 According to the answers given by the selected sample, Maderigiriya has been affected severely by floods in Polonnaruwa district and other divisional secretary's areas also were equally affected by floods.

5.7 Details of incident/damages during floods (Q-02)

Nature of damage	No of People	Percentage
Death	-	0%
Casualties	12	24%
Property losses	32	64%
Above all	06	12%
Total	50	

TABLE 4.3

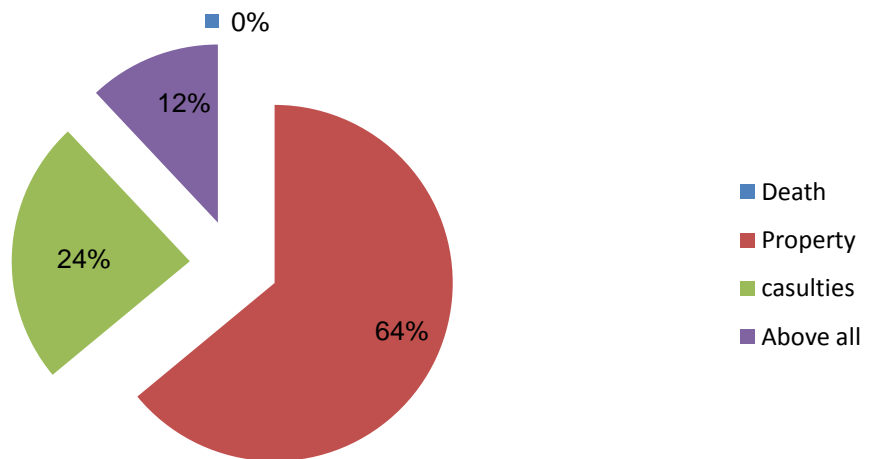


FIGURE 4.1

5.7.1 It has been reported that 64% of paddy fields and other lands were inundated by severe foods during year 2011 and 2012. Eventhough it is reported less number of deaths, observed many people were displaced.

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5.8 **Major causes for floods in Polonnaruwa District(Q-3)**

Reason	No of people	Percentage
Overflowing Tanks	10	20%
Weakness of draining system	07	14%
Flat land area	22	44%
Continuous severe floods	02	04%
Above all	11	22%

TABLE 4.4

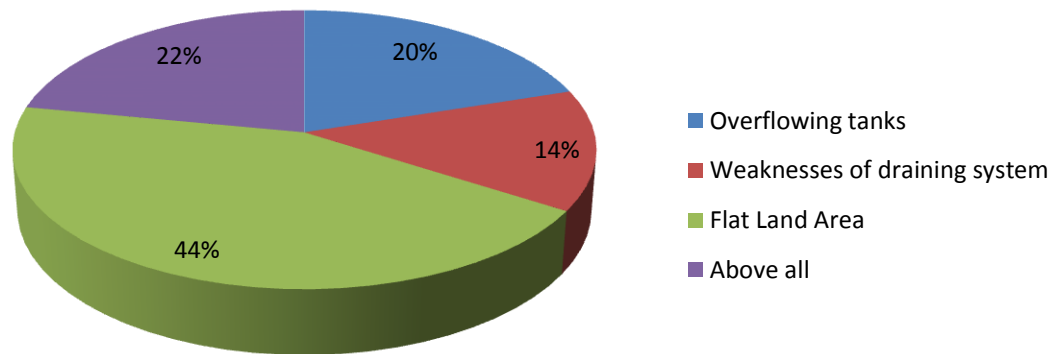


FIGURE 4.2

5.8.1 The irrigation engineer Mr LA Harischandra revealed that most of the areas in polonnaruwa District have been flooded due to flat land areas and overflowing of major tanks as well as small scale tanks located in Polonnaruwa District. Due to heavy rainfall, water level of Mahaweli River and other Tanks increase and it results to inundate many areas of polonnaruwa District. Due to flat land, excessive water does not flow speedily along the free lands and then water level gets increase and creates floods. Further they mentioned the weakness of Draining system of Polonnaruwa District.

Utilization of Correlation formula for the analysis

5.9 Utilization of Correlation formula is used with two variables which are flood relief capabilities of Sri Lanka Navy and final outcome of Productivity providing flood relief to the victim. Those variables are named as X and Y respectively.

5.10 Allocation of Marks for the Questionnaire which asked from selected sample and is as follows.

- | | | |
|------------------------|---|---|
| 1. Totally agreed | - | 5 |
| 2. Agreed | - | 4 |
| 3. Cannot be mentioned | - | 3 |
| 4. Disagree | - | 2 |
| 5. Completely disagree | - | 1 |

5.11 Potential or reported short comings during flood relief duties of Sri Lanka Navy in Polonnaruwa District (Q-05)

- | | | | | | |
|-----|---------------|-----|---------------------|-----|---------------------|
| 5 - | Totally agree | 4 - | Agree | 3 - | cannot be mentioned |
| 2 - | Disagree | 1 - | Completely Disagree | | |

Marks	Quantity	Percentage
5	12	24%
4	23	46%
3	2	4%
2	9	18%
1	4	8%
Total	50	

TABLE 4.5

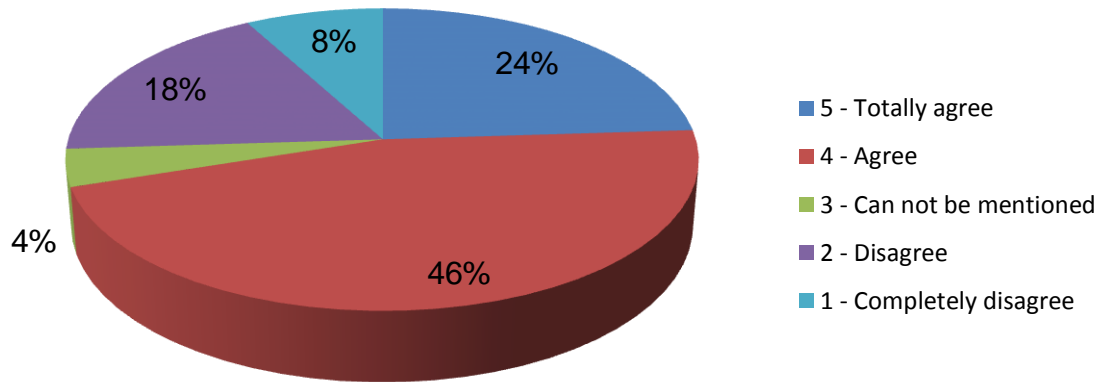


FIGURE 4.3

5.11.1 Data analysis revealed that 70% of people reported the shortcomings when carrying out flood relief operation. The Out of them, 26% accepted the existing system of Sri Lanka Navy. Especially they have highlighted the response time of Sri Lanka Navy and inadequacy of man power and equipments. Many professionals in related field emphases that these circumstances are caused due non availability of rescue camp within the Polonnaruwa District.

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5.12 Sri Lanka Navy has made a active Participation during floods relief duties of Polonnaruwa District (Q-6)

- 5 - Totally agree 4 - Agree 3 - cannot be mentioned
2 - Disagree 1 - Completely Disagree

Marks	Quantity	Percentage
5	2	4%
4	30	60%
3	6	12%
2	12	24%
1	0	0%
Total	50	100%

TABLE 4.6

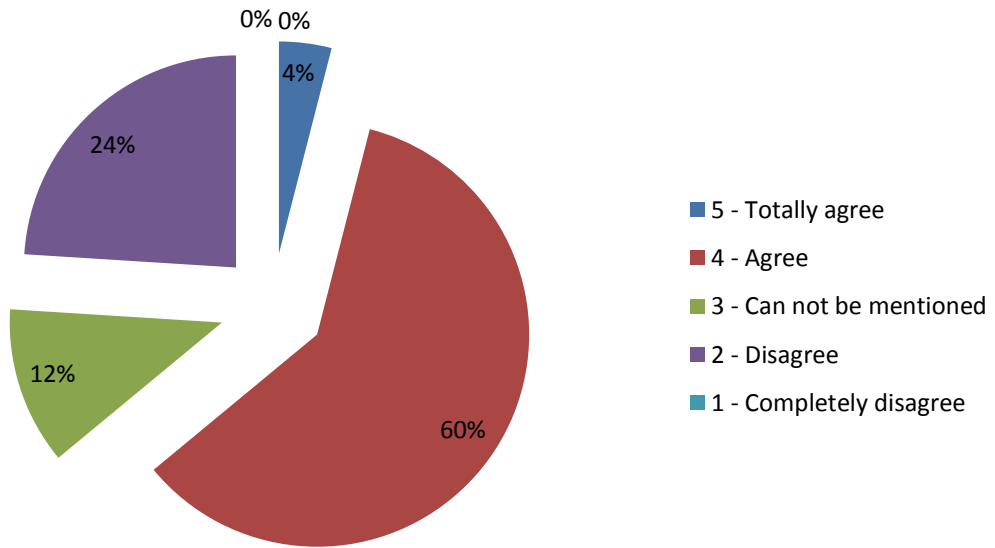


FIGURE 4.4

5.12.1 Active participation of Sri Lanka Navy during floods relief duties was accepted by 64% of sample population. They have highlighted inadequacy of personnel and equipment of Sri Lanka Navy. Especially flood affected people reported that sometimes relief are not fairly

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distributed to the civilians due to size of affected area and less infrastructure facilities. Professionals in selected sample highlighted the importantly of mapping out flood prone areas of Polonnaruwa District and relief personals can be distributed in accordance with vulnerability of affected areas.

5.13 There are weaknesses of Sri Lanka Navy during floods relief duties (Q-7)

- 5 - Totally agree 4 - Agree 3 - cannot be mentioned
2 - Disagree 1 - Completely Disagree

Marks	Quantity	Percentage
5	4	8%
4	29	58%
3	6	12%
2	9	18%
1	2	4%
Total	50	

TABLE
4.7

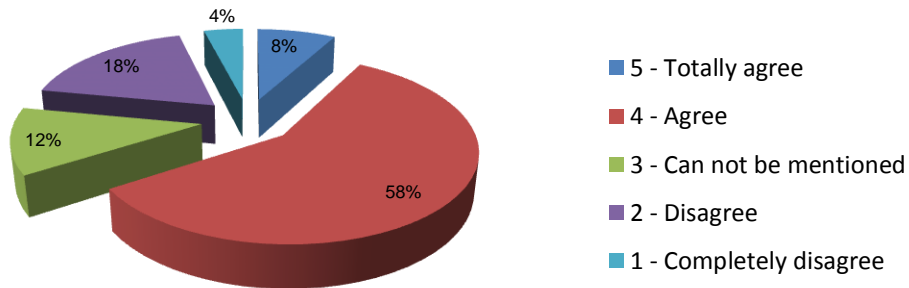


FIGURE 4.5

5.13.1 Above table depicts that, the lapses of Sri Lanka Navy when providing flood relief duties were stated by 64% of sample people. Many victims and professionals reiterated

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the requirement of paying equal attention to affected people and further argued, responses should be provided according to the vulnerability of affected areas.

5.14 Man-power of Sri Lanka Navy during floods relief duties is adequate(Q-8)

- 5 - Totally agree 4 - Agree 3 - cannot be mentioned
2 - Disagree 1 - Completely Disagree

Marks	Quantity	Percentage
5	2	4%
4	5	10%
3	6	12%
2	24	48%
1	13	26%
Total	50	

TABLE 4.8

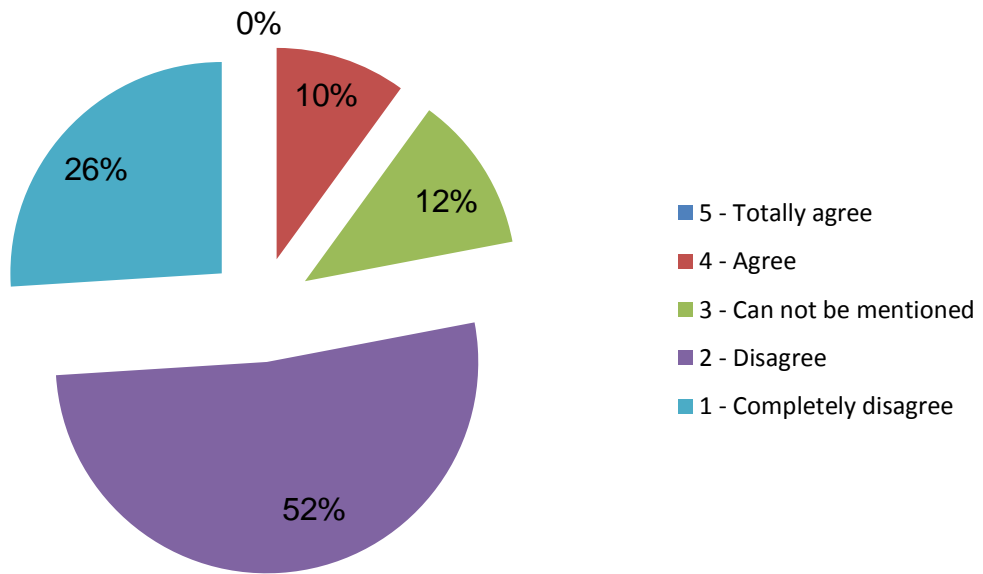


FIGURE 4.6

5.14.1 Above question statement was denied by 74% of people in selected sample. Further chart proves that inadequacy of man power of Sri Lanka Navy when providing flood relief to the affected civilians in Polonnaruwa District. Naval Officers who engaged with disaster

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management mentioned that paying attention of other flood affected areas such as BCO, Kiran,Sampoor and Kinniya also carried out by TCO Naval base and Difficult to manage rescue troops sufficiently with the existing condition

5.15 Equipment of Sri Lanka Navy during floods relief duties is adequate (Q-9)

- 5 - Totally agree 4 - Agree 3 - cannot be mentioned
2 - Disagree 1 - Completely Disagree

Marks	Quantity	Percentage
5	2	4%
4	4	8%
3	4	8%
2	30	60%
1	10	20%
Total	50	

TABLE 4.9

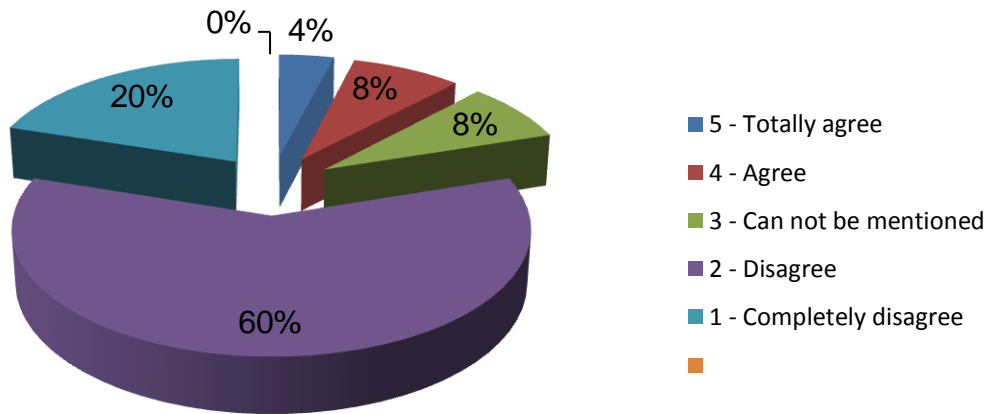


FIGURE 4.7

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5.15.1 Above question statement was denied by 80% of people in selected sample revealing the inadequacy of naval rescue equipment which are presently available in Sri Lanka Navy and 8% of people in the sample disagreed to answer the same question.12% of people mentioned the existing rescue equipment are adequate to carry out flood relief operations in Polonnaruwa District. Especially, Officers who are involved in Flood relief duties of Sri Lanka Navy emphasis that TCO Naval base has to distribute naval rescue boats and other equipments not only the Polonnaruwa District but also the other areas of Eastern naval area. Further when floods occur simultaneously in many areas of Eastern naval area,Sri Lanka Navy has to manage and restrict relief equipments in order to vulnerability of flood affected areas.

5.16 Changes are required in Sri Lanka Navy with regard to flood relief duties (Q-10)

- 5 - Totally agree 4 - Agree 3 - cannot be mentioned
2 - Disagree 1 - Completely Disagree

Marks	Quantity	Percentage
5	6	12%
4	22	44%
3	4	8%
2	13	26%
1	5	10%
Total	50	

TABLE 4.10

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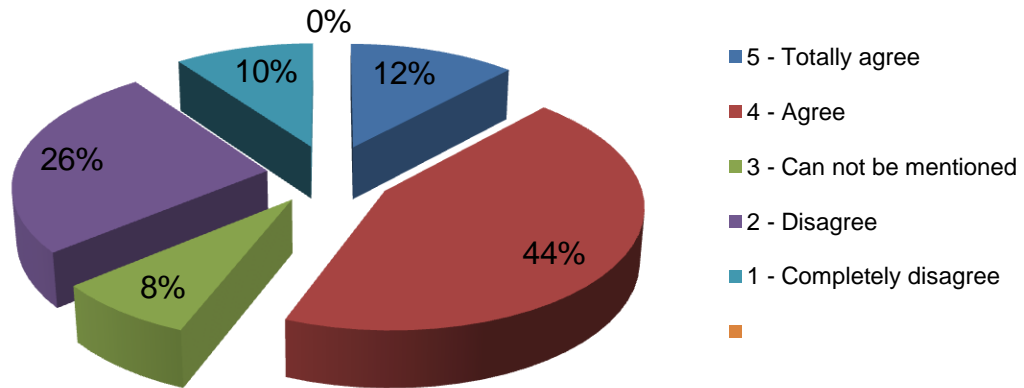


FIGURE 4.8

5.16.1 As per above chart, 56% of people mention the need of considerable changes in existing naval disaster management system and 8% of people disagreed to answer the same question.36% of people agreed with the existing system of Sri Lanka Navy.

5.17 Sri Lanka Navy responds swiftly for rescue and relief duties during flood (Q-11)

5 - Totally agree 4 - Agree 3 - cannot be mentioned
2 - Disagree 1 - Completely Disagree

Marks	Quantity	Percentage
5	7	14%
4	10	20%
3	2	4%
2	26	52%
1	5	10%
Total	50	

TABLE 4.11

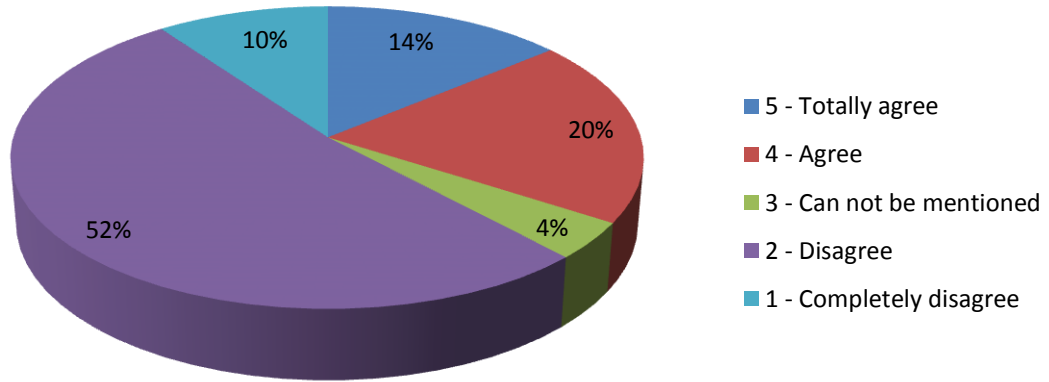


FIGURE 4.9

5.17.1 62% of people in the sample denied the above statement. 4% Of selected sample hasn't made any comments for above question statement and 34% of people agreed with that. They further emphasised the requirement of naval detachment close proximity of Polonnaruwa District. Majority have produced their answers considering the time factor when naval forces arriving to Polonnaruwa District.

5.18 Sri Lanka Navy coordinates with other relevant organizations during flood relief operation (Q-12)

- 5 - Totally agree 4 - Agree 3 - cannot be mentioned
2 - Disagree 1 - Completely Disagree

Marks	Quantity	Percentage
5	5	10%
4	18	36%
3	9	18%
2	16	32%
1	2	4%
Total	50	

TABLE 4.12

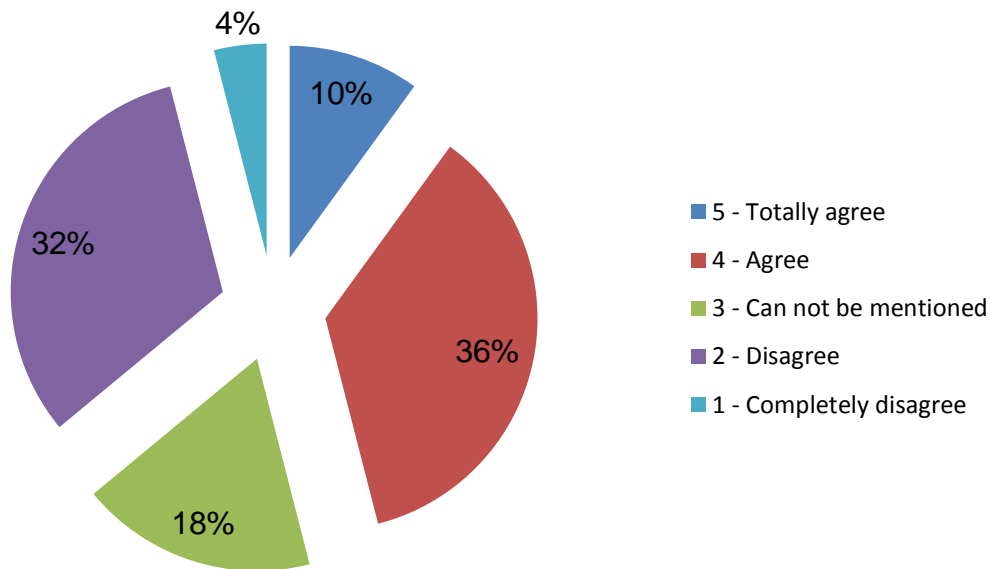


FIGURE 4.10

5.18.1 When analyzing above chart, answers were given accepting above statement with the average of 46%. And 36% of people were against with the statement. 18% of people were reluctant to comment on the above statement. Nevertheless, During the interview many expertises reveals that existing communication system should have been developed and it is needed to have a developed disaster management plan for Polonnaruwa District with the coordination of DMC and other rescue organization.

5.19 All Existing equipment are efficiently utilized by Sri Lanka Navy during flood relief duties in Polonnaruwa District (Q-13)

- 5 - Totally agree 4 - Agree 3 - cannot be mentioned
2 - Disagree 1 - Completely Disagree

Marks	Quantity	Percentage
5	3	6%
4	6	12%
3	7	14%

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2	30	60%
1	4	8%
Total	50	

TABLE 4.13

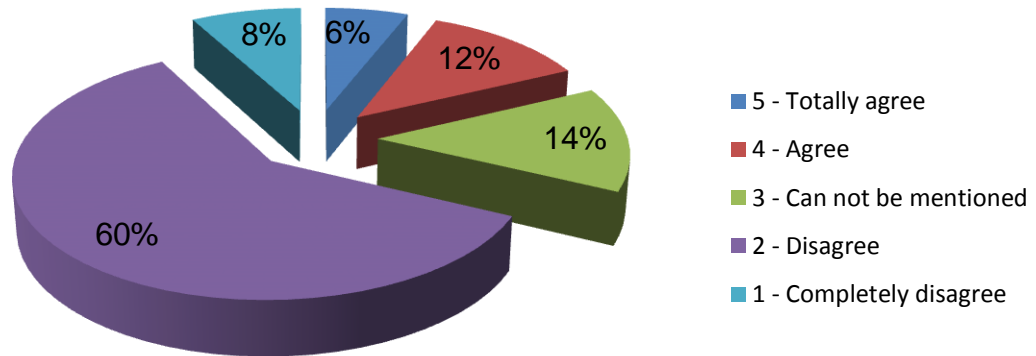


FIGURE 4.11

5.19.1 As per the 68% of answers given by the selected sample revealed that utilizing the naval equipment effectively during flood relief operation was unsatisfactory. 18% of people agreed to the above question statement and 14% of them denied giving any answer for above question. Naval rescue personal reveals that RFD's are ideal to utilize flood relief duties especially in shallow water area. If the depth is less than 6 feet, FGD's are difficult to deploy during floods. Further rescue personal reveals that requirement of own protection equipments such as rescue jacket, GPS, Hand set, Helmet, Night vision, Day vision and Compass.

5.20 Sri Lanka Navy participates for the training programs of Disaster Management which conducted by Disaster management centre of Polonnaruwa (Q-14)

5 -Totally agree 4 - Agree 3 - cannot be mentioned
2 -Disagree 1 - Completely Disagree

Marks	Quantity	Percentage
-------	----------	------------

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5	5	10%
4	17	34%
3	9	18%
2	14	28%
1	5	10%
Total	50	

TABLE 4.14

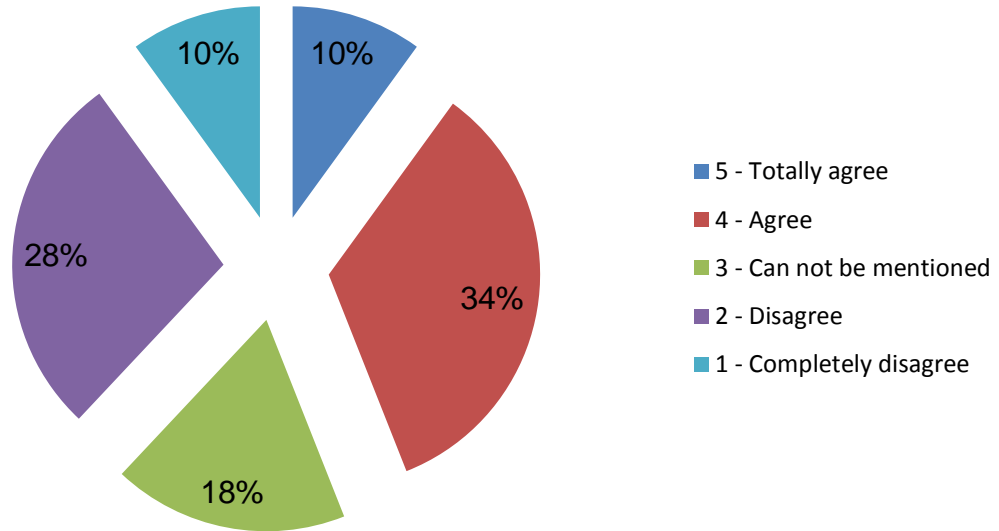


FIGURE 4.12

5.20.1 44% of selected sample indicates active participation of Sri Lanka Navy for training program which conducted by DMC.38% of people in selected sample oppose to the above statement and 18% did not give any reply for it. Nevertheless, Professionals in DMC in Polonnaruwa District and other Expertises mentioned that Sri Lanka Navy should attend more concentration regarding training programs and have been kept good coordination with them.

5.21 Sri Lanka Navy involves pre-Disaster activities in order to mitigate the flood disaster informing General public with the support of other organization (Q-15)

5 - Totally agree 4 - Agree 3 - cannot be mentioned
2 - Disagree 1 - Completely Disagree

Marks	Quantity	Percentage
-------	----------	------------

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5	4	8%
4	6	12%
3	5	10%
2	26	52%
1	9	18%
Total	50	

TABLE 4.15

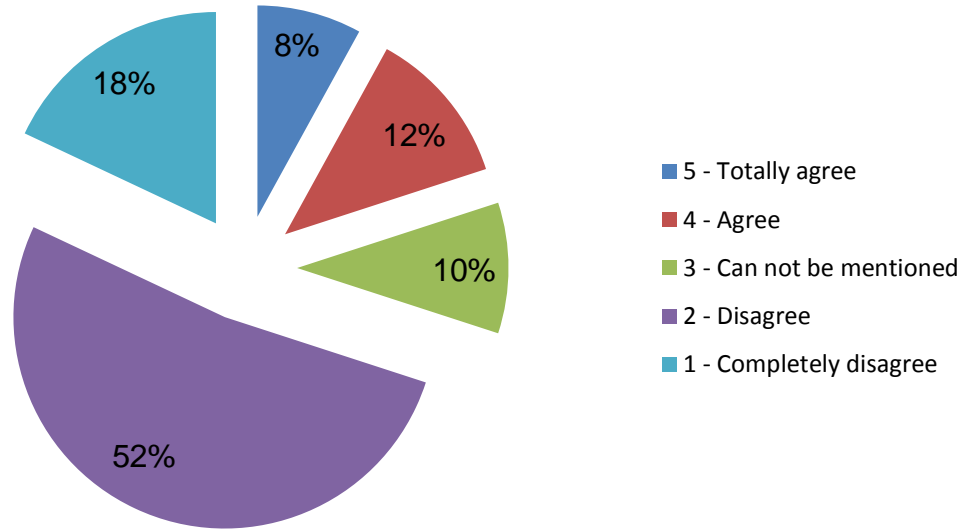


TABLE 4.13

5.21.1 70% of sample disagreed to the above statement and 20% of sample mentions the effective and adequate consultation by Sri Lanka navy for other organization regarding plan of flood relief duties. It is essential that Sri Lanka Navy involvements during pre-Disaster activities specially, General Public can train regarding rescue procedures and can be utilized according to the floods situation.

5.22 Contribution of Sri Lanka Navy towards flood relief duties is satisfactorily. (Q-16)

- | | | |
|-------------------|-------------------------|-------------------------|
| 5 - Totally agree | 4 - Agree | 3 - cannot be mentioned |
| 2 - Disagree | 1 - Completely Disagree | |

Marks	Quantity	Percentage
-------	----------	------------

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5	6	12%
4	6	12%
3	5	10%
2	20	40%
1	13	26%
Total	50	

TABLE 4.16

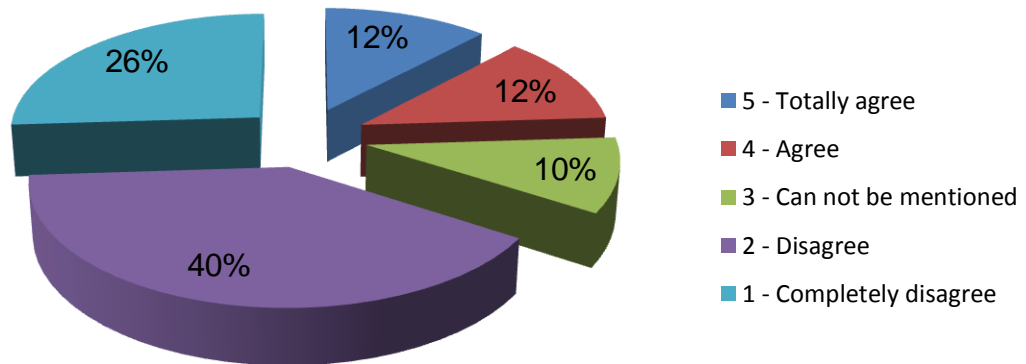


TABLE 4.14

5.22.1 66% of sample revealed that Sri Lanka Navy hasn't performed according to the above question statement .24% of sample agreed with the above statement and 10% of people did not reply. Sri Lanka Navy officials mentioned that rescue troops have been sending for flood relief duties in many areas of Eastern naval area. Further, food affected people mention that there are a lot of flood prone areas which has not been provided flood relief by Sri Lanka Navy during floods of Polonnaruwa District.

5.23 Paying attention of senior officers towards flood relief duties of Polonnaruwa District is satisfactorily (Q-17)

5 - Totally agree 4 - Agree 3 - cannot be mentioned

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2 - Disagree

1 - Completely Disagree

Marks	Quantity	Percentage
5	8	16%
4	21	42%
3	10	20%
2	6	12%
1	5	10%
Total	50	

TABLE 4.17

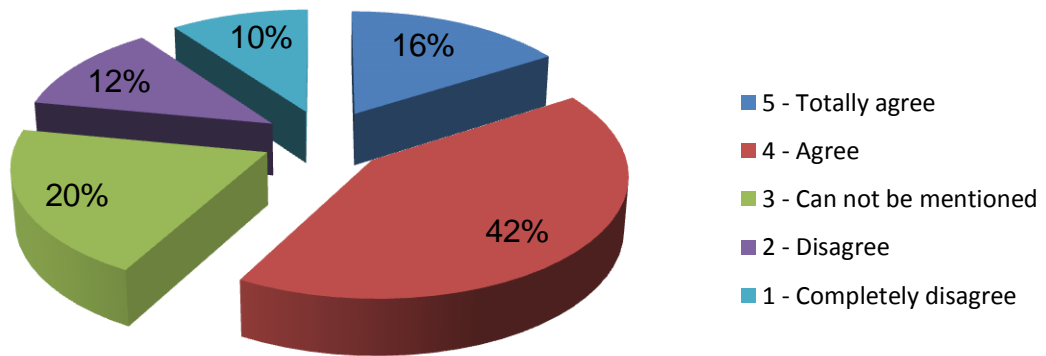


TABLE 4.16

5.23.1 As per above chart, 58% of sample mentioned the commitment of senior officers towards disaster relief management. 20% of sample hasn't answered and 22% were disagreed with above question statement. Affected community mentioned Even though officers are paying considerable attention towards floods of Polonnaruwa District, all responsible units should have kept much coordination each other.

5.24 Sri Lanka Navy has provided adequate rescue water patrol and other transportation inland water ways during floods of Polonnaruwa District (Q-18)

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5 - Totally agree 4 - Agree 3 - cannot be mentioned
2 - Disagree 1 - Completely Disagree

Marks	Quantity	Percentage
5	9	18%
4	15	30%
3	10	20%
2	12	24%
1	8	16%
Total	50	

TABLE 4.18

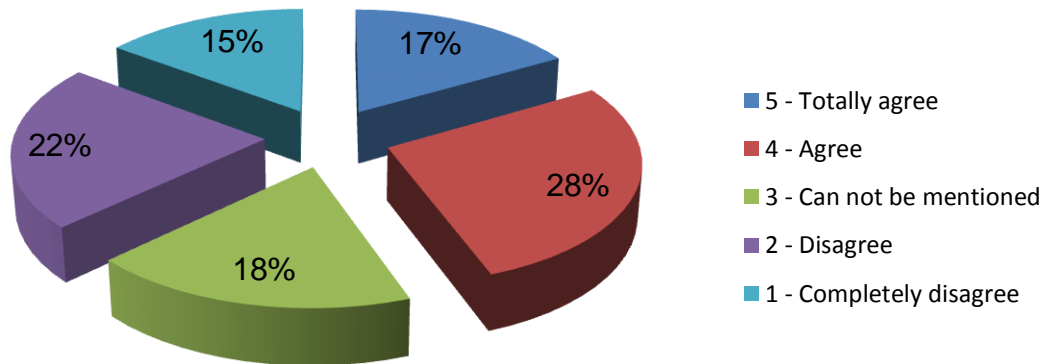


TABLE 4.17

5.24.1 48% of sample stated that Sri Lanka Navy has deployed enough transportation inland water ways of Polonnaruwa District.40% of sample totally disagree with above question statement and 20% of selected sample maintained silence with the above question.

5.25 As per above analysis of collected data, Calculation has been made with the assistance of co-relation formula.

X - Current Naval Capabilities

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- Y - Final outcome of naval Productivity (when providing flood relief to the victim)
- X̄ - Medium of Capabilities
- Ȳ - Medium of Productivity

$$\begin{aligned} \text{Correlation } r &= \frac{\sum (X - \bar{X}) (Y - \bar{Y})}{\sqrt{\sum (X - \bar{X}) \sum (Y - \bar{Y})}} \\ \\ X̄ &= \frac{\sum FX}{N} = \frac{144.125}{50} = 2.882 \\ \\ Ȳ &= \frac{\sum FY}{N} = \frac{130.5}{50} = 2.610 \\ \\ r &= \frac{-0.0043}{\sqrt{5.0705 \times 4.7093}} \\ &= \frac{-0.043}{\sqrt{23.8785}} \\ &= \frac{-0.0043}{4.8865} \\ &= \underline{\underline{-0.00087}} \end{aligned}$$

5.25.1 Above calculation has been proved that relationship between both variables (capabilities(X) and Productivity(Y) is answered as minus correlation. Instead of having minus answer, it does not witness highly to make big amendments in existing disaster management system of Sri Lanka Navy. After scrutinizing above answer given by calculation, there is a

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tendency to Sri Lanka Navy to make a plus correlation having considerable amendment in existing system.

CONCLUSION

5.26 In the present scenario, modern navies in the world are almost certainly the best organised and managed to provide assistance to a full range of public services such as public work, health and emergency medical service, communications and transport, rescue and support activities in disaster relief operation. They can react quickly and respond rapidly in a fully self contained, self sufficient and highly mobile fashion. Naval personal are well trained in individuals skills necessary to perform their professionals and functional activities, are practical in collaboration, and coordinate action under an integrated/flexible management system. Thus, there is enormous potential inherent in the naval forces to serve as an additional instrument for the effective delivery of emergency assistance.

5.27 The flood is created devastation when it overflows and inundates the urban areas in many part of Polonnaruwa District and has been occurring in several hundred of years in Sri Lanka. It has been observed the consequent damages an increasing trend till the end of century. So that it is imperative to have both structural and non structural measures to control flood. During disasters, Effective measures could be taken not only the Naval Forces but also with the participation of community and other rescue forces ensuring the sustainability of the affected people.

5.28 Main significant aspects of flood relief operation are to provide emergency relief to the affected personal in the quickest possible time. The primary concern after the occurrence of a disaster is that provides immediate relief and need to response the affected people earliest. Sri Lanka Navy should assist the civil administration to evacuate and shift victims to safer places, establishing relief camp, dispatch essential commodities and restore communication with the coordination of other organization. In the presence of enormous dedication made by other

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services towards disaster relief management, Sri Lanka Navy should have a bigger role in order to achieve efficient and effective disaster relief management system of Sri Lanka Navy.

FINDING

5.29 Professional's views and ideas were gathered during the interview and they came up with valuable ideas, experiences and details and the important points. The most important points stated by those individuals are recorded as follows.

a. Rescue personal have taken a longer period and have to go through the naval procedures to collect their dry ration due non availability of pre- prepared dry ration. This is caused to get delay sending rescue personal to Polonnaruwa district at correct time.

b. It is initially needed infrastructures facilities for setting up of command and control organization involves provision of all kind of disaster relief equipments and manpower.

1. Lack of life serving equipments
2. Insufficient uniforms and other own protection accessories.
3. Medical facilities

c. Existing transport facilities are not effectively provided to transfer rescue personal and equipments to Polonnaruwa district during floods and there aren't any protection for rescue personal and equipments of trucks without having a canopies. Further there aren't any secure arrangements for the protection of OBM and other rescue equipments. Hence there is a tendency to damage these equipment due failure of proper management.

d. There hasn't been an accommodation to stay rescue personal at Polonnaruwa district. Then troops have been taking a longer period to reach Polonnaruwa District from

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ND Digampathana. Further it is reported that their meals also get delayed due to distance graph between Digampathana and Polonnaruwa.

e. It has been reported that job satisfaction of rescue personal are being degraded with the insufficiency of basic requirements of naval personals.

f. 4RS personal reported that their rescue jackets are uncomfortable and heavier when carrying out duties wearing with this.

RECOMMENDATION

ESSENTIAL ACTIVITIES OF DMC OF POLONNARUWA

5.30 It is observed that activities of DMC's are still limited even though it was established before 8 years. The DMC's function should have been gradually developed. Sri Lanka Navy should coordinate with DMC and should establish core activity areas and focus their activity with them. Vulnerable areas in the district have to be identified and special consciousness and efforts should have been made those areas disaster proof which should be over a period of time able to come out of the vulnerability. As the guiding and coordinating body, National disaster Management Committee and DMC should establish a proper flood management platform for Polonnaruwa district. Especially Sri Lanka Navy as major rescue force should influence following aspects.

- a. Prepare a disaster management plan at district/local/institution level and it should have been practiced. Further it has to be kept in the public domain and keep periodically revised and updated.
- b. Coordination on the disaster management activities such as preparation of hazard maps, early warning system, disaster management exercise and implementation of structural measures.
- c. Community based disaster management activities.
- d. Utilization of human resources development.

5.31 All Naval rescues personal are to be provided emergency ration well in advance and without any delay prior they leave to rescue operation.

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5.32 Concentrations should be made towards 4RS rescue personals considering their fundamental requirements such as meals, uniforms, medical facilities and other essential requirements prior they departure for rescue operation during floods of Polonnaruwa.

5.33 All vehicles which are attached for flood duties could be appropriate to the requirements of rescue operation and are to provide entire protection for rescue personal and equipments. Further it is ideal to have a truck with canopies and there should be secure arrangements when all items are loading and transferring. It will reduce the damages of all rescue equipment. Further recommend to utilize vehicles within the flood effected community with the coordination of DMC.

5.34 Naval relationship should be enhanced with other rescue units such as DMC(Polonnaruwa district),irrigation department, district secretary, 22-3 brigade, police station and district hospitals.

5.35 Presently large numbers of FGD are deployed for floods of Polonnaruwa District. Observed, inflatable boats are ideal to be deployed during floods of polonnaruwa district.

5.36 Manampitiya area has been recommended to establish naval relief camp with the purpose of saving the time factor to reach the Polonnaruwa District and enhancing the effectiveness of naval forces during flood relief duties. Village of Gallalla is under Manampitiya divisional secretary and observed there are a lot of people have been affected by floods since long time. As a transport facility, one vehicle should have been attached continuously throughout the disaster period. When Navy engages with the flood disaster, people in the vulnerable area have to be equipped and trained especially to counter and cope with the disasters. Especially the youngsters and the children of the school and colleges in the area need training and survival skills to be imparted to them. Then Sri Lanka Navy will be privileged to have a effective and efficient disaster management for Polonnaruwa District.

5.37 To mitigate the effects of floods in Polonnaruwa District is compulsory. Hence it is required structural and non structural measures as proposed master plan to undertake and reduce vulnerability of floods. Following non-structural measures highly recommended.

- a. Strengthen of laws and regulations, land fillings, land selling and land use planning etc.
- b. Hazard mapping and flood zoning should be implemented.
- c. Continue awareness programs for community by related government and non-government agencies.

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d. All canals to be cleaned and implements canal cleaning project.

5.38 Sri Lanka Navy should obtain clear definition and designations of the flood prone areas of Polonnaruwa District. Public water body and flood prone areas should be in written format. This has to be done by DMC. Then Sri Lanka Navy will be able to provide effective and efficient flood relief operation as per the concerning vulnerability of the floods in Polonnaruwa District.

Requirement of Capacity enhancement for Sri Lanka Navy and other rescue organization

5.39 Providing rescue operation during floods by Sri Lanka Navy is compulsory and it is a prime role. Observed capacities for managing disasters are very weak and their interest on this is very low. Then Sri Lanka Navy and other rescue organization have to be functional for effective disaster management activities. Hence active implementation of capacity development for all rescue units is strongly recommended.

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7. There are weaknesses of Sri Lanka Navy during floods relief duties?
5 - Totally agree 4 - Agree 3 - cannot be mentioned
2 - Disagree 1 - Completely Disagree
8. Man-power of Sri Lanka Navy during floods relief duties is adequate?
5 - Totally agree 4 - Agree 3 - cannot be mentioned
2 - Disagree 1 - Completely Disagree
9. Equipment of Sri Lanka Navy during floods relief duties is adequate?
5 - Totally agree 4 - Agree 3 - cannot be mentioned
2 - Disagree 1 - Completely Disagree
10. Present deployment pattern and locations are satisfactory?
5 - Totally agree 4 - Agree 3 - cannot be mentioned
2 - Disagree 1 - Completely Disagree
11. Changes are required in Sri Lanka Navy with regard to flood relief duties?
5 - Totally agree 4 - Agree 3 - cannot be mentioned
2 - Disagree 1 - Completely Disagree
12. Sri Lanka Navy responds swiftly for rescue and relief duties during flood?
5 - Totally agree 4 - Agree 3 - cannot be mentioned
2 - Disagree 1 - Completely Disagree
13. Sri Lanka Navy coordinates with other relevant organizations during flood relief operation?
5 - Totally agree 4 - Agree 3 - cannot be mentioned
2 - Disagree 1 - Completely Disagree
14. All Existing equipment is efficiently utilized by Sri Lanka Navy during flood relief duties in Polonnaruwa District?
5 - Totally agree 4 - Agree 3 - cannot be mentioned
2 - Disagree 1 - Completely Disagree
15. Sri Lanka Navy participates for the training programs of Disaster Management which conducted by Disaster management centre of Polonnaruwa?
5 - Totally agree 4 - Agree 3 - cannot be mentioned
2 - Disagree 1 - Completely Disagree

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16. Sri Lanka Navy involves pre-Disaster activities in order to mitigate the flood disaster informing General public with the support of other organization?

- | | | | | | |
|-----|---------------|-----|---------------------|-----|---------------------|
| 5 - | Totally agree | 4 - | Agree | 3 - | cannot be mentioned |
| 2 - | Disagree | 1 - | Completely Disagree | | |

17. Contribution of Sri Lanka Navy towards flood relief duties is satisfactorily?

- | | | | | | |
|-----|---------------|-----|---------------------|-----|---------------------|
| 5 - | Totally agree | 4 - | Agree | 3 - | cannot be mentioned |
| 2 - | Disagree | 1 - | Completely Disagree | | |

18. Paying attention of senior officers towards flood relief duties of Polonnaruwa District is satisfactorily?

- | | | | | | |
|-----|---------------|-----|---------------------|-----|---------------------|
| 5 - | Totally agree | 4 - | Agree | 3 - | cannot be mentioned |
| 2 - | Disagree | 1 - | Completely Disagree | | |

19. Sri Lanka Navy has provided adequate rescue water patrol and other transportation inland water ways during floods of Polonnaruwa District?

- | | | | | | |
|-----|---------------|-----|---------------------|-----|---------------------|
| 5 - | Totally agree | 4 - | Agree | 3 - | cannot be mentioned |
| 2 - | Disagree | 1 - | Completely Disagree | | |

20. Sri Lanka Navy is provided more contribution and attention towards floods of Polonnaruwa among following rescue forces?

- | | | | | | | | |
|-----|---------------|-----|---------------------|-----|---------------------|----|--------|
| a. | SLN | b. | Army | c. | DMC | d. | Police |
| 5 - | Totally agree | 4 - | Agree | 3 - | cannot be mentioned | | |
| 2 - | Disagree | 1 - | Completely Disagree | | | | |

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ANNEX B

AVERAGE BETWEEN NAVAL CAPABILITIES AND PRODUCTIVITY

Sam-ple	Current Naval Capabilities									Productivity								
	Question no's									Question no's								
	5	6	7	8	9	10	11	12	AVG	13	14	15	16	17	18	19	20	AVG
1	4	3	3	1	2	4	2	4	2.875	2	3	5	1	5	4	1	4	3.125
2	4	4	3	2	2	4	3	4	3.250	2	2	4	2	4	2	3	4	2.750
3	2	2	4	2	3	4	4	2	2.875	2	1	4	2	4	1	2	3	2.375
4	2	3	4	1	1	3	2	3	2.375	2	2	2	2	4	1	2	4	2.375
5	4	4	4	2	1	1	1	2	2.375	3	2	3	3	3	1	2	3	2.500
6	2	4	4	2	2	2	2	4	2.750	2	2	4	2	4	2	2	2	2.500
7	3	4	4	1	1	2	3	2	2.500	2	3	4	2	4	2	3	4	3.000
8	2	2	4	3	1	3	3	2	2.500	2	4	3	2	2	2	4	1	3.500
9	4	4	2	1	2	4	1	3	2.625	2	2	3	2	2	3	1	3	2.250
10	3	3	4	2	2	4	2	3	2.875	2	2	2	1	2	3	2	4	2.250
11	4	4	4	2	2	2	2	2	2.750	1	2	1	2	2	4	2	2	2.000
12	4	4	2	2	2	4	2	2	2.750	1	5	1	2	3	4	3	2	2.625
13	5	5	4	1	3	1	2	2	2.875	2	2	2	4	4	3	1	2	2.500
14	5	2	4	1	4	4	3	2	3.125	3	3	2	1	2	3	2	4	2.500
15	4	4	4	1	2	3	4	2	2.875	1	4	1	2	2	2	2	4	2.250
16	4	4	2	2	3	4	1	4	3.000	2	4	4	1	3	2	4	2	2.750
17	4	4	2	3	5	2	2	2	3.000	2	2	3	2	4	2	4	2	2.625
18	4	4	4	2	2	4	2	2	3.000	3	1	2	1	4	1	4	3	2.375
19	4	4	4	2	4	4	4	2	3.500	4	2	4	2	4	2	2	4	3.000
20	5	3	5	2	4	2	2	5	3.500	1	2	1	3	5	2	2	2	2.250
21	5	4	3	3	2	2	2	4	3.125	2	4	2	1	2	1	3	3	2.250
22	4	2	4	3	2	4	4	4	3.375	2	2	3	2	3	2	4	3	2.625
23	4	4	2	2	1	4	3	3	2.875	2	2	4	4	1	2	2	4	2.625
24	4	4	4	2	2	1	2	2	2.625	4	3	4	2	1	3	2	4	2.875
25	5	3	2	2	2	3	2	2	2.625	4	1	2	5	4	2	2	5	3.125

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26	3	2	1	2	3	4	2	2	2.375	1	2	4	2	4	4	1	5	2.875
27	2	4	4	1	2	4	1	5	2.875	2	2	3	3	4	2	2	4	2.750
28	2	4	5	2	2	4	2	2	2.875	2	1	4	4	2	2	2	4	2.625
29	4	4	5	2	1	2	2	2	2.750	2	2	2	2	3	4	3	5	2.875
30	4	2	4	1	2	2	2	1	2.250	2	2	2	2	4	2	3	5	2.750
31	4	2	4	2	1	4	2	3	2.750	3	2	2	1	5	2	2	4	2.625
32	4	4	3	2	2	2	3	4	3.000	2	2	4	1	2	1	2	4	2.250
33	3	4	3	4	2	2	4	3	3.125	4	2	5	2	2	2	3	4	3.000
34	2	4	2	2	2	4	3	4	2.875	2	3	3	1	4	2	3	2	2.500
35	4	4	4	2	2	4	4	4	3.500	2	2	4	1	4	3	2	2	2.500
36	4	2	4	1	2	3	4	4	3.000	2	2	4	1	4	4	2	3	2.750
37	5	4	2	2	2	4	2	3	3.000	2	2	2	3	3	1	2	3	2.250
38	2	4	2	4	1	4	2	3	2.750	2	4	2	4	2	2	1	2	2.375
39	3	2	4	1	2	2	2	4	2.500	1	2	1	2	4	2	2	4	2.250
40	4	2	4	1	2	2	1	4	2.500	2	2	2	2	2	1	4	4	2.375
41	4	4	3	2	1	4	2	2	2.750	1	3	3	3	2	2	1	5	2.500
42	3	4	2	2	2	4	2	2	2.625	1	2	4	1	4	2	2	2	2.250
43	5	2	4	3	2	2	2	5	3.125	2	2	2	1	3	1	3	4	2.250
44	5	4	1	3	1	2	2	4	2.750	2	1	4	2	2	2	4	2	2.375
45	4	3	4	4	2	1	3	4	3.125	4	2	4	2	2	2	2	3	2.750
46	4	5	4	4	2	2	4	4	3.625	2	2	4	2	2	3	4	4	2.875
47	4	2	4	4	4	2	1	4	3.125	2	2	3	2	5	2	4	4	3.000
48	4	4	4	2	1	1	2	3	2.625	1	1	2	5	5	4	4	5	3.375
49	5	4	4	2	2	3	5	4	3.625	2	3	5	4	1	2	3	4	3.000
50	2	4	4	1	2	2	2	4	2.625	2	4	2	5	2	1	4	3	2.875

Source : Research sample 2012

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ANNEX C

ANALYSIS OF NAVAL CAPABILITIES AND PRODUCTIVITY

X	\bar{X}	(X- \bar{X})	Y	\bar{Y}	(Y- \bar{Y})	(X- \bar{X})(Y- \bar{Y})	(X- \bar{X}) ²	(Y- \bar{Y}) ²
2.875	2.880	- 0.005	3.125	2.610	0.515	-0.0025	0.00002	0.2652
3.250	2.880	0.370	2.750	2.610	0.140	0.0518	0.1369	0.0196
2.875	2.880	- 0.005	2.375	2.610	- 0.235	0.0011	0.0002	0.0552
2.375	2.880	- 0.505	2.375	2.610	- 0.235	0.1180	0.2550	0.0552
2.375	2.880	- 0.130	2.500	2.610	- 0.110	0.0550	0.2550	0.0121
2.750	2.880	- 0.130	2.500	2.610	- 0.110	0.0140	0.0169	0.0121
2.500	2.880	- 0.380	3.000	2.610	- 0.390	- 0.1480	0.1444	0.1521
2.500	2.880	- 0.380	3.000	2.610	0.390	- 0.1480	0.1444	0.1521
2.625	2.880	- 0.255	2.250	2.610	- 0.360	0.0910	0.0650	0.1296
2.875	2.880	- 0.005	2.250	2.610	- 0.360	0.0010	0.00002	0.1296
2.750	2.880	-0.130	2.000	2.610	- 0.610	0.0790	0.0169	0.3721
2.750	2.880	-0.130	2.625	2.610	0.015	0.0019	0.0169	0.0002
2.875	2.880	-0.005	2.500	2.610	- 0.110	0.0005	0.00002	0.0121
3.125	2.880	0.245	2.500	2.610	- 0.110	-0.0260	0.0600	0.0121
2.875	2.880	-0.005	2.250	2.610	-0.360	0.0010	0.00002	0.1296
3.000	2.880	0.120	2.750	2.610	0.140	0.0160	0.0144	0.0196
3.000	2.880	0.120	2.625	2.610	0.015	0.0010	0.0144	0.0002
3.000	2.880	0.120	2.375	2.610	- 0.235	-0.0280	0.0144	0.0552
3.500	2.880	0.620	3.000	2.610	0.390	0.2410	0.3844	0.1521
3.500	2.880	0.620	2.250	2.610	-0.360	-0.2230	0.3844	0.1296
3.125	2.880	0.245	2.250	2.610	-0.360	-0.0880	0.0600	0.1296
3.375	2.880	0.495	2.625	2.610	0.015	0.0070	0.2450	0.0002
2.875	2.880	-0.005	2.625	2.610	0.015	- 0.00007	0.00002	0.0002
2.625	2.880	-0.255	2.875	2.610	0.265	- 0.0670	0.0650	0.0702
2.625	2.880	-0.255	3.125	2.610	0.515	- 0.1310	0.0650	0.2652
2.375	2.880	-0.505	2.875	2.610	0.265	- 0.1330	0.0250	0.0702
2.875	2.880	-0.005	2.750	2.610	0.140	- 0.0007	0.0002	0.0196

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2.875	2.880	-0.005	2.625	2.610	0.015	- 0.0007	0.0002	0.0002
2.750	2.880	-0.130	2.875	2.610	0.265	- 0.0340	0.0169	0.0702
2.250	2.880	-0.630	2.750	2.610	0.400	- 0.2520	0.3969	0.1600
2.750	2.880	-0.130	2.625	2.610	0.015	- 0.0019	0.0169	0.0002
3.000	2.880	0.120	2.250	2.610	-0.360	- 0.0430	0.0144	0.1296
3.125	2.880	0.245	3.000	2.610	0.390	0.0950	0.0060	0.1521
2.875	2.880	-0.005	2.500	2.610	-0.110	0.00050	0.00002	0.0121
3.500	2.880	0.620	2.500	2.610	-0.110	- 0.0682	0.3844	0.0121
3.000	2.880	0.120	2.750	2.610	0.140	0.0160	0.0144	0.0196
3.000	2.880	0.120	2.250	2.610	-0.360	- 0.0430	0.0144	0.1296
2.750	2.880	-0.130	2.375	2.610	-0.235	0.0300	0.0160	0.0550
2.500	2.880	-0.380	2.250	2.610	-0.360	0.1360	0.1444	0.1296
2.500	2.880	-0.380	2.375	2.610	-0.235	0.0890	0.1444	0.0550
2.750	2.880	-0.130	2.500	2.610	-0.110	0.0140	0.0169	0.0121
2.625	2.880	-0.255	2.250	2.610	-0.360	0.0918	0.0650	0.1296
3.125	2.880	0.245	2.250	2.610	-0.360	0.0880	0.06600	0.1296
2.750	2.880	-0.130	2.375	2.610	-0.235	0.0300	0.0160	0.0550
3.125	2.880	0.245	2.750	2.610	0.140	0.0340	0.0600	0.0196
3.625	2.880	0.745	2.875	2.610	0.265	0.1970	0.5550	0.0700
3.125	2.880	0.245	3.000	2.610	0.390	0.0950	0.0600	0.1521
2.625	2.880	-0.255	3.375	2.610	0.765	-0.1950	0.0650	0.5852
3.625	2.880	0.745	3.000	2.610	0.390	0.2900	0.5550	0.1521
2.6625	2.880	-0.255	2.875	2.610	0.265	-0.0670	0.0650	0.0700
						- 0.0043	5.07058	4.7093

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Information regarding floods in Polonnaruwa District in year 2012 according to the Details of DMC

Date	Divisional secretaries	Affected families		Death	casualties		Damage houses		Displaced camp		
		families	people				Fully	Half	Camp	Number of families	people
2012.12.29	Alahera	191	683	-	-		35	153	-	-	-
2012.12.29	Thamankaduwa	1747	6159	-	-		26	53	1	6	25
2012.12.29	Lankapura	1942	8183	1	-	-	-	94	1	155	516
2012.12.29	Madirigiriya	92	370	-	-	-	02	12	1	92	370
2012.12.29	Walikanda	54	190	-	-	-	02	14	-	-	-
2012.12.29	Dibulagala	340	1206	-	-	-	28	217	-	-	-
TOTAL		4366	16791	1	-	-	93	543	03	253	911

Table 5.1

Source : Report of District Disaster Management Centre during inundation of Polonnaruwa District in year 2012

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