

A Study on the significance of enhancing disaster resilience
among communities of disaster prone areas of Cuddalore district,
Tamil Nadu, India

Asharose

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List of Abbreviations and Acronyms

ADRC – Asian Disaster Reduction Center

CBO – Community Based Organization

CCA – Climate Change Adaptation

CDRI – Climate-based Disaster Resilience Index

DM Act – Disaster Management Act

DRH – Disaster Reduction Hyperbase

DRH-Asia – Disaster Reduction Hyperbase-Asia Application

DRR – Disaster Risk Reduction

GDP – Gross Domestic Product

GIS – Geographic Information System

IDNDR – International Decade of Natural Disaster Reduction

IPCC – Intergovernmental Panel on Climate Change

NGO – Non-Governmental Organization

UN – United Nations

UNISDR – United Nations International Strategy for Disaster Reduction

WCDR – World Conference on Disaster Reduction

Chapter 1 Introduction

1.1 General Introduction

Since long past, the world has been witnessing disasters both natural and manmade. The occurrence of such disasters and the distribution of their impacts vary depending on geography, topography, level of preparedness, resource abundance and the awareness level of people to point out a few. However, it is noteworthy that the number and frequency of such disasters, as well as subsequent losses, have increased over time (Orencio and Fuji, 2013). Furthermore, it is also relevant that, compared with the rich, disasters impose a greater impact on the poor with less access to resources comparing to that of rich. Based on disaster distribution, developing countries have suffered the greatest impacts and greatest losses (UNISDR, 2004); accounting for 97% of the affected communities worldwide are in developing countries (SIWI, 2005). Compared with developed countries, fatality rates from disasters in developing countries are higher and impacts consume a greater proportion of gross domestic product (GDP) (Handmer *et al.*, 2012).

Disaster records from the past can help in understanding the nature of disasters and their nature of impacts. Reviewing past disasters yields two important facts: the number of victims has risen over time and that people who are affected, killed, or injured in disasters are largely from low-income groups (Fig. 1.1 and Fig. 1.2). A more concerted understanding of these issues is necessary in order to plan and act accordingly thereby for lowering/ reducing the disaster impacts on a whole.

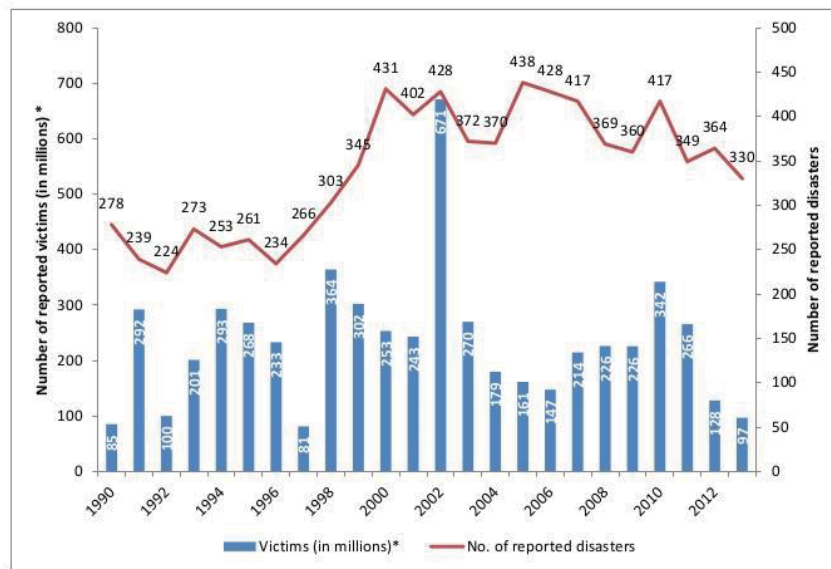


Fig. 1.1 Variation in the number of victims vs. number of disasters from 1990–2013 (Source: Annual Disaster Statistical Review, 2014)

Fig. 1.1 shows an increasing trend, especially in the number of victims. It is noteworthy that only three countries accounted for 72.4 percent of all the victims: China (28.5%), the Philippines (26.6%), and India (17.3%). Most disaster victims in 2013 were those affected by Cyclone Haiyan, which affected 16.1 million people; while Cyclone Phailin, which hit India in October, affected 13.2 million and Cyclone Utor/Labuyo in China, in August affected 8 million people (Annual Disaster Statistical Review, 2014).

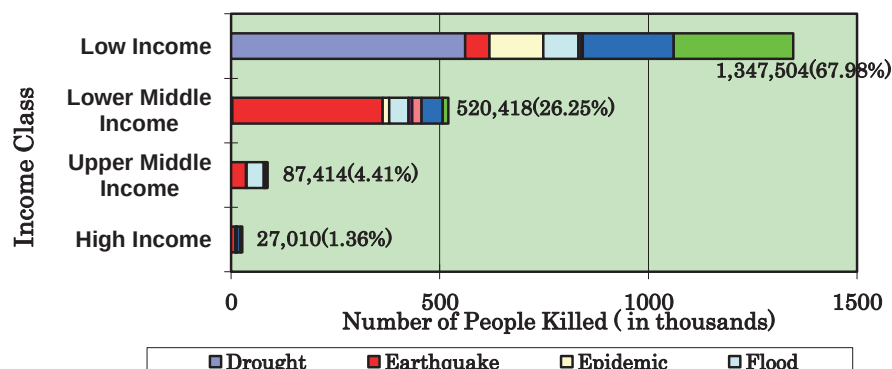


Fig. 1.2 Number of people killed (income class/disaster type) from 1975–2000 (world summary) (Source: ADRC 20th Century Asian Natural Disasters Data Book, 2002)

Fig. 1.2 shows that the major proportion of people killed were of low income class; it can also be seen that higher income classes exhibit a decreased number of people killed. According to various studies, the poor are more likely to die and suffer injury; they sustain proportionately higher material losses, endure more psychological trauma, and face more obstacles during response, recovery, and reconstruction. It cannot be asserted that richer nations do not experience fewer natural disaster events than poorer nations do; however, richer nations do suffer fewer deaths from disasters. Between 1980 and 2002, India experienced 14 earthquakes that killed a total of 32,117 people while the United States experienced 18 earthquakes that killed only 143 people (Kahn, 2003). The Intergovernmental Panel on Climate Change reports that 65% of world deaths from natural disasters between 1985 and 1999 took place in nations where incomes were below \$760 per capita (IPCC 2001).

1.2 Background of the Study

India has traditionally been vulnerable to natural disasters on account of its unique geoclimatic conditions. Floods, droughts, cyclones, earthquakes, and landslides have been recurrent phenomena. About 60% of the landmass is prone to earthquakes of various intensities; over 40 million hectares is prone to floods; about 8% of the total area is prone to cyclones; and 68% of the area is susceptible to drought. In the decade 1990–2000, an average of about 4,344 people lost their lives and about 30 million people were affected by disasters every year (Sharma and Khanna, 2013).

Moreover, as mentioned earlier, by being the group who suffer more fatalities in disasters and, compared with the rich, who have less access to resources, poor people are not only likely to suffer more greatly but will take longer time to recover back into their normal in the post-disaster phase (Asharose and Saizen, 2014). India, being a developing country with much poor people, this phenomenon was once again proved true in the aftermath of the 2004 Indian Ocean Tsunami. The tsunami, which occurred on December 26, 2004, significantly affected the coastal regions of southern peninsular India. In India, the death toll was 10,273 and the number of missing persons were 5,832. India was one severely battered country among several, including Indonesia and Sri Lanka. In India, the states severely affected by the tsunami were Tamil Nadu, Kerala, and Andhra Pradesh. The state of Tamil Nadu was the worst affected state on the mainland with a death toll of

7,793. The most severely affected districts in Tamil Nadu were Nagapattinam, Kanyakumari, Cuddalore, Chennai, and Kancheepuram. Net economic losses in India were estimated to be about Rs. 10,000 crore (approximately US\$2.2 billion) (Murty *et al.*, 2006).

Prior to December 26, 2004, there had been no recorded tsunamis on the southwest coast of India. The west coast of India was hit by a tsunami after an earthquake with a magnitude of 8.1 and an epicenter 100 km from Karachi, Pakistan on November 27, 1945, but the effects were felt only up to Karwar, 250 km north of the Kerala border. The southeast coast had experienced earlier tsunamis, the earliest of which occurred on December 31, 1881: a tsunami 1-m high was recorded in Chennai. It was caused by an earthquake with a magnitude of 7.9 below Car Nicobar Island. The August 1883 eruption of the Krakatoa volcano in Indonesia caused Chennai to be hit by 2-m-high tsunami waves. On June 26, 1941, an earthquake with a magnitude of 8.1 occurred in the Andaman archipelago, which triggered a tsunami of about 1 m in Chennai. While some scientists have estimated that over 3,000 people along the east coast of India died in the 1941 tsunami, there are no reliable data on the number of deaths, if any in fact occurred, due to that tsunami (Murty and Rafiq, 1991, Bilham *et al.*, 2005).

As tsunamis had not been expected to occur frequently in the area, there was accordingly little awareness of the nature of tsunamis when the 2004 Indian Ocean Tsunami hit India. The number of lives lost was influenced by the proximity of residential areas to the coastline, exposure to previous disasters, and the local disaster management capability. Every disaster provides an opportunity to strengthen the capacity to respond appropriately the next time. We have to ensure that we are capable of making use of that opportunity in its true sense. In order to do this, it is essential to determine prevailing issues that are hurdles to effective response, pitfalls in the disaster management approaches undertaken, and engage in capacity building.

1.3 Research Objectives

The aim of this research was to understand the factors that serve as hurdles in responding appropriately towards disasters and to search for and propose solutions to overcome those challenges. To achieve this, the research framed the following objectives:

- ❖ To explore the existing issues and challenges in the research location with reference to disaster resilience

- ❖ To develop a practical approach for inculcating awareness among the community about disasters and management strategies
- ❖ To develop a management framework to facilitate better implementation of disaster management at the district level

1.4 Research Location

Cuddalore, with 612 victims dead, was one of the worst affected districts in Tamil Nadu in 2004 Indian Ocean Tsunami. Considering the disaster significance because of its multi-hazard prone nature and low economic background (one of the country's 250 most backward districts) of Cuddalore district with annual cyclonic depressions four coastal villages in Cuddalore were selected for conducting research. Along with the coastal villages, two inland villages were also selected for conducting comparative studies.

Cuddalore District (Fig. 1.3) is one of the 32 districts of the state of Tamil Nadu; it lies on the southeastern coast of the Indian mainland. Cuddalore is a district prone to multiple hazards, including annual cyclonic depressions and floods, and it falls in Zone 3 with respect to earthquakes. Cuddalore District falls within the geographical constraints of 11°45' N and 79°45' E. The district has a coastline of 57.5 km and has 363 coastal villages.

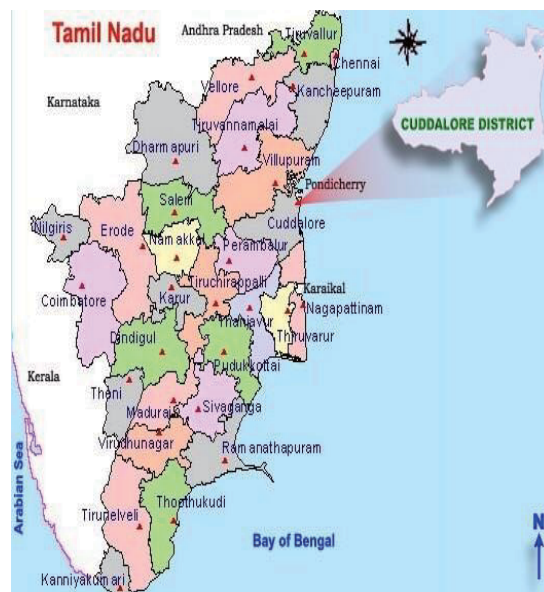


Fig. 1.3 Map of Tamil Nadu showing the location of Cuddalore District

(Source: www.google.com)

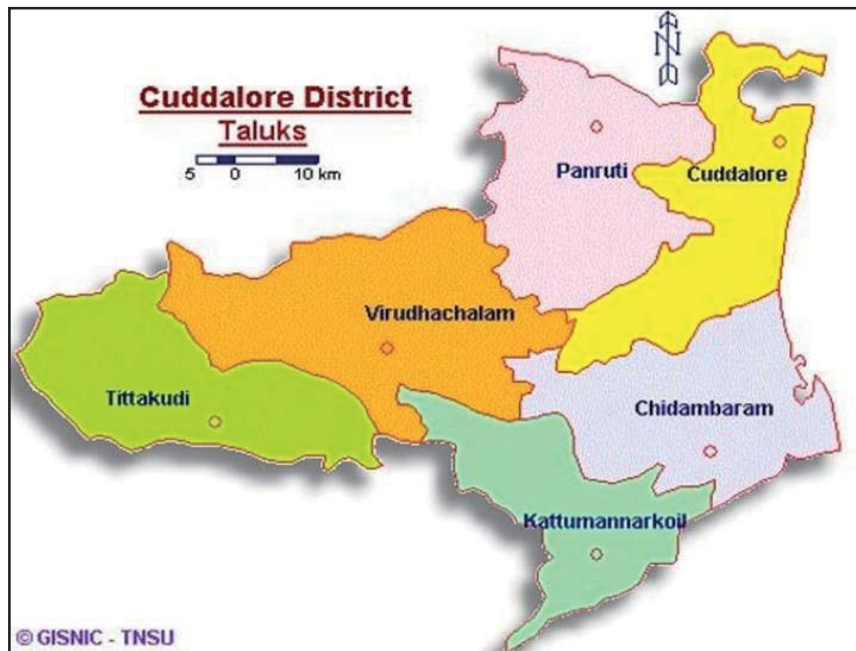


Fig. 1.4 Taluks of Cuddalore District (Source: www.cuddalore.tn.nic.in)

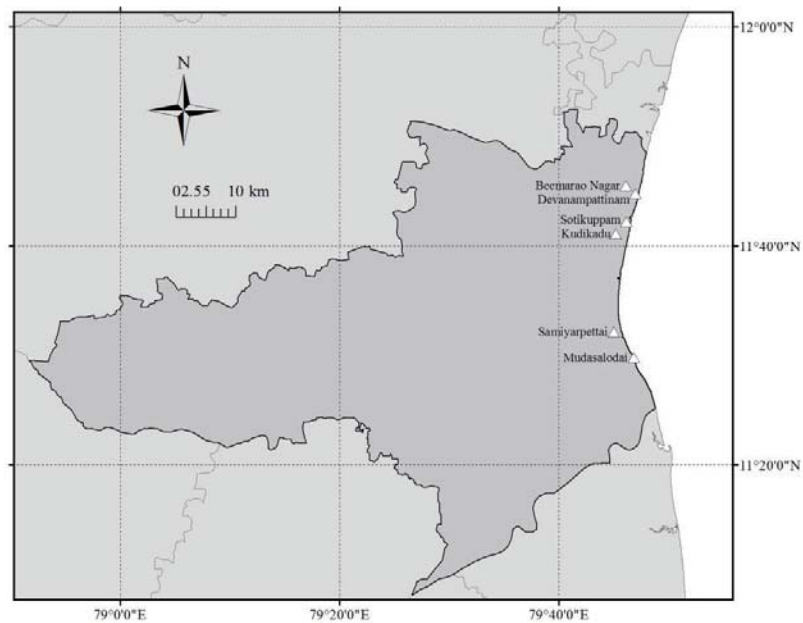


Fig. 1.5 Cuddalore District Map showing the Research Locations (selected villages)

The district is divided further into six administrative divisions known as “taluks” (Fig. 1.4). Two of the coastal villages selected, Devanampattinam and Sothikuppam, are in Cuddalore Taluk; the other two coastal villages selected, Samiyarpettai and Mudasalodai, are in Chidambaram Taluk. The two inland villages selected, Kudikadu and Beemaroo Nagar, are also in Cuddalore Taluk (Fig. 1.5).

1.5 Research Methodology

In this research, various approaches were undertaken to collect data and information in fulfilling the objectives. As a primary step, existing studies related to the research context were reviewed. The major methods used for primary data collection were questionnaire survey and focus group discussions. The type of analysis performed can be broadly divided into two types: macro-level analysis and micro-level analysis. Macro-level analysis included the analysis of disaster risk reduction issues and the determination of disaster resilience based on the climate-based disaster resilience index (CDRI) model; micro-level analysis included analysis performed at the village, community, and household levels (Table 1.1).

Table 1.1 Type and method of analysis

Type of Analysis	Analysis Method
Disaster Risk Reduction Issue Analysis [Macro-level Analysis]	Questionnaire survey on disaster risk reduction issues (35 samples including government officials, NGO personnel, academics, and media personnel)
Climate-based Disaster Resilience Index Analysis (CDRI) [Macro-level Analysis]	Questionnaire survey on the disaster resilience index of taluks in Cuddalore District to obtain an overview of the status of the district's resilience
Village-level Analysis [Micro-level Analysis]	Focus group discussions in four villages in two taluks in Cuddalore District
Community-level Analysis [Micro-level Analysis]	Awareness workshop, pre- and post-evaluation tests (30 samples)
Household-level Analysis [Micro-level Analysis]	Questionnaire survey of 360 households in the six villages selected

Government officials, NGO personnel, academics, and media personnel were selected as the key informants for the survey conducted for understanding the disaster risk reduction issues faced by the Cuddalore district. Using the CDRI model developed by Shaw et al. (2011), a survey was conducted in all the six taluks (Panruti, Cuddalore, Virudhachalam, Chidambaram, Tittakudi, and Kattumanarkoil) of Cuddalore District. This was done mainly to understand the overall resilience status of the district and in particular, to understand the resilience status of Cuddalore and Chidambaram Taluks, where the villages selected for research were located. A household-level survey was conducted in 360 households in the six villages selected. Focus group discussions were also done in all six villages to obtain village-level assessment regarding disaster perceptions and challenges. To determine the level of awareness and seek approaches for enhancing it, an awareness workshop was conducted at the community level by using the educational tool developed.

1.6 Structure of the Dissertation

This dissertation consists of seven chapters. A schematic representation of the chapters and how they are divided is given below (see Fig. 1.6).

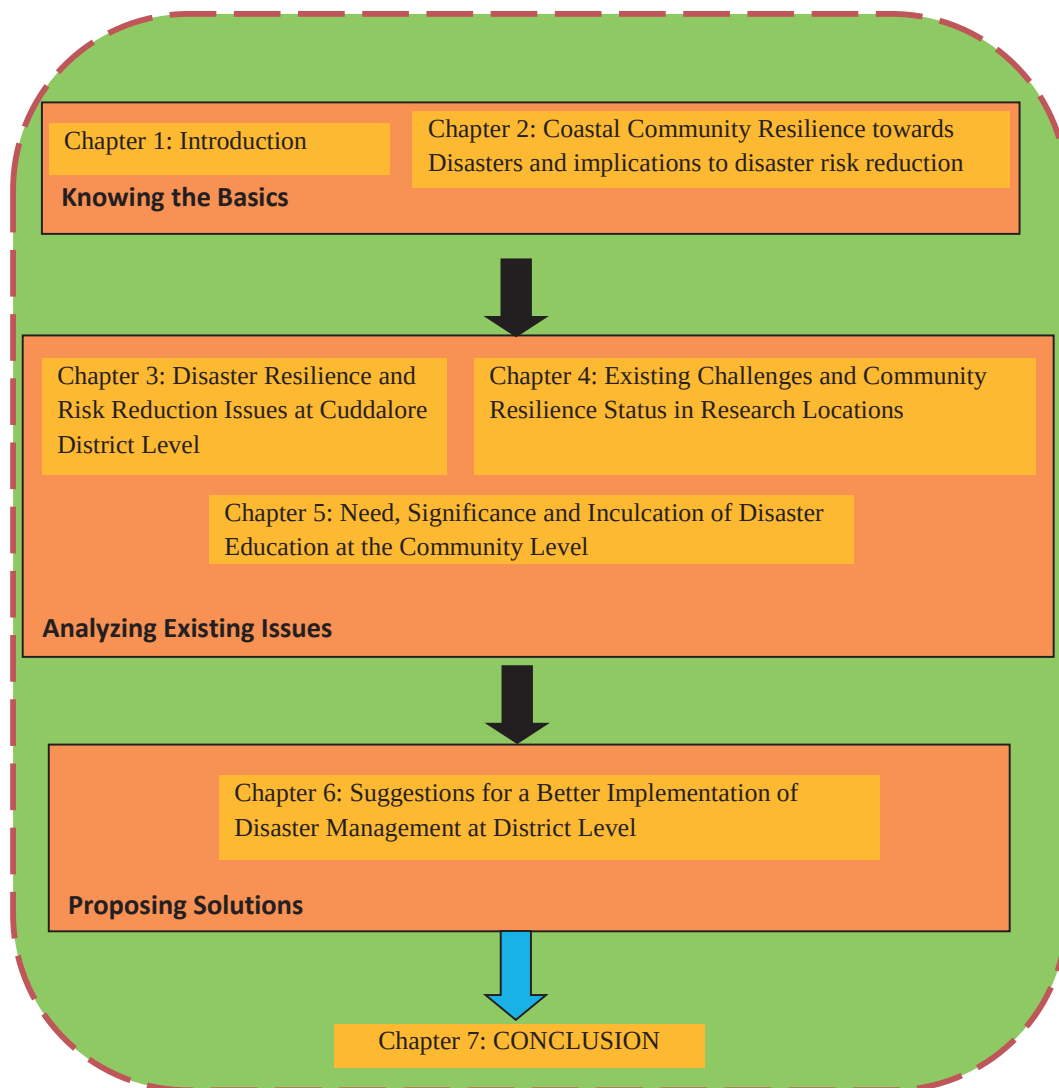


Fig. 1.6 Structure of the Dissertation

The dissertation is divided into three major parts. The first division provides an overall view of the research performed. As an introduction to the whole research work done, Chapter 1 explains the research background, followed by the objectives of this research, and the various methodologies adopted in conducting the research. Chapter 2 provides a basic understanding of the major concepts in alignment with the research objectives.

The second part is comprised of three chapters; it provides an analysis of issues and challenges regarding disasters, disaster resilience, and risk reduction initiatives. Chapter 3 discusses the disaster resilience status of Cuddalore District at the district level as well as risk reduction issues currently faced by the district. To understand disaster resilience issues faced by communities in the selected villages of Cuddalore Taluk further, household survey and focus group discussions were conducted. The results of the survey and focus group discussions are provided in Chapter 4. A lack of proper understanding was one main problem that was identified; this hinders appropriate responses to disasters. Chapter 5 discusses the educational tool that was developed as a practical initial step in solving this issue. Changes in level of awareness were analyzed to determine whether the awareness workshop was effective.

The third part has one chapter. Chapter 6 advances solutions and suggestions for bettering the existing disaster management framework of the district. Based on key findings and inferences from the previous chapters, framing strategies for formulating better solutions for disasters yet to come are addressed.

Chapter 7, the conclusion, provides a summary of the research.

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Chapter 2 Coastal Community Resilience towards Disasters and Implications to Disaster Risk Reduction

2.1 Introduction

The concept of resilience can be found explained and defined in various fields in various ways. The concept was first introduced in the field of ecology where it was described as a measure of the persistence of systems and of their ability to absorb change and disturbance and still maintain the same relationships between populations or state variables (Holling, 1973). Consequently, with opinions of various researchers the concept has undergone much theoretical evolution. Resilience has been generally defined in two broad ways: as a desired outcome(s) or as a process leading to a desired outcome(s) (Kaplan, 1999).

2.2 Disaster Resilience

Disaster resilience is mainly linked with socio-ecological system and how they respond and recover after a disaster occurs. In the context of a socio-ecological system, resilience is defined as the capacity of a system to recover when exposed to an exogenous shock or disturbance (Folke *et al.*, 2004). According to Rose (2004), resilience can exist at the three levels: the micro level such as households and individual firms, medium level such as sectors and groups, and macro level with all individual units.

When resilience is considered in the household level, it is defined as the capacity of households to absorb and mitigate damage or loss caused by natural disasters (Holling, 1973; Perrings, 2001). This refers to the ability to recover from disasters and the ability to withstand disasters (Briguglio *et al.*, 2009; Cannon, 2008; Rose, 2004). Disaster resilience could be also viewed as the intrinsic capacity of a system, community or society predisposed to a shock or stress to adapt and survive by changing its nonessential attributes and rebuilding itself (Manyena, 2006).

Because of differences in resilience and coping capacity, the effects of disasters are differential at the country as well as at the household levels (Benson, 1997; Cochrane, 1975; Kaplan, 2010; Noy, 2009, Briguglio *et al.*, 2009 and Davies *et al.*, 2013). Countries, communities, households with better resilience and coping capacity will have to face only lesser effects and impacts comparing to those

with low resilience and coping capacity. Thus resilience is the ability of a social system to respond and recover from disasters and includes those inherent conditions that allow the system to absorb impacts and cope with an event, as well as post-event, adaptive processes that facilitate the ability of the social system to re-organize, change, and learn in response to a threat (Cutter *et al.*, 2008). Vulnerability and resilience are dynamic processes, but for measurement purposes they are often viewed as static phenomena (Cutter *et al.*, 2008).

In hazards research, the definition of resilience is refined to mean the ability to survive and cope with a disaster with minimum impact and damage (Berke and Campanella, 2006; National Research Council, 2006). It incorporates the capacity to reduce or avoid losses, contain the effects of disasters, and recover with minimal social disruptions (Buckle *et al.*, 2000; Manyena, 2006; Tierney and Bruneau, 2007). Resilience within hazards research is generally focused on engineered and social systems, and includes pre-event measures to prevent hazard-related damage and losses (preparedness) and post-event strategies to help cope with and minimize disaster impacts (Bruneau *et al.*, 2003; Tierney and Bruneau, 2007). Resilience is thus an amalgamation of both process and outcome.

2.3 Community and Community Disaster Resilience

Community and disaster resilience are two terms that are complementary to each other in terms of its significance regarding disasters. At the same time both are explained in numerous ways at various time periods and in various contexts. It is important in having a clear understanding on both community and disaster resilience based on the particular context of research, assessment or investigation. Thus in each case it would differ depending on the context for example it may differ when assessment is based on economy to that of based on environmental assessment. The following sections describes about the concepts of community and community disaster resilience in detail.

2.3.1 Describing Community

Almost like the concept of resilience, researchers have quite distinct viewpoints regarding the concept of community. In conventional emergency management, communities are viewed in spatial terms: groups of people living in the same area or close to the same risks. This overlooks other significant dimensions of 'community' which are to do with common interests, values, activities and structures (Twigg, 2007). Proving the explanation of Twigg (2007), Ferdinand *et al.* (2012) explains

that a community refers to a group of individuals and households living in the same location and having the same hazard exposure, who can share the same objectives and goals in disaster risk reduction. While, (Laverack and Wallerstein, 2001) describes that the community can also be interpreted as heterogeneous individuals and groups who share common interests and needs, and who are able to mobilize and organize themselves towards social and political change. Whereas, Cutter *et al.* (2008) has a view that communities are the totality of social system interactions within a defined geographic space such as a neighborhood, census tract, city, or county and that there are many different communities within such geographically defined spaces and sub-populations may indeed have different levels of vulnerability and resilience that could result in recovery disparities.

Communities are complex and they are often not united. There will be differences in wealth, social status and labour activity between people living in the same area, and there may be more serious divisions within the community. Individuals can be members of different communities at the same time, linked to each by different factors such as location, occupation, economic status, gender, religion or recreational interests (Turner, 2010; Twigg, 2009; SCRA, 2010). Communities are dynamic; people may join together for common goals and separate again once these have been achieved (Twigg, 2009; McAslan, 2011). These factors make it difficult to identify clearly the 'community' one is working with.

From a hazards perspective, the spatial dimension is an essential element in identifying communities at risk, but this must be linked to an understanding of the socioeconomic differentiations, linkages and dynamics within the area at risk, not only to identify vulnerable groups but also to understand the diverse factors that contribute to vulnerability. Community businesses, services and infrastructure must also be taken into account. Communities do not exist in isolation. The level of a community's resilience is also influenced by capacities outside the community, in particular by emergency management services but also by other social and administrative services, public infrastructure and a web of socio-economic and political linkages with the wider world. Virtually all communities are dependent on external service providers to a greater or lesser extent (Twigg, 2007).

2.3.2 Concept of Community Disaster Resilience

The impact of natural disasters on households depends on the level of resilience of households and communities to natural disasters (Arouri, 2015). When referring to people, the essence of resilience centers on quick recovery from shock, illness or hardship. One who is resilient may be considered irrepressible, buoyant, enduring, flexible; the person who bounces back—unchanged—from

exposure to stresses and shocks (Vickers and Kouzmin, 2001). The emphasis of human resilience is in the processes of enhancing human capacity to recover from a disaster within the shortest possible time with minimal or no outside assistance. This approach recognizes that communities have certain levels of resilience built over centuries. Local adaptation strategies, culture, heritage, knowledge and experiences are the building blocks for boosting a community's disaster resilience. The approach focuses on the quality of life of the people at risk and development opportunities to enhance resilience (Manyena, 2006).

Assessing a community's resilience is of high significance, at the same time, is indeed a complex task. Selecting the factors or indicators or attributes to be considered and the required benchmark of those factors can pave way for a realization of what a community is good at, so how it can be utilized for the betterment of that community itself and also the negative sides of weak points of that community, so how those weaknesses can be rectified and to know about the possible reformation needed.

Recently, Cutter *et al.* (2008) developed a new model called the Disaster Resilience of Place (DROP) model that can be used to assess disaster resilience at the community level. According to Cutter *et al.* (2008), resilience can be defined as the ability of a human system to respond and recover from natural disasters. It consists of both antecedent conditions that allow the system to absorb impacts and cope with natural disasters as well as post-event adaptive ability that helps the system to adjust and learn in response to the natural disasters. To measure resilience, Cutter *et al.* (2008) propose thirty-six indicators for measuring and monitoring disaster resilience of local communities that are classified into the five resilience categories, namely: social, economic, institutional, infrastructure, and community capital.

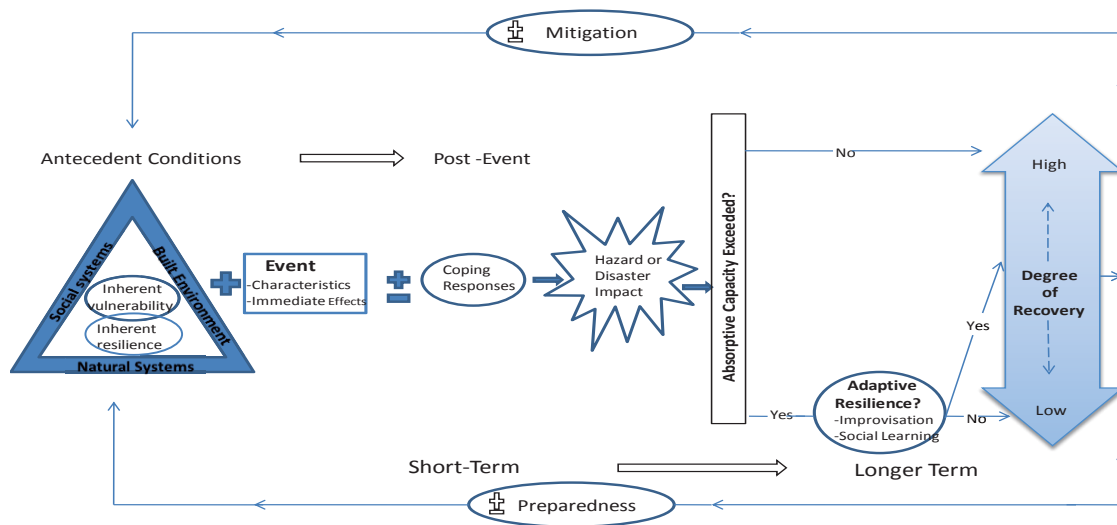


Fig. 2.1 Disaster Resilience of Place (DROP) model (Source: Cutter *et al.*, 2008)

(Note: Modified by authors)

The households in better-off areas are more resilient to natural disasters (De Haen and Hemrich, 2007; Greiving, 2006; Greiving *et al.*, 2006; Kaplan, 2010; Ludwig *et al.*, 2007). At the same time, the impact of natural disasters on household welfare might be more severe if income redistribution is not appropriately conducted (Fothergill and Peek, 2004; Wisner *et al.*, 2004).

The resilience of a community is inextricably linked to the condition of the environment and the treatment of its resources; therefore the concept of sustainability is central to studies of resilience. Within the context of natural disasters, sustainability is defined as the ability to “tolerate—and overcome—damage, diminished productivity, and reduced quality of life from an extreme event without significant outside assistance” (Mileti, 1999.). An environment stressed by unsustainable practices may experience more severe environmental hazards. For example, large-scale deforestation was a factor in increasing the flooding hazard, in the 1998 floods in China (Wisner *et al.*, 2004), and loss of coastal wetlands is a contributing factor to the severity of impacts of tropical storms and hurricanes on coastal Louisiana (Austin, 2006). These cases underlines the significance of the call for a shift from ad hoc, disaster-driven, and reactive systems and policies to a proactive, threat-driven, and mitigative focus (Godschalk, 1999). Referring to all these opinions of various researchers Cutter

et al. (2008) describes that these efforts not only make sense for reducing the impacts of environmental hazards, but they are also much more in line with the generational equity concerns inherent in sustainability science.

Community competence is another form of resilience and highlights those attributes of places that promote population wellness, quality of life, and emotional health (Norris *et al.*, 2008). Community competence measures how well the community functions pre-and post-disaster including a sense of community and ideals as well as attachment to place and the desire to preserve pre-disaster cultural norms and icons (Vale and Campanella, 2005). Resilient communities experience less damage and tend to recover quickly from disasters (Buckle, 2001). These communities absorb stress either through resistance or adaptation, manage and maintain basic functions despite effects, and can recover with specific behavioral strategies for risk reduction (Twigg, 2007).

2.3.3 Features of Coastal Community

Sea coasts, with their boundless economic opportunities and better quality of life, increasingly are viewed as preferred places to live, work, play, and retire (Hinrichsen, 1998). Because of all these factors, coastal zones within 200 km of the oceans are home to about half of the global population (Creel, 2003) and as they are more prone to hazards (Boesch *et al.*, 2000; IPCC, 2007), a large number of people are at risk. Majority of this kind of population is often composed of communities that lack the capacity to effectively plan for and respond to hazard. Greatest concentration of people, over dependence on marine resources for the livelihood that can be in turn explained as over exploitation of resources are some of the features of coastal communities that has to be concerned about. Coastal development and adaptation policies that consider social, economic and environmental risks simultaneously can reduce social and economic vulnerability and maximize the risk reduction benefits that natural habitats can provide.

2.4 Implication of Disaster Risk Reduction on Community Resilience and Empowerment

Resilience is currently too vague a concept to be useful in informing the Disaster Risk Reduction (DRR) agenda (Hanley, 1998). Although there may be recognition of the hazards in many communities, risk reduction and vulnerability often are not salient concerns until after the disaster occurs (Cutter *et al.*, 2008). To enhance resilience it is necessary to have a good initial understanding of what it is, its determinants (Klein *et al.*, 1998), and how it can be measured, maintained and

improved (Klein *et al.*, 2003). Being the vulnerable and first responders, it is most important that communities should have clear understanding about these all, as much as that of the disaster managers, stakeholder organizations working towards rectifying the challenges through various management aspects. Disaster resilience activities can 'lead to actions such as enhancing community coping capacity and livelihoods', allowing communities to make appropriate choices within the context of their environments (Maneya, 2006).

The Hyogo Framework for Action identified both the need for and ways to build resilient communities by (1) integrating disaster prevention, mitigation, preparedness, and vulnerability reduction perspectives into sustainable development policies; (2) increasing local capacity (institutions and mechanisms) for building hazard resilience; and (3) incorporating risk reduction into the design and implementation of emergency preparedness, response, recovery, and reconstruction programs in affected communities (International Strategy for Disaster Reduction, 2005).

Disasters have major impacts on vulnerable, generally less-developed, societies, and make achieving sustainable development exceedingly difficult (McBean, 2012). Therefore, empowering such societies and communities towards resilience is imperative in every sense. The significance of resilience is indispensable, as it has strong bonding with sustainable development. Meanwhile, community empowerment is usually considered as a process in the form of a dynamic continuum involving—personal empowerment: (i) development of small mutual groups, (ii) community organizations, and (iii) social and political action (Jackson *et al.*, 1989; Labonte, 1994; Rissel, 1994).

Community empowerment and DRR both are linked one another and that link can be magnified by betterment of collaborative mechanism between the local authorities, the local communities and other stakeholders. One of the many benefits of community based disaster risk reduction (CBDRR) addressed by the United Nations International Decade for Disaster Reduction (UN-IDNDR) is that, community participation will positively address the local socio-economic concerns in disaster reduction, by empowering the community with knowledge and skills and develop the leadership capability of the community members and further strengthen their capacity to contribute to development initiatives (Pribyl and Mariany, 2012).

Empowering the community by internalizing the tools and methods of DRR is a good way to deal with the future potential risks (Aravind, 2008). To sustain empowerment, a consensus approach to decision making is recommended, which assures participation in identifying shared problems, as well as developing and implementing solutions that in turn facilitates the development of problem-focused coping, a sense of community, and a commitment to action (Paton and Johnston, 2001).

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Chapter 3 Disaster Resilience and Risk Reduction Issues at Cuddalore District Level

3.1 Introduction

Disaster resilience and risk reduction exists complementary to each other. More broadly, the risk reduction can be of any type; like, it can be the reduction of environmental risk, economic risk reduction etc. When we have to make the management plan and design policies we have to have an understanding about the existing status of resilience level and prevailing risk reduction issues. This could further help in knowing main characteristics of issues existing, the regions where more reformation is needed and kind of improvements needed.

3.2 Disaster Resilience Level

Assessments of disaster resilience level should be considering a wide range of attributes that potentially can impose an effect (positive or negative) on resilience, in order to reflect findings that stand more close to field reality. CDRI model is one such model used for assessing disaster resilience level. The model was initially developed with the idea of quantitatively assessing the resilience of cities to hydro-meteorological disasters such as floods, storms, rainfall induced landslides etc. (Shaw, 2009).

When we consider Tamil Nadu, major disasters to be concerned about and that usually strikes when we have a look on to its disaster history; it is hydro meteorological disasters. Considering this into account, disaster resilience of Cuddalore district was decided to be assessed using CDRI model. Assessment was done in all the 6 taluks (administrative division) of Cuddalore district to find the areas of higher as well as lesser resilience index.

3.2.1 Methodology

The model evaluates the resilience level by assessing the physical, social, economic, institutional and natural dimensions based issues of the target area. For the clarity in the assessment, 25 parameters (five parameters in each dimension), and 125 variables (five variables in each parameter, i.e. 25 variables in each dimension) tries to cover the key aspects of resilience towards climate related disasters. The parameters and variables used for the assessment have been given in the Table 3.1.

Table 3.1 Dimensions, parameters and variables of CDRI assessment

DIMENSIONS	PARAMETERS AND VARIABLES
Physical	Electricity (access, availability, supply capacity, alternative capacity) Water (access, availability, supply capacity, alternative capacity) Sanitation and solid waste disposal (access to sanitation, collection of waste: treated, recycled, collection of solid waste after a disaster) Accessibility of roads (% of land transportation network, paved roads, accessibility during flooding, status of interruption after intense rainfall, roadside covered drain) Housing and land-use (building code, buildings with non-permanent structure, buildings above water logging, ownership, population living in proximity to polluted industries)
Social	Population (population growth, population under 14 and above 64, population informal settlers, population density at day and night) Health (population suffer from waterborne/vector-borne diseases, population suffer from waterborne diseases after a disaster, access to primary health facilities, capacity of health facilities during a disaster) Education and awareness (literacy rate, population's awareness about disasters, availability of public awareness programs/disaster drills, access to internet, functionality of schools after disaster) Social Capital (population participating in community activities/clubs, acceptance level of community leader (in ward), ability of communities to build consensus and to participate in taluk's decision-making process (level of democracy), level of ethnic segregation) Community preparedness during a disaster (preparedness (logistics, materials and management), provision of shelter for affected people, support from NGOs/CBOs, population evacuating voluntarily, population participating in relief works)
Economic	Income (population below poverty line, number of income sources per household, income derived in informal sector, % of household have reduced income due to a disaster)

	Employment (formal sector: % of labour unemployed, % of youth unemployed, % of women employed, % of employees come from outside the city, % of child labour in taluk) Household assets (households have: television, mobile phone, motorized vehicle, non-motorized vehicle, basic furniture) Finance and savings (availability of credit facility to prevent disaster, accessibility to credits, accessibility to credits for urban poor, saving practice of households, household's properties insured) Budget and Subsidy (funding of DRM, budget for DRR sufficient, availability of subsidies/incentives for residents to rebuild houses, alternative livelihood, health care after a disaster)
Institutional	Mainstreaming of DRR and Climate Change Adaptation (CCA) (mainstreaming of CCA and DRR in: zone's development plans, ability (manpower) and capacity (technical) to produce development plans, extent of community participation in development plan preparation process, implementation of disaster management plan) Effectiveness of taluk's crisis management framework (existence and effectiveness of an emergency team during a disaster: leadership, availability of evacuation centers, efficiency of trained emergency workers during a disaster, existence of alternative decision-making personnel) Knowledge dissemination and Management (effectiveness to learn from previous disasters, availability of disaster training programs for emergency workers, existence of disaster awareness programs for communities, capacity (books, leaflets, etc.) to disseminate disaster awareness programs (disaster education), extent of satisfaction from disaster awareness programs) Institutional collaboration with other organizations and stakeholders, during a disaster (taluk's dependency to external institutions/support, collaboration and interconnectedness with neighbouring taluks, taluk's cooperation (support) with central corporation department for emergency management, cooperation taluk's officials for emergency management, taluk's institutional collaboration with NGOs and private organizations)

	Good Governance (effectiveness of early warning systems, existence of disaster drills, promptness of taluk body to disseminate emergency information during a disaster to communities and transparency of taluk body to disseminate accurate emergency, capability of taluk body to lead recovery process)
Natural	Intensity/severity of natural hazards (floods, cyclones, heat waves, droughts (water scarcity), tornados) Frequency of natural hazards (floods, cyclones, heat waves, droughts (water scarcity), tornados) Ecosystem services (quality of taluk's: biodiversity, soils, air, water bodies, urban salinity) Land-use in natural terms (area vulnerable to climate-related hazards, urban morphology, settlements on hazardous ground, amount of Urban Green Space (UGS), loss of UGS) Environmental policies (use of taluk level hazard maps in development activities, extent of environmental conservation regulations reflected in development plans, extent of implementation of environmental conservation policies, implementation of efficient waste management system (RRR), implementation of mitigation policies to reduce air pollution)

Each variable ($x_1, x_2, \dots, x_5$) provided allows to choose from five different choices varying from score 1 (very poor, not available/ exist) to score 5 (best). In addition to this, a weighting scheme that the five variables that comes under a parameter has to be ranked ($w_1, w_2, \dots, w_5$) depending on their importance within the target area's (here, taluk) context i.e. low importance means score 1, highest importance comparing to other variables means score 5. This ranking has to be done in relation to the characteristics of the target area. For calculating the CDRI scores for each variable, parameter and dimension in a standardized manner, the formula named weighted mean has been used. The formula of weighted mean has been explained in Equation 3.1.

Weighted Mean:

$$\frac{\sum_{i=1}^n WiXi}{\sum_{i=1}^n Wi} = \frac{w1x1 + w2x2 + w3x3 + w4x4 + w5x5}{w1 + w2 + w3 + w4 + w5}$$

Equation 3.1 Formula for calculating Weighted Mean

Questionnaires were made to be filled by officers in revenue division (as it is the division that holds the responsibility of taking caring of disaster management issues) under the supervision of deputy tahsildar (officer of taluk office). As exact data regarding details of most of the parameters and variables are not available the results are mainly depend on the perception of the respondents (officers of revenue division). Models like this are very useful in providing a broad view of resilience level as well as in recognizing the issues prevailing that need urgent attention that further will help in enhancing the resilience level. Like that, (Wisner *et al.*, 2004). mentions that predicting the hazard event, and strengthening the resilience of people and property, significantly reduces the negative impact of hazards; by influencing one of the two factors, it is possible to reduce the risks, as described by the Pressure and Release (PAR) model.

3.2.2 Results of Resilience Assessment

Through the questionnaire survey, resilience status of overall Cuddalore district and that of each taluk were assessed. Along with that, results also helped in finding out the prioritization given to the parameters and variables. Table 3.2 shows the CDRI scores of parameters.

Table 3.2 CDRI Score for parameters

Sanitation and Waste management	2.08
Employment	2.21
Envt. policies	2.54
Income	2.59
Frequency	2.59
Ecosystem services	2.64
Finance and Saving	2.74
Land-use	2.81
DRR and CCA	3.11
Community prepare	3.14
Social capital	3.21
Budget and Subsidy	3.24
Road	3.31
Intensity/severity	3.31

Health	3.31
Housing Land use	3.32
Education and awareness	3.43
Water	3.44
Knowledge dissemination and Management	3.45
Population	3.49
Electricity	3.50
Household assets	3.72
Good Governance	3.84
Collaboration	3.85
Crisis management framework	3.88

Out of the 25 parameters, Sanitation and waste management, employment, environmental policies, income, ecosystem services have least scores (Table 3.2). This points out that, these parameters are weak in the district and that more emphasis has to be given for improving the present status of these parameters.

Table 3.3 Importance of parameters in influencing resilience scores

Budget and Subsidy	4.33
Frequency	4.00
DRR and CCA	3.83
Employment	3.66
Intensity/severity	3.66
Crisis management framework	3.66
Water	3.66
Road	3.50
Electricity	3.33
Health	3.33
Community prepare	3.16
Knowledge dissemination and Management	3.16
Finance and Saving	3.16
Education awareness	3.00
Env. Policies	3.00
Population	3.00
Income	2.66
Housing Land use	2.50
Social capital	2.50
Collaboration	2.50
Eco services	2.50
Sanitation and Waste management	2.00
Good Governance	1.83
Land use	1.83

Table 3.3 shows the prioritization given to the parameters by the respondents. The values of the parameters shows that Budget and Subsidy, Frequency of disasters, Mainstreaming of DRR and Climate Change Adaptation, Employment, Intensity/severity of disasters and Crisis Management Framework are the 6 most important parameters which influence the resilience scores.

Table 3.4 Variable Prioritization

% of taluk's annual budget targeting disaster management	4.50
Capability of taluk to lead recovery process(relief work, reconstruction and rehabilitation)	4.50
Functionality of schools after a disaster	4.33
% of population suffer from waterborne diseases every year	4.33
% of non permanent housing structure	4.16
% of taluk population living in slum area/urban informal settlement/ urban poor areas	4.16
Existence of disaster awareness programs (disaster education) for communities	4.16
Frequency of Flood	4.16
Average soil quality – degraded land, derelict land (industrial contamination)	4.16
Status of interruption after heavy rainfall in affected areas – Road accessibility	4.00
Extent of taluk population participate in community activities	4.00
% of households depend on only one income source	4.00
Intensity/ Severity of Flood	4.00
Frequency of Drought	4.00
Loss of green space (parks, trees, forests) due to development of infrastructure, housing, etc.	4.00
Extent of use of taluk hazard maps in development activities	4.00
Extent of opportunity for taluk's communities to participate in the decision making	3.83
Ability of taluk's communities to build consensus and deliver shared interest	3.83
% of taluk's population living below the poverty line	3.83
Efficiency of trained emergency workers during a disaster	3.83
Extent of dependency to external institutions/support during a disaster	3.83
Effectiveness of early warning systems led by taluk	3.83
Extent of implementation of mitigation policies to reduce CO ₂ emissions	3.83

Table 3.4 shows the variables which were given highest weight or importance in shaping resilience of their respective parameters and dimension they fall under. Based on the table, percentage of taluk's annual budget targeting disaster management and capability of taluk to lead recovery process (relief work, reconstruction and rehabilitation) are considered as the 2 most important variable out of the total 125 variables. Both of these variables are considered to be equally important as both have got the same value 4.5. This first two variables, out of 125 variables represents Institutional

Dimension. Out of 23 variables which were given the first 5 ranks among the 125 variables, 7 variables represent natural dimension, 6 variables represent social dimension 5 variables institutional 3 variables economic 2 represent physical.

3.2.2.1 Physical Resilience

Basic utilities mainly express the physical resilience level. Among the taluks, Cuddalore taluk (which is also the district head quarters) shows highest resilience whereas Kattumanarkoil has the lowest physical resilience (Fig. 3.1(a)). Considering the overall physical resilience (Fig. 3.1(b)), sanitation and waste management is the parameter which has the lowest value and thus improving the quality of this parameter can further help in increasing the physical resilience to a better level. Road accessibility is the other parameter which has to be improved.

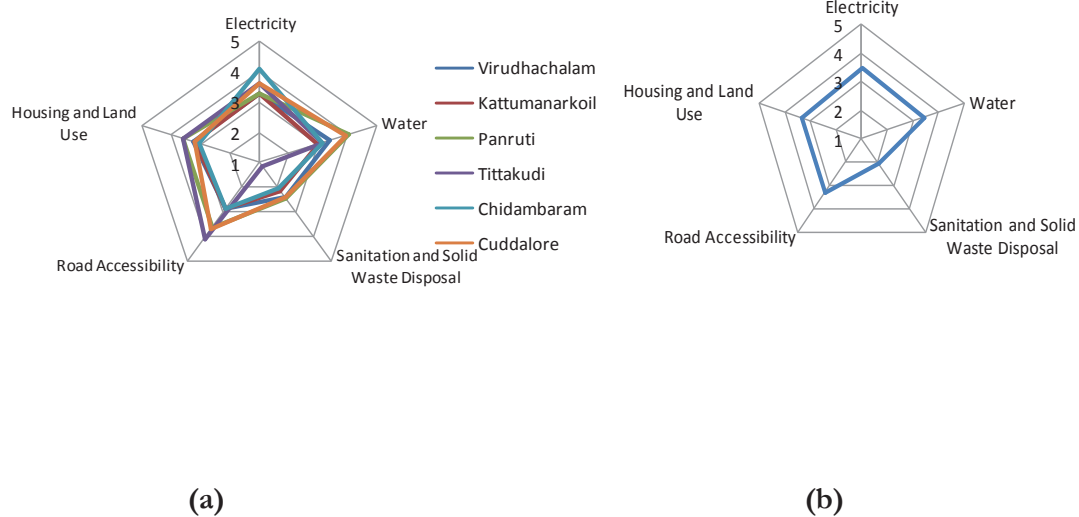


Fig. 3.1(a) Taluk wise Physical Resilience Overview and (b) Overall Physical Resilience

3.2.2.2 Social Resilience

Differing from the case of physical resilience, here Panruti shows high social resilience whereas Chidambaram has the lowest (Fig. 3.2(a)). Low scores for parameters such as population, health and community preparedness lowered the social resilience of Chidambaram. When overall social resilience is considered (Fig. 3.2(b)), community preparedness towards disasters is the parameter which has lowest score thus needing more attention as well as actions from the administrative authorities. Looking on to it further; if it is possible to improve / increase the extent of households

prepared for disasters in terms of logistics, materials and management as well as extent of affected people evacuating voluntarily after a disaster , there will be much significant difference in the community preparedness. It is interesting to note that for attaining this proper education and awareness has to be given to community about the important of preparedness and assure it, how to do voluntary evacuation so evacuation plan is needed, route has to be known to everyone in the community. So every parameter is interlinked, as inefficiency of one parameter will affect the others too.

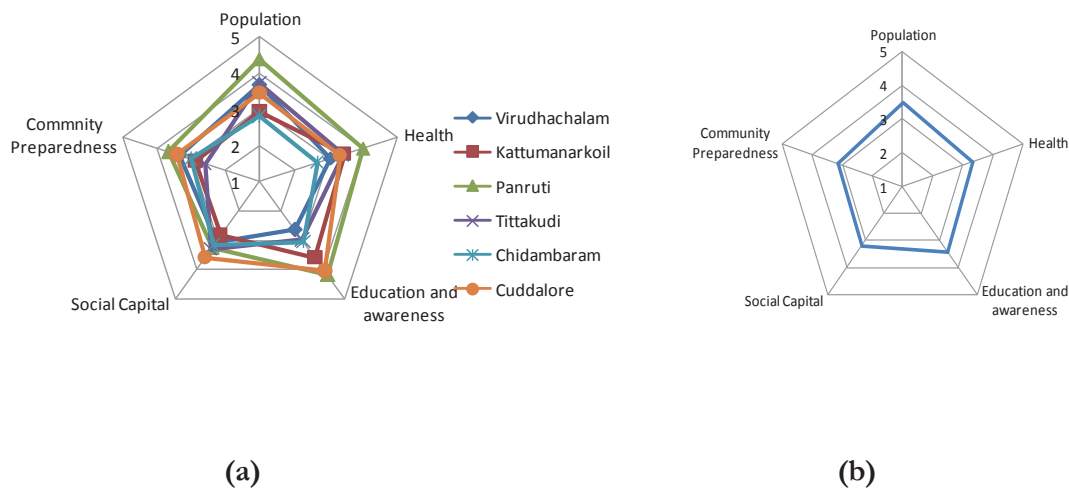


Fig. 3.2(a) Taluk wise Social Resilience Overview and (b) Overall Social Resilience

3.2.2.3 Economic Resilience

Overall economic resilience can be seen shaped by lower employment situations leading to lower income which has resulted in lower finance and saving trend (Fig. 3.3(b)). As a result, prevalence of all these same reasons make Virudhachalam the lowest economically resilient taluk. Cuddalore has better economic resilience comparing to other taluks (Fig. 3.3(a)). Being the district headquarters, Cuddalore taluk all the parameters besides employment above average resilience. Higher percentage of labour unemployed in formal sector, less percentage of youth representation in formal sector as well as less percentage of the employed women in formal sector is the reasons which lowered the resilience of employment parameter in the Cuddalore taluk. These are not only a characteristics of Cuddalore taluk itself, in all taluks the employment in formal sector, women in formal sector and youth employed in formal sector are less.

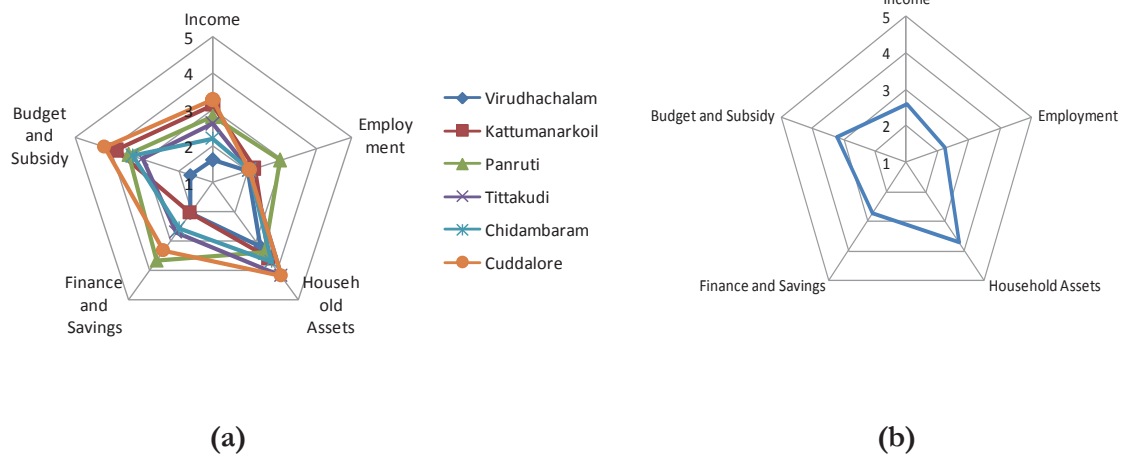


Fig. 3.3(a) Taluk wise Economic Resilience Overview and (b) Overall Economic Resilience

3.2.2.4 Institutional Resilience

It is not surprising to see the Cuddalore being the headquarters, Cuddalore taluk shows the best institutional resilience among all the taluk while Chidambaram shows least resilience towards institutional resilience (Fig. 3.4(a)). When the overall resilience is taken (Fig. 3.4(b)), though the district has a strong and effective crisis management framework, mainstreaming of DRR and climate change adaptation can be found as the weakest parameter. Thus it shows that, though the district is well prepared for post disaster management, it is weak when pre disaster management efficiency is concerned.

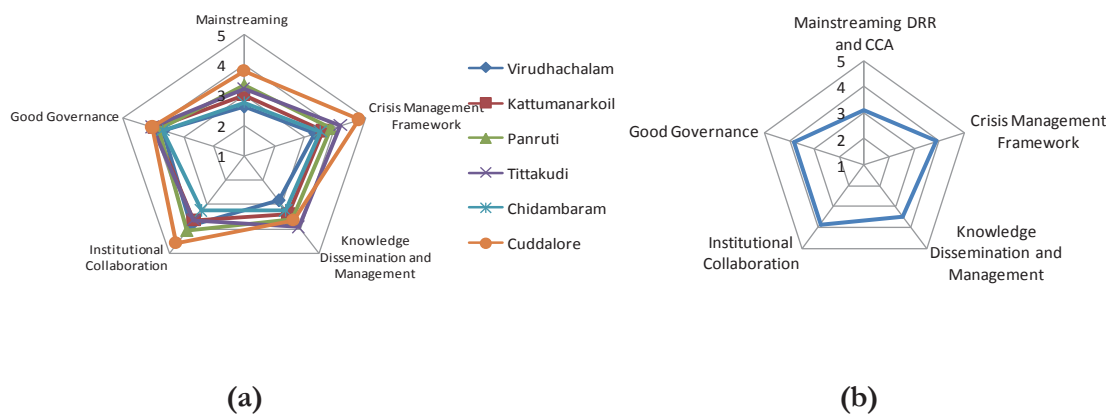


Fig. 3.4(a) Taluk wise Social Institutional Overview and (b) Overall Institutional Resilience

3.2.2.5 Natural Resilience

Apart from having highest physical, economic, institutional resilience, Cuddalore taluk shows lowest natural resilience. High frequency of natural hazards, low quality of ecosystem services and land use in natural terms are the factors that are behind in lowering the natural resilience of Cuddalore taluk. Another interesting finding is that though both Cuddalore and Chidambaram have almost same frequency of natural hazards, severity is higher in Cuddalore. This may be because Chidambaram is having a better quality of ecosystem services and land use in natural terms which regarding Cuddalore is bad. Here, Panruti shows better resilience with lesser frequency and intensity of hazards (Fig. 3.5(a)). When overall resilience (Fig. 3.5(b)) is considered, environment policies are found to be the weakest parameter. The next weak parameter is the high frequency of hazards; one reason for this is, Cuddalore district is a coastal district and located in the east coast of India which is prone to cyclonic depressions. Chidambaram and Cuddalore gets most affected by the coastal hazards so the respective taluks also face direct as well as indirect effects of the impacts. Water scarcity is another hazard they face.

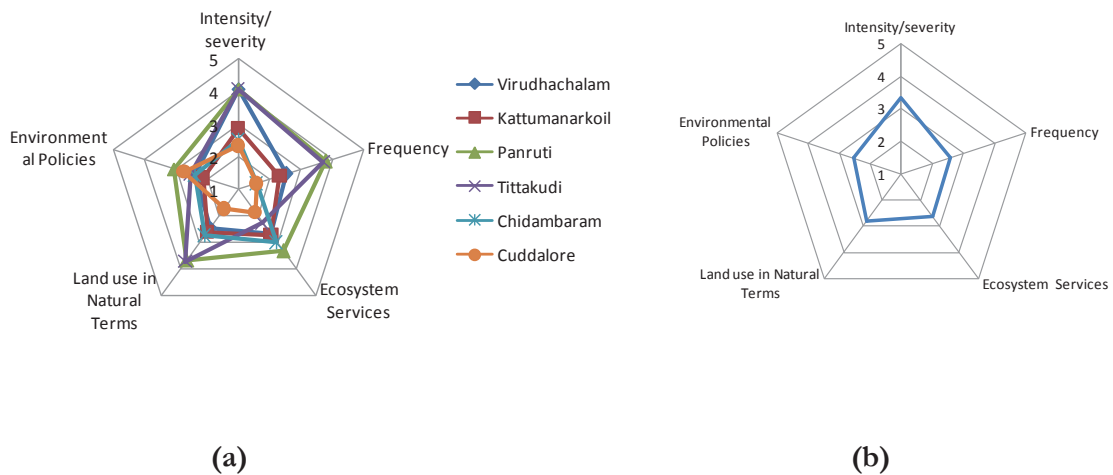


Fig. 3.5(a) Taluk wise Natural Resilience Overview and (b) Overall Natural Resilience

3.3 Taluk wise Results

Now it is tried to find taluk wise status towards each dimension and the parameters in which each taluk is good in and weak parameter which needs improvement.

3.3.1 Status of Virudhachalam Taluk

When overall resilience of the taluk is considered, resilience status is least for economic condition and highest for institutional setup in the taluk (Fig. 3.6(b)). At the same time detailed resilience status of each dimension has been explained below and also in Fig. 3.6(a).

Physical resilience:

Around 80% of the households in the taluk have access to electricity and 81-95% has access to water supply. In both the cases, respective authorities of taluk are capable in providing water and electricity 51-75% of its demand. 61-75% of population has access to hygienic sanitation facility. Only about 66-80% of the solid waste produced per day is being collected, more than that before dumping solid waste is not treated at all and only up to 10% of being recycled. Usually, about half of the waste is collected within 48 hours after a disaster like flood, cyclone etc. During normal flooding, in affected areas 51-60% of roads remain accessible and after a heavy rainfall status of interruption occurs for about 5-8 hours in those areas. It is also notable that only less than 15% of roads have roadside covered drains. More than 30% of the total housing in the taluk is non-permanent structures. About half the percentage of houses are above normal/ flood water logging level. It can be taken as a positive side of the taluk that less than 12.4% of the population live in proximity to polluted industry/ dumping ground/sea beach plant etc.

Social Resilience:

Among the total population of the taluk, around 32% population is under 14 and over 64. More important thing to be noticed is up to 25 - 37.4% of total population live in slum area or urban informal settlement or urban poor areas. Regarding health issues of the taluk, every year around 23% of the population suffers from water borne diseases, while following a disaster about 11% of people use to suffer from waterborne diseases. Comparing to waterborne diseases taluk shows a lesser rate of (11%) population that suffers from vector borne diseases every year. The capacity of health facility of taluk to face emergency or hazardous situation is just medium. Taluk authority manages to organize public awareness programs/ disaster drill once every year and when functionality of schools

after a disaster is taken it happens to be poor. The extent of taluk population who participate in community activities is low which only up to is 30%. While the ability of taluk communities to build consensus as well as to deliver shared interest and their opportunity to participate in the process of activities like making of development plans is medium. In the case of community preparedness, extent of households prepared in terms of logistics, material and extent of support from NGOs/CBOs or religious organizations after a disaster are medium. However, participation in relief works can be found good after a disaster.

Economic Resilience:

More than 40% of the taluk population lives below the poverty line. Thus, not surprisingly, 75-99% depends on only one source for income as well as average number of source per household is only one. Due to disasters, more than 40% of income gets reduced in affected households. Considering the employment situations, more than 25% of labour is unemployed in formal sector. Along with that 24% of youth is unemployed in formal sector and only less than 20% of women are employed in formal sector. Much of the households are occupied with household assets like television, telecommunication (mobile phone) but households having furniture to secure key items like emergency food, money important documents, medicine etc. during disasters is less than 50%. Availability of credit facility of financial institutions in taluk to face or prevent disaster is poor and also only up to 30% of households have saving practice. Just up to 10% of houses are under any sort of insurance scheme. Being a non-coastal taluk that does not get affected much by cyclonic depressions that occur every year, annual budget of taluk does not target disaster risk management at all and there is no fund for climate change related disaster risk reduction measures. Moreover the availability of subsidies/ incentives for residents to receive/ provide alternative livelihood during a disaster is poor.

Institutional Resilience:

Capacity (logistics, materials (technical)) to produce development plan as well as incorporation of DRR and climate change adaptation in development plans is poor, while incorporation of disaster management plan is medium. Considering the effectiveness of taluk's crisis management framework, existence and effectiveness of emergency team during a disaster is medium. Efficiency of trained emergency workers during a disaster is also medium but the existence and readiness of alternative decision making personnel is found good. Once or twice a year regularly, disaster training

programmes are available for emergency workers but existence of awareness programmes (disaster education) for communities is poor. Regarding knowledge dissemination, capacity (leaflets, manpower, campaigns) of taluk is just medium. During a disaster, collaboration with neighbouring taluk's for emergency management is in a good level, as well as corporation of taluk officials for emergency management and institutional collaboration of taluk with NGOs and private organizations are at its best during a disaster. Overall governance of taluk can be found to be maintaining a good status, by having disaster drills once every year and being good at the promptness to disseminate emergency information to communities and in the transparency to disseminate accurate emergency information during disasters.

Natural Resilience:

Severity of hazards such as flood, cyclones, heat waves, droughts (water scarcity) are normal. However cyclone, heat waves and water scarcity occur once per year and flooding occur with a frequency of once every five years. Besides poor soil quality, quality of ecosystem services like air, water biodiversity as well as salinity issues are medium in the taluk. About 26-50% of taluk area is vulnerable to climate related hazards however, less than 10% of settlements locate on hazardous ground (steep slope, flood prone area) that are vulnerable to exposure of hazards. Even though, more than 40% of green space has been lost due to development of infrastructure housing over the last 50 years. Taking policies into consideration, extent of use of hazard maps in development activities are only medium. In the case of environment conservation regulations, the extent reflected in development plans is also medium but the extent of implementation is poor.

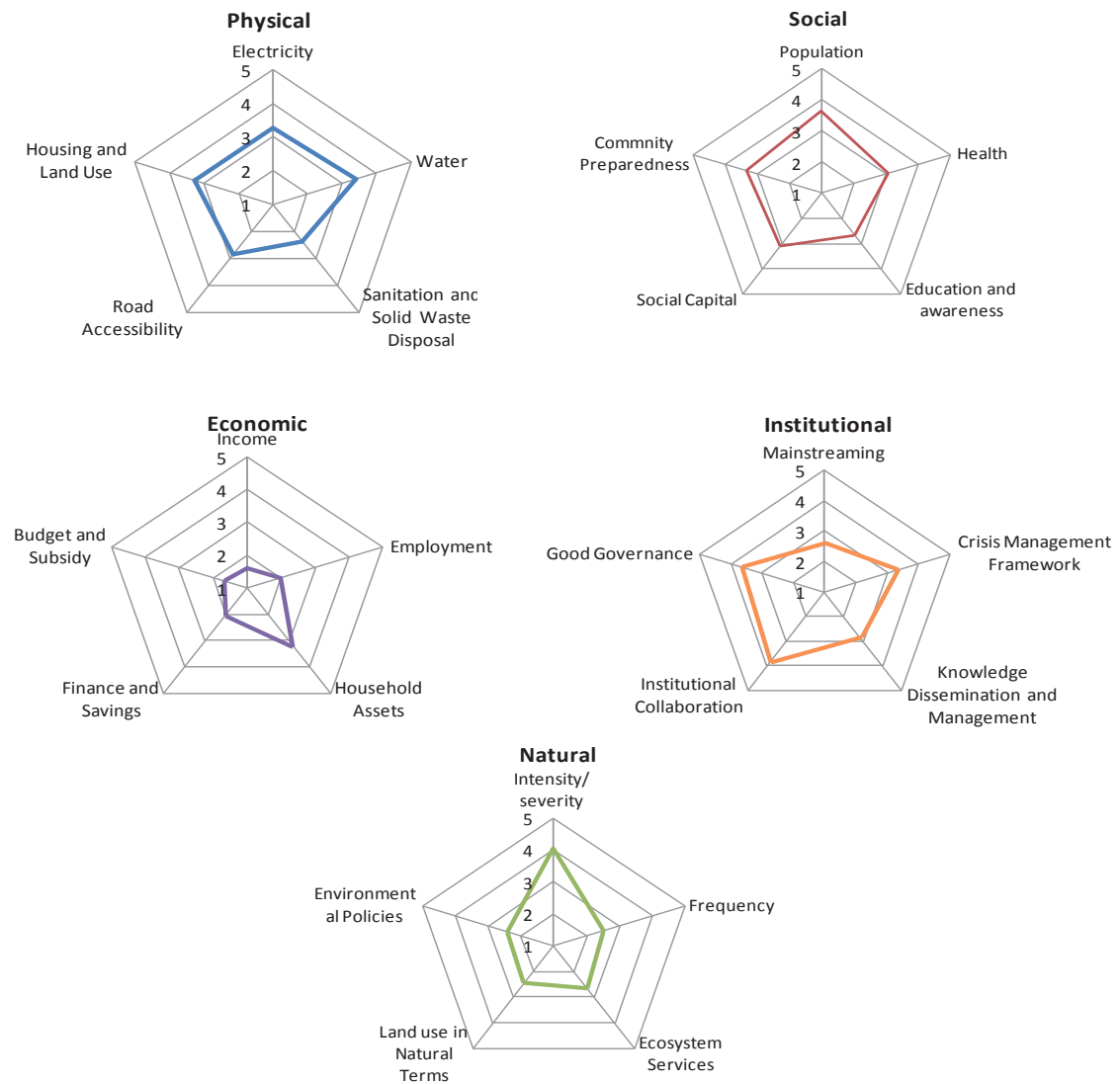


Fig. 3.6(a) Resilience Statuses of Virudhachalam Taluk in five dimensions

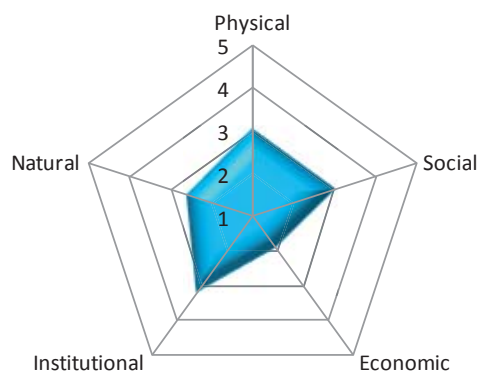


Fig. 3.6(b) Overall Resilience of Virudhachalam Taluk

3.3.2 Status of Kattumannarkoil Taluk

When overall resilience of the taluk is considered, resilience status is highest for institutional setup in the taluk (Fig. 3.7(b)). At the same time detailed resilience status of each dimension has been explained below and in Fig. 3.7(a).

Physical resilience:

The households in the taluk have 81-95% access to both electricity and water supply. In both the cases, respective authorities of taluk shows much variation in their capability of providing water and electricity, as taluk is capable of providing about half the demand of electricity while water authority is capable in providing 76-100% of its demand. 81-100% of population has access to hygiene sanitation facility. About 81-95% of the solid waste produced per day is being collected, more than that before dumping solid waste is treated and half of the solid waste is being recycled. Usually, about half of the waste is collected within 48 hours after a disaster like flood, cyclone etc. During normal flooding, in affected areas only half the roads remain accessible and after a heavy rainfall status of interruption occurs for about 9-12 hours in those areas, which is a miserable condition. Only 16-30% of roads have roadside covered drains. More than 30% of the total housing in the taluk is non permanent structures. About half to 60% of the houses are above normal/ flood water

logging. Up to 24.9% of the taluk population live in proximity to polluted industry/ dumping ground/sea beach plant etc.

Social Resilience:

Among the total population of the taluk, more than 45% is under the age of 14 and over 64 years of age. More than half the population lives in slum area or urban informal settlement or urban poor areas and this of course is a serious issue of the taluk, which can be a major factor in lessening the social resilience. Regarding health issues of the taluk, population that suffer with the incidence of water borne and vector borne diseases per year is only up to 5%. Only the same rate of people gets affected by water borne diseases after a disaster also. The capacity of health facility of taluk to face emergency or hazardous situation is just medium. Taluk authority manages to organize public awareness programs/ disaster drill once every year and when functionality of schools after a disaster is taken it happens to be just medium. The extent of taluk population who participate in community activities is low which only up to is 40%. Taluk communities shows a medium ability to build consensus as well as to deliver shared interest and but they are having poor opportunity to participate in the process of activities like making of development plans. In the case of community preparedness, extent of households prepared in terms of logistics, materials and management is poor. However, extent of support from NGOs/CBOs or religious organizations after a disaster as well as participation of taluk population in relief works can be found medium after a disaster.

Economic Resilience:

Up to 40% of the taluk population lives below the poverty line. Average number of income source per household is two even though around 25-49% of households still depend only on one source for income. As a result of disasters, in affected households, around 30% of income gets reduced. If employment situations are taken, more than 25% of labour is unemployed in formal sector. The youth unemployed in formal sector is more than 25% and only less than 20% of women are employed in formal sector. More than half of the households have household assets like television, telecommunication (mobile phone) as well as furniture to secure key items like emergency food, money important documents, medicine etc. during disasters. In taluk financial institutions, availability of credit facility to face or prevent disaster is medium, while, only around 21-30% of households have saving practice. Just up to 10 % of houses in the taluk is under any sort of insurance scheme. Being a coastal taluk that is prone to coastal disasters like cyclonic depressions

etc., more than 3% of annual budget of taluk targets on disaster risk management, still, the sufficiency of budget for climate change related disaster risk reduction measure are just medium. While availability of subsidies/ incentives for residents to receive/ provide alternative livelihood during a disaster is good.

Institutional Resilience:

Even though, Kattumanarkoil is a coastal taluk prone to disasters especially coastal disasters, incorporation of DRR and climate change adaptation measures in taluk development plans, ability(manpower) to produce development plans, capacity (logistics, materials(technical)) to produce development plan is only medium. Without any surprise, incorporation of disaster management plan is also medium. Considering the effectiveness of (Kattumanarkoil) taluk's crisis management framework, existence of emergency team during a disaster is medium but the effectiveness is good. Efficiency of trained emergency workers during a disaster as well as the existence and readiness of alternative decision making personnel is found to be good. Once or twice a year regularly, disaster training programmes are available for emergency workers, adding to this, existence of awareness programmes (disaster education) for communities is also good. Considering knowledge dissemination, capacity (leaflets, manpower, campaigns) of taluk is just medium. During a disaster, collaboration with neighbouring taluk's for emergency management is in a medium level, but, cooperation of taluk officials for emergency management during a disaster is good. Institutional collaboration of taluk with NGOs and private organizations during a disaster is medium. The governance of taluk can be found good, by having disaster drills once every year, being good at the promptness to disseminate emergency information to communities and maintaining a medium level of transparency to disseminate accurate emergency information during disasters.

Natural Resilience:

Severity of hazards such as cyclones, heat waves, droughts (water scarcity) are medium while floods are severe here, However cyclone, floods and water scarcity occur once per year and heat waves occur with a frequency of once every five years. Besides this, soil quality, quality of ecosystem services like air, water, biodiversity are medium in the taluk. About 26-50% of taluk area is vulnerable to climate related hazards, however, only less than 10% of settlements locate on hazardous ground (steep slope, flood prone area) that are vulnerable to exposure of hazards. More

than 40% of green space has been lost due to development of infrastructure housing over the last 50 years. While when environmental policies are considered, extent of implementation of environmental conservation policies is medium while extent of implementation of mitigation policies to reduce air pollution is poor. Another important issue is the use of hazard maps in development activities are only up to 10%.

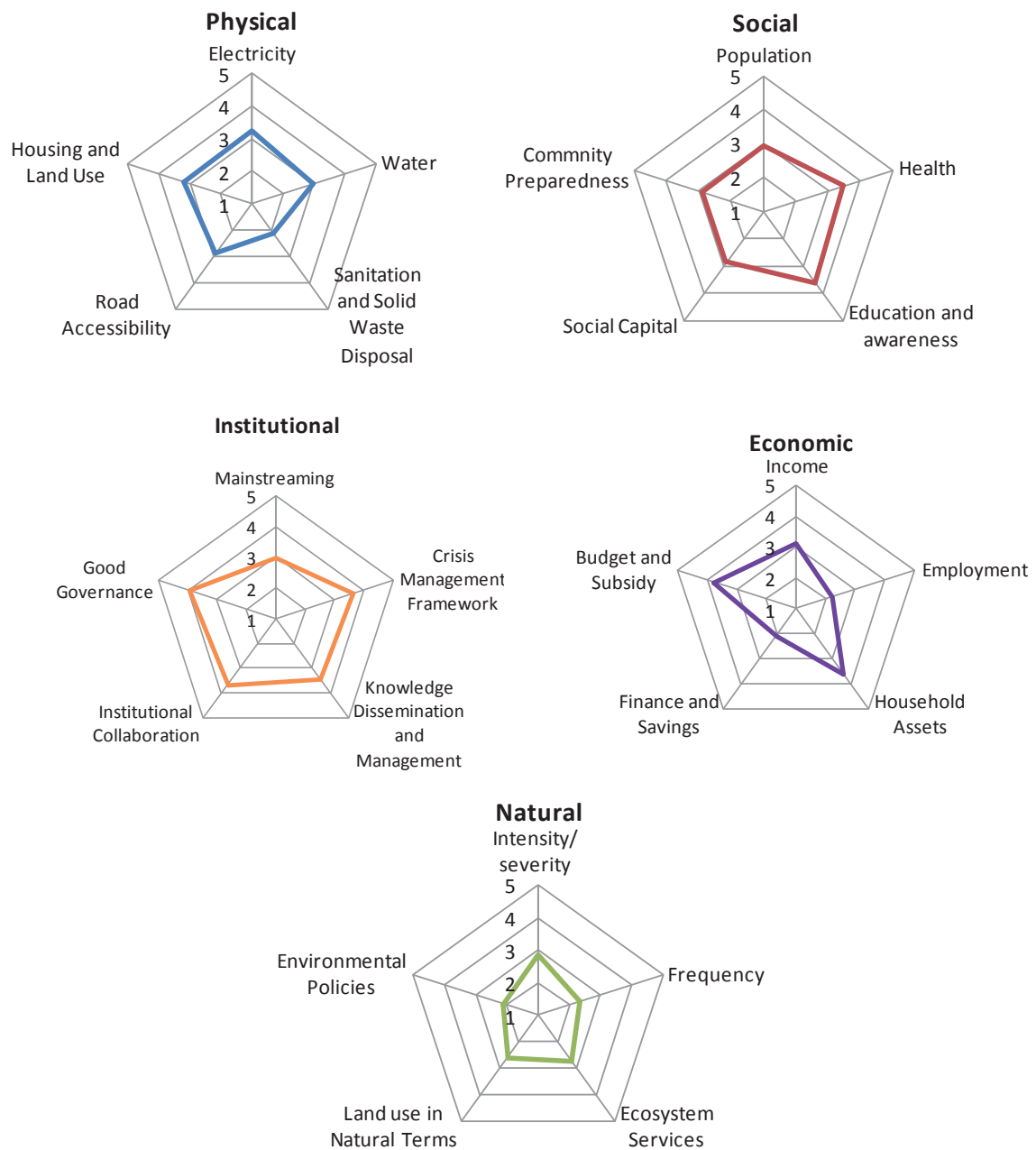


Fig. 3.7(a) Resilience Statuses of Kattumanarkoil Taluk in five dimensions

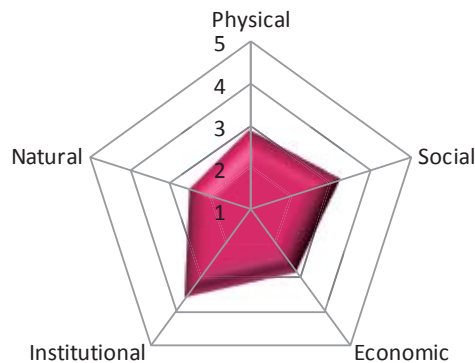


Fig. 3.7(b) Resilience Status of Kattumanarkoil Taluk

3.3.3 Status of Panruti Taluk

When overall resilience of the taluk is considered, resilience status is least for economic condition and highest for natural dimension of the taluk (Fig. 3.8(b)). At the same time, Fig. 3.8(a) shows detailed resilience status of each dimension and also has been explained below.

Physical resilience:

81-95% of households in the taluk have access to both electricity and water supply. Concerned authorities of taluk are capable of providing water and electricity about 51-75% its demand. 61-75% of population has access to hygienic sanitation facility. Only half to 65% of solid waste produced per day is being collected, moreover before dumping solid waste is not treated at all and only up to 10% of waste is being recycled. After a disaster, within 48 hours only around 25% of waste is being collected usually. During normal flooding, in affected areas half the percentage of roads remains accessible as well as after a heavy rainfall status of interruption is about 3 to 4 hours in those areas. 20 to 29% of the total housing in the taluk is non-permanent structures. About 61-70% percentage of houses have the plinth level of house above normal/ flood water logging level. Less than 12.4% of the population lives near polluted industry/ dumping ground/sea beach plant etc.

Social Resilience:

Among the total population of the taluk, up to 39% of population is under 14 and over 64. Moreover, population that live in slum area, urban informal settlement and urban poor areas is about 24.9%. Regarding health issues of the taluk, every year around 11% of the population suffers from water borne diseases, while following a disaster up to 5% of people use to suffer from waterborne diseases. Comparing to waterborne diseases, every year more people (17%) suffer from vector borne diseases. Taluk is good at its capacity of health facility to face emergency or hazardous situation. Taluk authority manages to organize public awareness programs/ disaster drill once every year. Functionality of schools after a disaster is also at its best. The participation rate of population in community activities is around 40%. While the ability of taluk communities to build consensus as well as to deliver shared interest and their opportunity to participate in the process of activities like making of development plans is medium. Regarding community preparedness, extent of households prepared in terms of logistics, materials is medium whereas people's participation in relief works, extent of support from NGOs/CBOs or religious organizations after a disaster is found good.

Economic Resilience:

Around 30% of the taluk population lives below poverty line. 74% of population depends only on one source for income as well as the average number of income source per household is one. If disasters occur, reduction in income for affected households is less than 11%. Employment situations in the taluk are like, 18% of the labour is unemployed in formal sector and 24% of youth is unemployed in formal sector. Along with that, of all employed women in the taluk 35% of women are employed in formal sector. The households are all occupied with assets like television, telecommunication (mobile phone) and vehicle. Half to 60% of households have furniture to secure key items like emergency food, money important documents, medicine etc. during disasters. Availability of credit facility of financial institutions in taluk to face or prevent disaster is good and around half the households have saving practice. Up to 24% of houses are also under (any sort of) insurance scheme. Even though Panruti is not prone to severe disasters, 3% of annual budget of taluk targets on disaster risk management and budget for climate change related disaster risk reduction measures is also medium. Moreover the availability of subsidies/ incentives for residents to receive/ provide alternative livelihood during a disaster is good.

Institutional Resilience:

Capacity (logistics, materials (technical)) of Panruti taluk to produce development plan is medium while ability or manpower to produce development plans is good. Like that, incorporation of disaster management plan in taluk is good but incorporation of DRR and climate change adaptation measures in taluk development plans is only medium. Considering the effectiveness of taluk's crisis management framework, existence and effectiveness of emergency team during a disaster is good. Efficiency of trained emergency workers during a disaster is just medium while the existence and readiness of alternative decision making personnel is at its best status. Disaster training programmes are available once or twice a year regularly for emergency workers; for communities, existence of awareness programmes (disaster education) is found to be good. Regarding knowledge dissemination, capacity (leaflets, manpower, campaigns) of taluk is just medium. During a disaster, good networking/collaboration exists with neighbouring taluks for emergency management; moreover, cooperation of taluk officials for emergency management during disaster is in its best status. Institutional collaboration of taluk with NGOs and private organizations is good during a disaster. Considering overall governance, disaster drills are done once every year, both promptness to disseminate emergency information to communities and transparency to disseminate accurate emergency information is medium during disasters.

Natural Resilience:

Severity of hazards such as flood, cyclones, heat waves, droughts (water scarcity) are normal. However flood, heat waves and water scarcity occur with a frequency of once every five years. Being a taluk known for its agricultural production taluk soil is good in its quality, while quality of other ecosystem services like air, water, biodiversity are medium. Around 26% of taluk area is vulnerable to climate related hazards however; there is no settlement located on hazardous ground (steep slope, flood prone area) that are vulnerable to exposure of hazards. Even though, over the last 50 years, up to 40% of green space has been lost due to development of infrastructure housing. Extent of use of hazard maps in development activities is only medium. Environment conservation regulations are best reflected in development plans and the extent of implementation is also good.

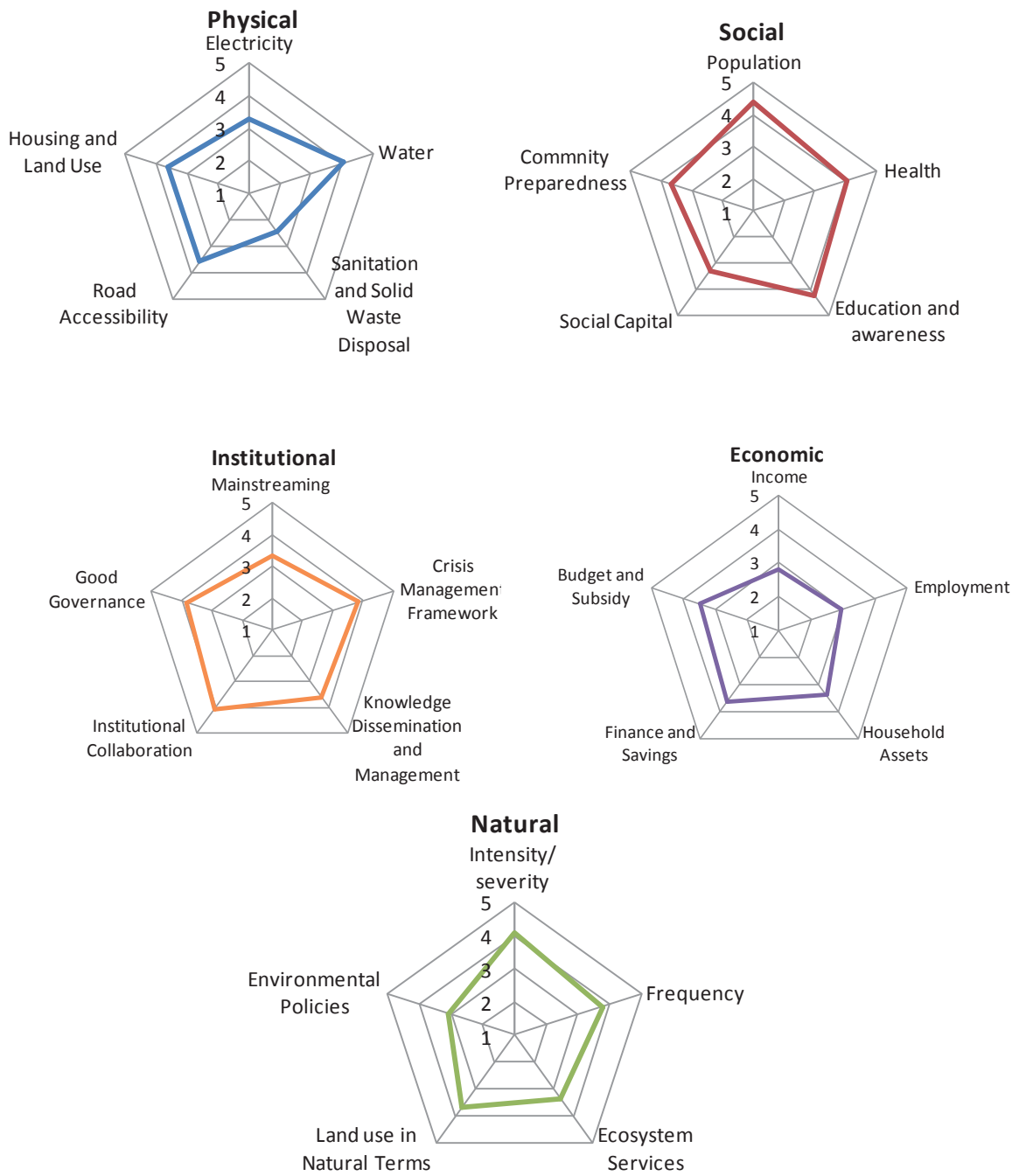


Fig. 3.8(a) Resilience Statuses of Panruti Taluk in five dimensions

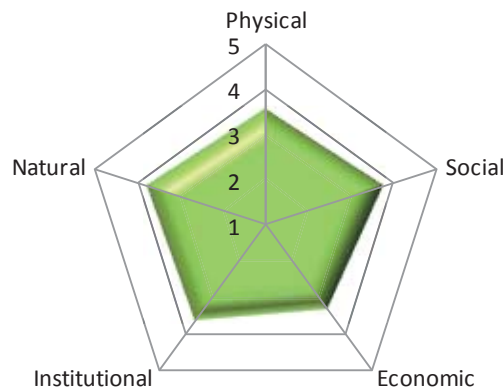


Fig. 3.8(b) Resilience Status of Panruti Taluk

3.3.4 Status of Tittakudi Taluk

When overall resilience of the taluk is considered, resilience status is highest for institutional setup in the taluk and least in its economic dimension (Fig. 3.9(b)). At the same time detailed resilience status of each dimension has been explained below and in Fig. 3.9(a).

Physical resilience:

Access to both electricity and water is there in 81-95% of households of taluk. In both the cases, respective authorities of taluk are capable of providing water and electricity more than 75% of its demand. Hygienic sanitation facility is accessible to up to 60% population. Only half the solid waste produced per day is being collected, moreover, before dumping solid waste is not treated at all and only up to 10% of being recycled. Like that, within 48 hours after a disaster like flood, cyclone etc. only up to 10% of waste gets collected. Less than 40% of roads remain accessible during normal flooding, in affected areas, even after a heavy rainfall interruption occurs for about 3-4 hours in those areas. The taluk has up to 30% of its roads have roadside covered drains. Around 19% of the total housing in the taluk is non-permanent structures. Less than half the percentage of houses is above normal/ flood water logging level also less than 12.4% of the population live near polluted industry/ dumping ground/sea beach plant etc.

Social Resilience:

Among the total population of the taluk, around 46% population is under 14 and over 64. More important thing to be noticed is up to 25 - 37.4% of total population live in slum area, urban informal settlement or in urban poor areas. Regarding health issues of the taluk, every year around 23% of the population suffer from water borne diseases, while after a disaster up to 5% of people suffer from waterborne diseases. Comparing to waterborne diseases taluk shows a lesser rate of population (11%) suffer from vector borne diseases every year. The taluk has good health facility in facing emergency or hazardous situation. Taluk authority organizes public awareness programs/ disaster drill once every year while functionality of schools after a disaster is medium. Around 40% of population usually participates in community activities. In addition, the ability of taluk communities to build consensus as well as to deliver shared interest and their opportunity to participate in the process of activities like making of development plans is medium. Regarding community preparedness, extent of households prepared in terms of logistics, material and extent of support from NGOs/CBOs or religious organizations after a disaster are medium. Similarly, the participation of taluk population in relief works is also medium after a disaster.

Economic Resilience:

The taluk population living below the poverty line is around 40%. Not surprisingly, almost 99% depend only on one source for their income as well as per household average number of income source is one. Disasters results an income reduction of less than 11%, in affected households. When employment situation of the taluk is taken, more than 25% of labour is unemployed in formal sector, and also, 24% of youth is unemployed in formal sector and among all the employed women, only less than 20% is employed in formal sector. Almost all households are occupied with household assets like television, telecommunication (mobile phone) but households having furniture to secure key items like emergency food, money important documents, medicine etc. during disasters is less than half the population. Credit facility available in financial institutions of taluk to face or prevent disaster is medium and also only up to 20% of households have saving practice. Similarly, only up to 10 % of houses are under any sort of insurance scheme. From the available annual budget of taluk about 2% targets disaster risk management and sufficiency of fund for climate change related disaster risk reduction measures is medium. Moreover the availability of subsidies/ incentives for residents to receive/ provide alternative livelihood during a disaster is also good.

Institutional Resilience:

Capacity (logistics, materials (technical)) to produce development plan, incorporation of DRR and climate change adaptation in development plans as well as incorporation of disaster management plan can be found medium in the taluk. In addition, extent of community participation in development plan preparation process is also medium. Considering the effectiveness of taluk's crisis management framework, effectiveness of emergency team during a disaster is maintaining its best possible status. Both efficiency of trained emergency workers during a disaster and existence and readiness of alternative decision making personnel are found good. Once or twice a year regularly, for emergency workers disaster training programmes are available and for communities good level of awareness programmes (disaster education) are available in taluk. Taluk has good capacity (leaflets, manpower, campaigns) in knowledge dissemination. During disasters, taluk maintains a good collaboration/networking with neighbouring taluk's for emergency management as well as maintains a good cooperation among taluk officials for emergency management. Institutional collaboration of taluk with NGOs and private organizations is medium. Overall governance of taluk can be found maintaining a good status, by conducting disaster drills once every year, by being good at the promptness to disseminate emergency information to communities as well as keeping transparency in disseminating accurate emergency information during disasters.

Natural Resilience:

Severity of hazards such as flood, cyclones, heat waves, droughts (water scarcity) are found normal in taluk. Taluk gets affected by floods, cyclone, and heat waves less than every five years and water scarcity occur with a frequency of once every five years. Average quality of ecosystem services air, soil, biodiversity is showing poor quality. Up to 25% of taluk area is vulnerable to climate related hazards, however, less than 10% of settlements locate on hazardous ground (steep slope, flood prone area) that are vulnerable to exposure of hazards. Furthermore, over the last 50 years, up to 20% of taluk's green space has been lost due to development of infrastructure housing. Taking environmental policies of taluk into consideration, extent of use of hazard maps in development activities is medium. In the case of environment conservation regulations, the extent reflected in development plans as well as its implementation is medium. Mitigation policies to reduce air pollution are still poor.

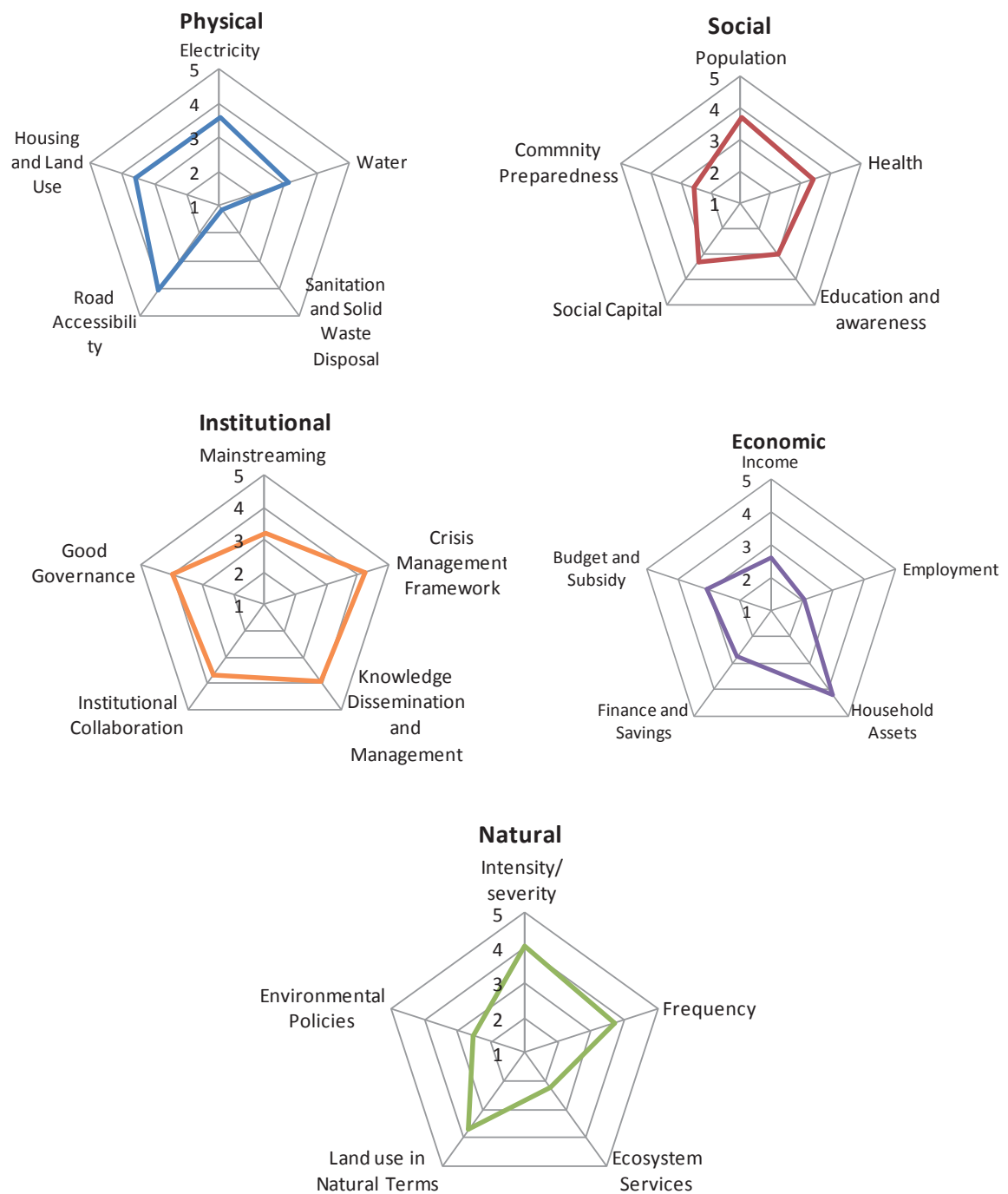


Fig. 3.9(a) Resilience Statuses of Tittakudi Taluk in five dimensions

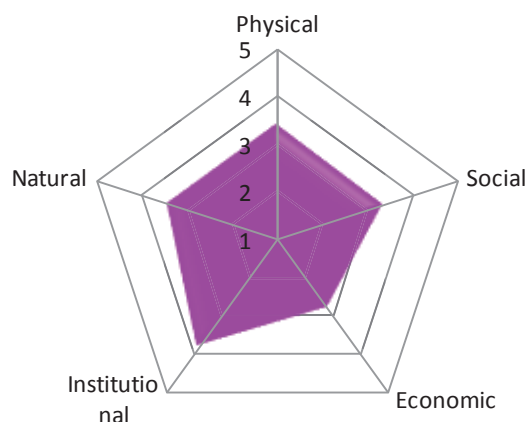


Fig. 3.9(b) Resilience Status of Tittakudi Taluk

3.3.5 Status of Chidambaram Taluk

When overall resilience of the taluk is considered, resilience status is above average for physical and institutional dimension while natural dimension is showing the least resilience status (Fig. 3.10(b)). At the same time detailed resilience status of each dimension has been explained below and in Fig. 3.10(a).

Physical resilience:

In Chidambaram taluk, households having access to electricity is around 96-100% while access to potable water supply is only around 66 to 80%. The concerned authority is capable of providing electricity to its 51-75% demand, though; capability is only half the demand in the case of water supply. Hygienic sanitation facility access by the population is really important but only up to 40% have its access. 65% of the solid waste produced per day is being collected, although before dumping solid waste is not treated at all and only up to 10% of it is being recycled. Usually, after a disaster like flood, cyclone etc. only about half the solid waste gets collected within 48 hours. During normal flooding, in affected areas half the percentage of roads is only accessible whereas after a heavy rainfall interruption occurs for about 5-8 hours in those areas. Out of total housing in the taluk around 29% is non-permanent structures. Still, up to 60% of houses have plinth level above normal/ flood water logging. 37.4% of the population lives near polluted industry/ dumping ground/ sea beach plant etc.

Social Resilience:

In the taluk, population under 14 and over 64 comprises of around 32% of total population. Moreover, 25 - 37.4% of total population lives in slum area or urban informal settlement or urban poor areas. While taking health issues of the taluk, every year 17% of the population suffers from vector borne diseases and around 23% suffer from water borne diseases. In addition, following a disaster about 17% of people are found suffering from waterborne diseases. Taluk holds a medium capacity of health facility to face emergency or hazardous situation. Taluk authority manages to organize public awareness programs/ disaster drill once every year and after a disaster, functionality of schools in taluk is of medium level. In community activities, generally about 40% of taluk population participates. Along with this, the ability of taluk communities to build consensus as well as to deliver shared interest and their opportunity to participate in the process of activities like making of development plans is medium. In the case of community preparedness, extent of households prepared in terms of logistics, material and extent of support from NGOs/CBOs or religious organizations after a disaster are medium. Similarly, participation of taluk population in relief works can be also found medium after a disaster.

Economic Resilience:

More than 40% of the taluk population lives below the poverty line. If source of income is taken, it can be seen that up to 74% of people depends only on one source for income as well as average number of income source per household is only one. Due to disasters, in affected households about 40% of income usually can be seen getting reduced. Considering the employment situations, more than 25% of labour is unemployed in formal sector. But at the same time 24% of the total youth is unemployed in formal sector and only less than 20% of women is employed in formal sector. Much of the households (more than 80%) are occupied with household assets like television, telecommunication (mobile phone) and 60% of households have furniture to secure key items like emergency food, money important documents, medicine etc. during disasters. Availability of credit facility of financial institutions in taluk to face or prevent disaster is medium and only up to 20% of households have saving practice. Houses under any sort of insurance scheme are also less which is about 16% of all households. Even though being a coastal taluk that gets affected much by cyclonic depressions that occur every year, only around 3% of taluk annual budget targets on disaster risk management and sufficiency of budgetary funds for climate change related disaster risk reduction

measures is medium. Moreover the availability of subsidies/ incentives for residents to receive/ provide alternative livelihood during a disaster is also medium.

Institutional Resilience:

The taluk shows a medium level status in capacity (logistics, materials (technical)) to produce development plan as well as incorporation of DRR and climate change adaptation in development plan as well as incorporation of disaster management plan. At the same time, when the effectiveness of taluk's crisis management framework is considered, existence and effectiveness of emergency team during a disaster is maintaining a good status. Efficiency of trained emergency workers during a disaster is found to be medium but the existence and readiness of alternative decision making personnel is found good. Once or twice a year regularly, disaster training programs are available for emergency workers but existence of awareness programmes (disaster education) for communities as well as capacity (leaflets, manpower, campaigns) of taluk regarding knowledge dissemination is just medium. During a disaster, the taluk's collaboration with neighboring taluks for emergency management, cooperation of taluk officials for emergency management and institutional collaboration of taluk with NGOs and private organizations are all found to be medium. Overall governance of taluk can be found to be maintaining a good status, by having disaster drills once every year and being good at the promptness to disseminate emergency information to communities and in the transparency to disseminate accurate emergency information during disasters.

Natural Resilience:

Severity of hazards such as flood and cyclones are severe but other hazards that affect the taluk like heat waves, droughts (water scarcity) are of normal severity. However, all these hazards usually occur with a frequency of once per year. Ecosystem services like soil, air, water biodiversity as well as salinity all can be found maintaining a medium quality in the taluk. About 26-50% of taluk area is vulnerable to climate related hazards moreover, 26-50% of settlements also locate on hazardous ground (steep slope, flood prone area) that are vulnerable to exposure of hazards. Adding to this, 21-40% of green space has been lost due to development of infrastructure housing over the last 50 years. Taking policies into consideration, it can be seen that besides being a coastal taluk which has high frequency of hazards, extent of use of hazard maps in development activities are only medium. In the case of environment conservation regulations, the extent reflected in development plans is medium but the extent of implementation is poor.

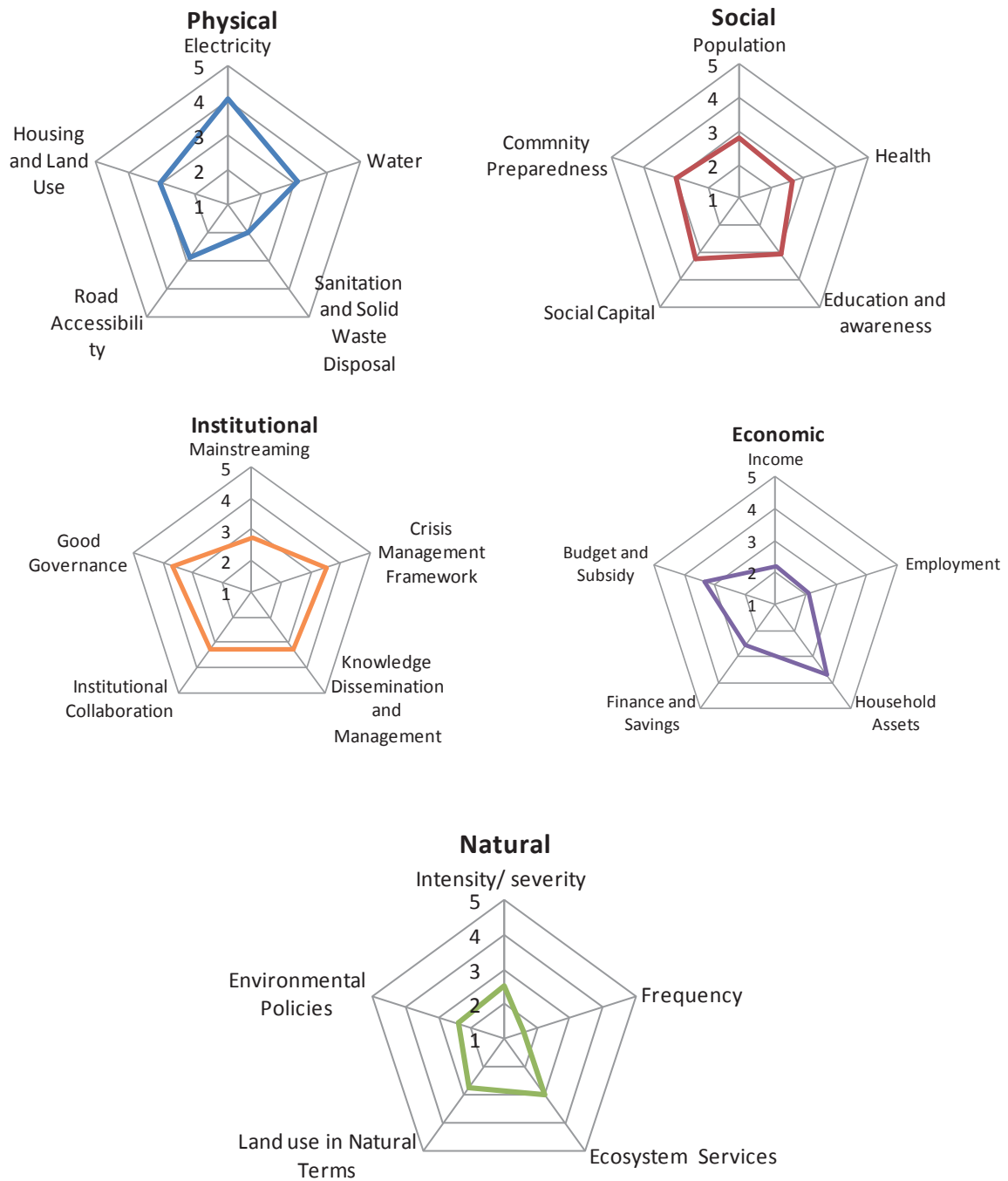


Fig. 3.10(a) Resilience Statuses of Chidambaram Taluk in five dimensions

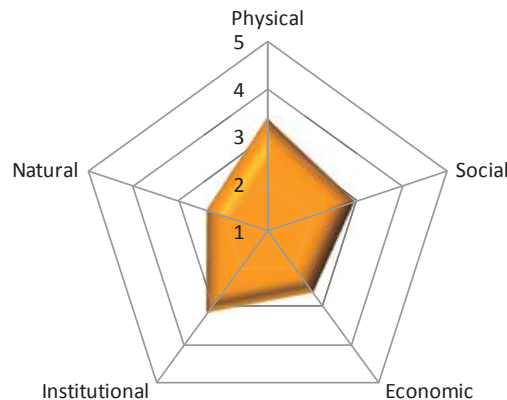


Fig. 3.10(b) Resilience Status of Chidambaram Taluk

3.3.6 Status of Cuddalore Taluk

When overall resilience of the taluk is considered, resilience status can be found above average for all the dimensions except for natural dimension (Fig. 3.11(b)). At the same time detailed resilience status of each dimension has been explained below and in Fig. 3.11(a).

Physical resilience:

96-100% households in the taluk have access to electricity and 81-95% has access to water supply. In both the cases, respective authorities of taluk are capable of providing 51-75% of demand of water and electricity. Sanitation and waste disposal conditions are not found to be good in the taluk. Only, 41-60% of population has access to hygienic sanitation facility. Regarding waste disposal, only about half the solid waste produced per day is being collected, more than that before dumping solid waste is not treated at all and only up to 10% of waste is being recycled. Usually, about half of the waste is collected within 48 hours after a disaster like flood, cyclone etc. During normal flooding, in affected areas less than 40% of roads remain accessible and after a heavy rainfall status of interruption occurs for about 9-12 hours in those areas. Furthermore, 16-30% of roads have roadside covered drains. Out of total housing in the taluk, 10-9% are non permanent structures. Only less than half the percentage of houses has their plinth level above normal/ flood water logging level. Moreover, almost half the population lives in proximity to polluted industry/ dumping ground/ sea beach plant etc.

Social Resilience:

When age distribution of the taluk is taken, it can be seen that the people are under 14 and over 64 consist of 40-46%. More importantly, almost half the population lives in poor living conditions like slum area or urban informal settlement or urban poor areas. Regarding health issues of the taluk, every year around 23% of the population suffers from water borne diseases, while following a disaster about 11% of people use to suffer from waterborne diseases. Comparing to waterborne diseases taluk shows a lesser rate of (11%) population that suffers from vector borne diseases every year. Presently, the taluk is good in its capacity of health facility face emergency or hazardous situation. Along with this, taluk authority is efficiently managing to organize public awareness programs/ disaster drill once every year and even functionality of schools after a disaster is good. The extent of participation of taluk population in community activities is up to 40%. The opportunity of taluk communities to participate in the process of activities like making of development plans is good while their ability to build consensus as well as to deliver shared interest is just medium. In the case of community preparedness, extent of households prepared in terms of logistics, material as well as people's participation in relief works after a disaster is of medium level. At the same time, extent of support extended by NGOs/CBOs or religious organizations after a disaster is appreciably, good.

Economic Resilience:

Differing from all the other taluks, Cuddalore taluk has least population that live below poverty line which is only 11%. But surprisingly as well as similar to other taluks, 75-99% depends only on one source for income as well as average number of source per household is also one. Due to disasters, about 40% of income gets reduced for affected households. Coming to employment situations, more than 25% of labour is unemployed in formal sector. Among total youth in the taluk, 24% are unemployed in formal sector and in formal sector only less than 20% of women are employed. Much of the households are occupied with household assets like television, telecommunication (mobile phone) but only less than half the percent of households are occupied with furniture to secure key items like emergency food, money important documents, medicine etc. during disasters. The taluk has a medium level of availability of credit facility in financial institutions to face or prevent disaster, but when it comes to saving practice of households, only about 20% have saving practice. Adding to this, only 10 % of houses are under any sort of insurance scheme. Being a

coastal taluk that witnesses various climate related hazards, more than 3% of annual budget targets on disaster risk management and there is good amount of funds that targets on climate change related disaster risk reduction measures. The taluk is also maintaining a good status in the availability of subsidies/ incentives for residents to receive/ provide alternative livelihood during a disaster.

Institutional Resilience:

Capacity (logistics, materials (technical)) to produce development plan as well as extent of community participation in development plan preparation process is medium. Meanwhile, the ability (manpower) to produce development plan incorporation of DRR and climate change adaptation in those plans and incorporation of disaster management plan in the taluk is maintaining a good status. Considering the effectiveness of taluk's crisis management framework, existence and effectiveness of emergency team during a disaster and likewise existence and readiness of alternative decision making personnel is at its best. Efficiency of trained emergency workers during a disaster is also found good. More than twice a year regularly, disaster training programs are made available for emergency workers at the same time; awareness programmes (disaster education) for communities also exist in a good level. Still, capacity (leaflets, manpower, campaigns) for knowledge dissemination is just medium in taluk. The overall status of institutional collaboration with other organizations and stakeholders seems to be efficient in Cuddalore taluk. Here, during disaster events, collaboration with neighboring taluk's for emergency management, cooperation of taluk officials for emergency management including institutional collaboration of taluk with NGOs and private organizations are at its best. Overall governance of taluk can also be found to be maintaining a good status, by having disaster drills once every year and being good at the promptness to disseminate emergency information to communities and by maintain good level of transparency to disseminate accurate emergency information during disasters.

Natural Resilience:

Being a coastal taluk of the coastal district, taluk shows severe intensity and medium intensity towards various hazards. Among the hazards that affect the taluk, flood and cyclones shows severe intensity whereas, intensity or severity is medium in the case of heat waves and towards water scarcity (drought). Same with the case of severity, in frequency of occurrence also cyclone, flood shows higher level by occurring more than once per year. Like that, heat waves and water scarcity shows comparatively lesser frequency than that of floods and cyclone with the probability of

occurrence only once per year. Similarly, condition ecosystems services are also having a bad condition. Among them, soil quality is very poor, quality of air, biodiversity as well as salinity issues are poor in the taluk. Comparing to other ecosystem services, quality of water is maintaining a medium quality. In area, about half to 75% of taluk is vulnerable to climate related hazards, furthermore, the situation is more worse as more than half the percent of the settlements are located on hazardous ground (steep slope, flood prone area) that are vulnerable to the exposure of hazards. Adding to this, more than 40% of green space has been lost due to development of infrastructure housing over the last 50 years. Taking policies into consideration, taluk maintains to use hazard maps in development activities to a good extent. In the case of environment conservation regulations, the extent reflected in development plans is medium but, the extent of implementation of mitigation policies to reduce air pollution, which is a major problem under present period of time around the globe, is further poor.

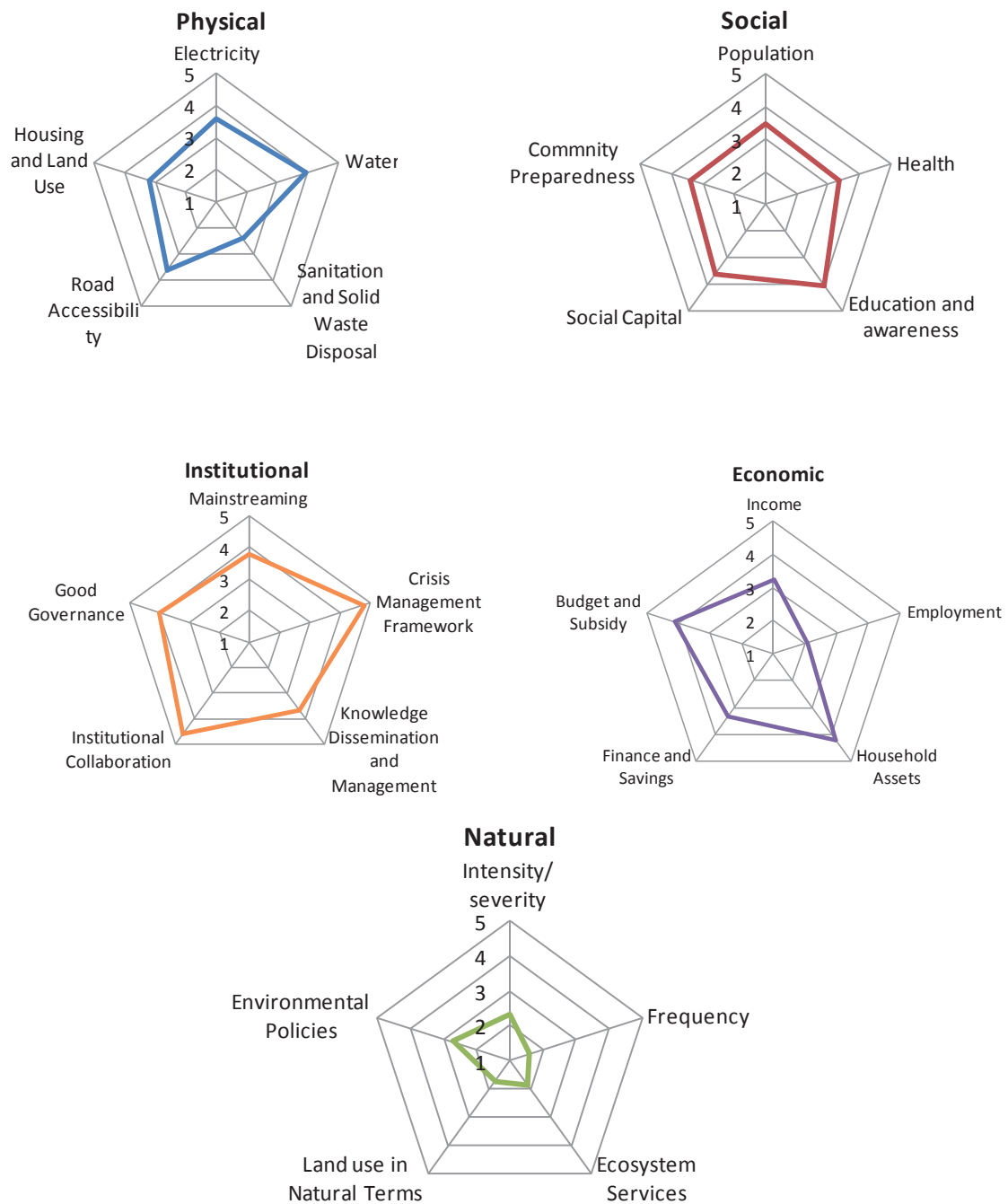


Fig. 3.11(a) Resilience Statuses of Cuddalore Taluk in five dimensions

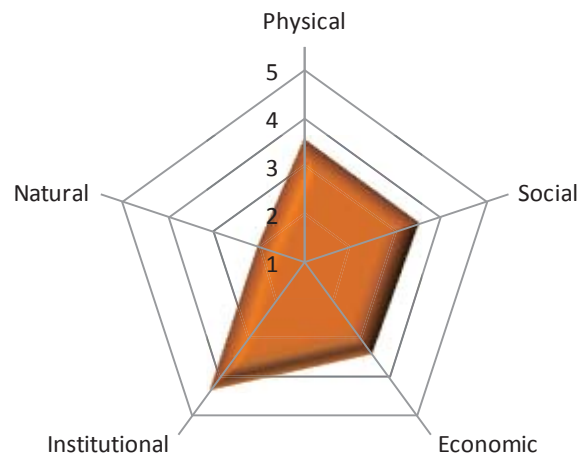


Fig. 3.11(b) Resilience Status of Cuddalore Taluk

“Ninety percent of the disaster victims worldwide live in developing countries where poverty and population pressures force growing numbers of poor people to live in harm’s way on flood plains, in earthquake prone zones and on unstable hillsides. Unsafe buildings compound the risks. The vulnerability of those living in risk prone areas is perhaps the single most important cause of disaster casualties and damage (Secretary General of the United Nations, Kofi Annan, 1999). These all elements that increase the risk can be seen present in Cuddalore taluks from the assessment.

3.3.7 Taluk Wise Resilience Distribution Pattern

An overview on distribution pattern of various types of resilience (physical, social, economic, institutional and natural) has been described here with the help of Table 3. 5 and Fig. 3.12 (a, b, c, d, e, f).

Table 3.5 Taluk wise Resilience Score

Name of Taluk	Physical Resilience	Social Resilience	Economic Resilience	Institutional Resilience	Natural Resilience	Overall Resilience
Chidambaram	3.31	2.91	2.62	3.14	2.31	2.85
Panruti	3.51	3.72	3.31	3.61	3.72	3.57
Kattumanarkoil	2.83	3.23	2.84	3.55	2.49	2.98
Virudhachalam	3.02	3.02	1.91	3.19	2.59	2.74
Cuddalore	3.50	3.50	3.39	4.31	2.00	3.34
Tittakudi	3.39	3.30	2.78	3.78	3.36	3.32

Table 3.5 shows the resilience score of each parameter and the overall resilience score obtained for each taluk. As scoring was done with a 1 to 5 scale values closer to 1 defines lower resilience and values closer to 5 defines a better resilience. The highest score obtained is 4.31 for institutional resilience of Cuddalore taluk. At the same time, the lowest resilience score (2) obtained is also for Cuddalore taluk for its natural resilience. The reason for this is mainly because of its high intensity and frequency of disasters along with poor land use management comparing to other taluks. The Table 3.5 also shows from the resilience scores obtained that, though both Cuddalore and Chidambaram taluks are coastal taluks with high frequency as well as intensity of disasters and having the lowest score for natural resilience (2 for Cuddalore and 2.31 for Chidambaram) comparing to other taluks, their overall resilience score is quite different. Cuddalore taluk is second highest in overall resilience score of all taluks while Chidambaram is having the least overall resilience among the 6 taluks. This emphasizes that, even if a place/ region is having high frequency and intensity of disasters, efforts in maintaining a sound condition of other attributes that also play a role in deciding the resilience (like social, economic, physical and institutional dimensions) will help in assuring a better overall resilience of that particular place/region.

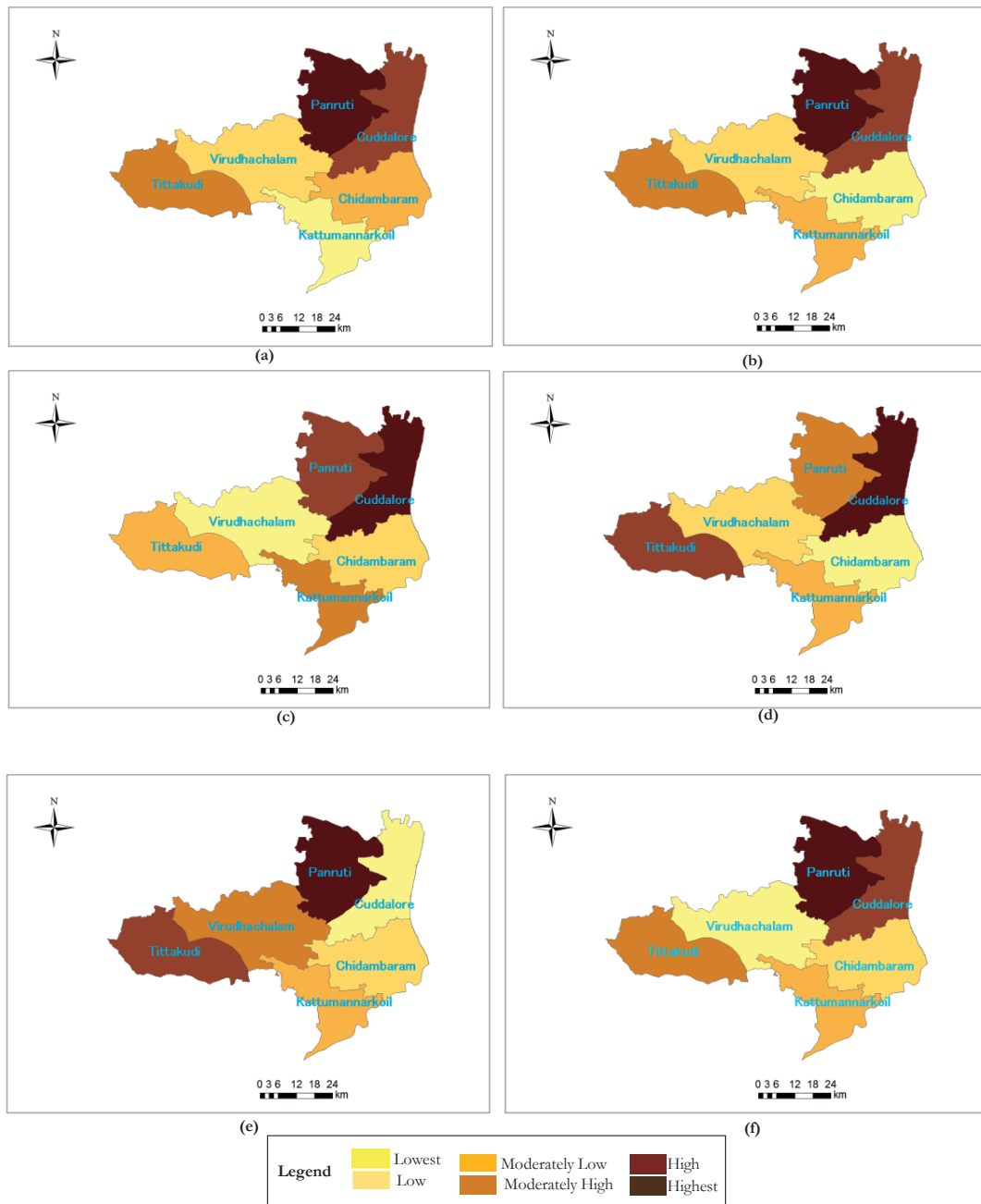


Fig. 3.12 Spatial Distribution pattern of Resilience ((a) Physical, (b) Social, (c) Economic, (d) Institutional, (e) Natural, (f) Overall)

Based on the resilience score, spatial distribution pattern of resilience obtained has been given in Fig. 3.12((a), (b), (c), (d), (e), (f)). The figure helps in understanding clearly, the level of resilience of taluk in each dimension (in a scale varying from highest to lowest). As maps are effective in

communicating the results, this can help decision makers, policy makers, concerned authorities in understanding the prevailing situation of each place and to take actions accordingly.

3.4 Disaster Risk Reduction Issues in the District

Emphasizing more on to the DRR measures in developing countries, through a better and proper implementation as well as management can actively contribute to preparedness and mitigation efforts. This approach, thus in long run can lessen the vulnerability of citizens and the severity of impacts they have to face in future. Considering this into account, apart from trying to assess the disaster resilience status of Cuddalore district, apparently it was also tried to find out the perceptions of respondents who work in various organizations (that directly or indirectly related to disaster reduction and management of the district) on major DRR issues and the support that are needed further for a better execution of DRR measures in the district. Thus, a questionnaire survey was done with a total of 34 respondents.

United Nations International Strategy for Disaster Reduction (UNISDR) defines Disaster Risk Reduction (DRR) as the concept and practice of reducing disaster risks through systematic efforts to analyze and manage the causal factors of disasters, including through reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events (UNISDR, 2009). Developed countries which have modern early warning systems and effective mitigation programs are able to reduce the impact of natural hazards whereas countries with less preparedness and inadequate mitigation efforts suffer more from natural hazards (Sharma and Khanna, 2013).

As an effort towards emphasizing the significance of better deployment of DRR in the district, the survey conducted tried to assess the major underlying causes of disaster, major actors in DRR, major roles of Local Government and NGOs as well as support needed for Local Government.

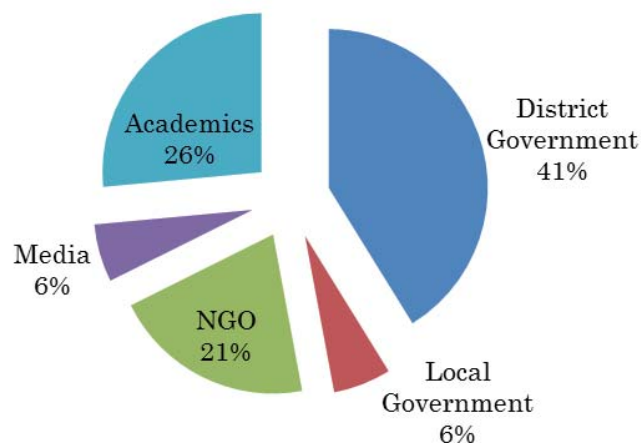


Fig. 3.13 Organizations to which respondents belong

Fig. 3.13 shows that the majority of the responders were district Government officials (41.00%), second major responders were from academia sector (26.00%), NGO officials contributed 21.00% and the least participation were by Local Government and Media (both 6.00%)

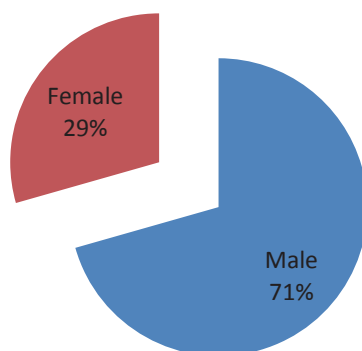


Fig. 3.14 Gender of respondents

If we categorize the respondents gender wise, majority of the participants were male (71%), while female had a representation of 29% (Fig. 3.14). One of the major reasons for the low participation

of female is that, as seen from CDRI results, percentage of working female (especially in formal sector) is much less comparing to that of men.

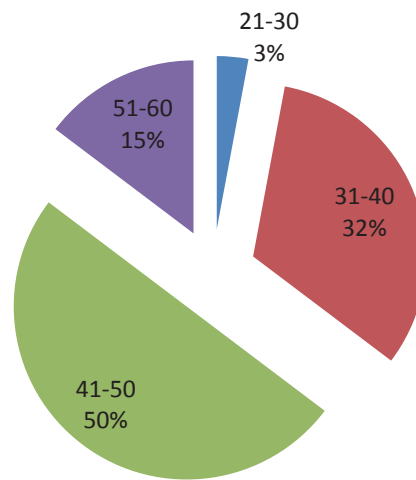


Fig. 3.15 Age of respondents

Upon age wise categorization, Fig. 3.15 shows that the half percentage of the respondents was of 41-50 age group, while respondents who belonged to the age group of 21-30 years were least in number (only 3%).

3.4.1 Methodology

Statistical software SPSS was used for analysis where, factor analysis with a principal component extraction method with varimax rotation was employed. Kaiser-Meyer-Olkin (KMO) was applied to check the sample adequacy (values below 0.50 is unacceptable and value above 0.9 is marvelous) and Bartlett's test for sphericity to check statistical significance (should be less than 0.05) and thus appropriateness of factor analysis was confirmed. If there is statistical significance then, it means we can pull out factors i.e. there are interconnection between variables. Reliability test to check internal consistency of items used in questionnaire is checked using Cronbach alpha reliability test and if the value comes in a range of 0.7 to 0.9 can be considered reliable. As per the procedure, after extraction if the value is less than 0.4 means the respective variables representing them have no meaning so those variables have to be avoided/ excluded. In all the cases explained below all values are above

0.4. Thus none of the variables were eliminated from the questions. If the variables for assessment are above 7 in number, factor related grouping is usually preferred. Principal component factor analysis is the method used here for grouping the variables or elements under assessment. Thus the purpose of principal component is to explain most of the variance as possible using few components as possible. The number of components having 'Total' (Initial Eigenvalues) > 1 is taken as group i.e. if 3 components have 'Total' (Initial Eigenvalues) > 1, then 3 groups will be formed based on those factors Eigen value less than 1 means, they don't explain much variance. There by, this method reduces complexity of data set by reducing the number of dimension without much loss of information (Ionita and Schiopu, 2010).

3.4.2 Major Underlying Causes to Disaster

Table 3.6(a) shows that all the values (extraction communalities) after extraction are above 0.4 thus none of the components were eliminated. KMO value obtained is 0.74 and significance of Bartlett's test of sphericity is 0.00 showing the appropriateness of the sample. The reliability test result value obtained was 0.869. As the variables for assessment are above 7 in number grouping is preferred. As the number of components having 'Total' (Initial Eigenvalues) > 1 is 4, so 4 factor based groups were formed by default (Table 3.6(b)). The total variance explained is 71.593% As per respondent's perception, the major underlying causes of disasters are represented by the group with highest mean (here, Group 2) (Table 3.6(d)). Thus the underlying causes are Lack of knowledge and skills to implement DRR, Lack of mitigation measures, Lack of mainstreaming DRR into development policy and Lack of disaster preparedness capacity (Table 3.6(c)).

Table 3.6(a) Extraction Values of Variables

	Initial	Extraction
Lack of coordination mechanism	1.000	.698
Lack of disaster management law and policy	1.000	.723
Lack of budget allocation	1.000	.534
Lack of early warning system	1.000	.795
Lack of risk assessment and identification	1.000	.618
Lack of public awareness and DRR education	1.000	.778
Lack of knowledge and skills to implement DRR	1.000	.643
Lack of mitigation measures	1.000	.725
Lack of mainstreaming DRR into development policy	1.000	.712
Lack of land-use planning	1.000	.757
Lack of environment management	1.000	.700
Lack of preparedness and contingency plan	1.000	.798
Lack of disaster preparedness capacity	1.000	.826

Note: Extraction Method: Principal Component Analysis

Table 3.6(b) Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared loadings		
	Total	Variance %	Cumulative %	Total	Variance%	Cumulative %	Total	Variance %	Cumulative %
1	5.423	41.717	41.717	5.423	41.717	41.717	2.798	21.521	21.521
2	1.640	12.619	54.336	1.640	12.619	54.336	2.690	20.696	42.217
3	1.205	9.268	63.604	1.205	9.268	63.604	2.373	18.255	60.471
4	1.039	7.989	71.593	1.039	7.989	71.593	1.446	11.122	71.593
5	.951	7.312	78.905						
6	.554	4.264	83.169						
7	.522	4.017	87.187						
8	.501	3.857	91.044						
9	.425	3.271	94.314						
10	.292	2.248	96.562						
11	.194	1.490	98.052						
12	.155	1.196	99.248						
13	.098	.752	100.000						

Note: Extraction Method: Principal Component Analysis

Table 3.6(c) Rotated Component Matrix^a

	Component (Groups)			
	1	2	3	4
Lack of coordination mechanism			.805	
Lack of disaster management law and policy			.733	
Lack of budget allocation	.437		.486	
Lack of early warning system	.521		.621	
Lack of risk assessment and identification	.717			
Lack of public awareness and DRR education	.836			
Lack of knowledge and skills to implement DRR		.699		
Lack of mitigation measures	.498	.643		
Lack of mainstreaming DRR into development policy		.821		
Lack of land-use planning				.808
Lack of environment management		.436		.664
Lack of preparedness and contingency plan	.559	.505	.465	
Lack of disaster preparedness capacity	.640	.641		

NOTE: Extraction Method: Principal Component Analysis.
 Rotation Method: Varimax with Kaiser Normalization.
 a. Rotation converged in 8 iterations.

Table 3.6(d) Descriptive statistics

Factors	Mean	Standard Deviation
Group 1	3.03	.87
Group 2	3.21	.77
Group 3	2.96	1.00
Group 4	3.13	.92

3.4.3 Major Actors in DRR

Organizational flexibility, informal work style, and close engagement with grassroots communities enable NGOs to deliver services to people at lower costs (Behera, 2002). This makes NGOs one of the best actors of DRR. At the same time, NGO should do work side by side with government, private sector, the press and other DRR actors so that all efforts of reducing disaster risk will be more effective and efficient in the future (Verayanti, 2011). While, by adoption of new technologies, tools and sharing of good practices by local governments can go a long way to reduce risk in those communities (UNISDR, 2009). Considering the potential of media (press) sectors in bringing huge positive transformations in DRR sector (if used properly); as Hatchuel (2002) has mentioned the importance of government and other organizations maintaining good relations with the press cannot be underestimated.

Table 3.7(a) shows that all the values after extraction are above 0.4 thus none of the components were eliminated. KMO value is 0.700 and significance level of Bartlett's test is 0.00. The Cronbach's Alpha reliability test result value is 0.837 thus confirming reliability. As the number of components having 'Total' (Initial Eigenvalues) > 1 is 3, so 3 groups will be formed (Table 3.7(b)). Total variance explained here is 68.829%. Table 3.7(d) shows Group 1 has the highest mean value among the three factor based groups formed, thus, the actors of DRR that comes under Group 1 represents the major actors of DRR as per respondents perception. So the major actors in DRR are National government, Local Government, Community Based Organizations (CBOs)/NGOs, Communities and Local Associations (Table 3.7(c)).

Table 3.7(a) Extraction Values of Variables

	Initial	Extraction
UN agencies	1.000	.750
International and regional organizations	1.000	.822
National Government	1.000	.765
Local Government	1.000	.704
CBOs/NGOs	1.000	.590
Academics	1.000	.655
Communities	1.000	.618
Private Sectors	1.000	.570
Media	1.000	.708
Local association constitution	1.000	.701

Note: Extraction Method: Principal Component Analysis.

Table 3.7(b) Total Variance Explained^a

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared loadings		
	Total	Variance %	Cumulative %	Total	Variance %	Cumulative %	Total	Variance %	Cumulative %
1	4.147	41.471	41.471	4.147	41.471	41.471	2.786	27.859	27.859
2	1.549	15.492	56.962	1.549	15.492	56.962	2.094	20.935	48.794
3	1.187	11.866	68.829	1.187	11.866	68.829	2.003	20.034	68.829
4	.840	8.396	77.225						
5	.644	6.435	83.661						
6	.472	4.716	88.376						
7	.404	4.040	92.417						
8	.357	3.567	95.984						
9	.237	2.374	98.357						
10	.164	1.643	100.000						

Note: Extraction Method: Principal Component Analysis

Table 3.7(c) Rotated Component Matrix^a

	Groups		
	1	2	3
UN agencies			.825
International and regional organizations			.886
National Government	.749		.451
Local Government	.835		
CBOs/NGOs	.657		
Academics		.685	.423
Communities	.705		
Private Sectors		.729	
Media		.766	
Local association	.632	.547	

NOTE: Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
^a. Rotation converged in 7 iterations.

Table 3.7(d) Descriptive statistics Mean and Standard Deviation

Factors	Mean	Standard Deviation
Group 1	3.97	.77
Group 2	3.62	.82
Group 3	3.58	.94

3.4.4 Major Roles of Local Government

Table 3.8(a) shows that all the values after extraction are above 0.4 thus none of the components were eliminated. KMO value and significance of Bartlett's test are 0.820 and 0.00 respectively. The reliability test result value is 0.938 as Cronbach's Alpha. As the variables/ components for assessment are 12 in number grouping is preferred (Table 3.8(b)). After analysis, 2 groups were

formed based on the 2 identified factors As the greatest mean value is shown by Group 1 (Table 3.8(d)) variables represented by Group 1 is considered as the major roles of Local Government. Therefore, major roles are Early Warning System and risk communication, Raise Awareness on DRR, Adopt DRR education into school curricula, Addressing needs of most vulnerable, Environment Management and Develop contingency/ location action plan (Table 3.8(c)).

Table 3.8(a) Extraction Values of Variables

	Initial	Extraction
Ensure local stakeholders involvement	1.000	.815
Establish coordination mechanism	1.000	.761
Ensure budget allocation for DRR	1.000	.741
Risk assessment and identification	1.000	.784
Early warning system and risk communication	1.000	.608
Capacity development for other local stakeholders	1.000	.482
Raise awareness on DRR	1.000	.725
Adopt DRR education into school curricula	1.000	.777
Address needs of most vulnerable	1.000	.745
Environment management	1.000	.815
Develop contingency/local action plan	1.000	.716
Ensure community has preparedness tools	1.000	.462

Note: Extraction Method: Principal Component Analysis

Table 3.8(b) Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	Variance %	Cumulative %	Total	Variance %	Cumulative %	Total	Variance %	Cumulative %
1	7.261	60.506	60.506	7.261	60.506	60.506	4.501	37.511	37.511
2	1.170	9.750	70.256	1.170	9.750	70.256	3.929	32.746	70.256
3	.898	7.481	77.737						
4	.640	5.334	83.071						
5	.511	4.256	87.327						
6	.376	3.135	90.462						
7	.332	2.768	93.230						
8	.300	2.497	95.727						
9	.194	1.621	97.348						
10	.151	1.259	98.607						
11	.091	.761	99.368						
12	.076	.632	100.000						

Note: Extraction Method: Principal Component Analysis

Table 3.8(c) Rotated Component Matrix^a

	Component	
	1	2
Ensure local stakeholders involvement		.889
Establish coordination mechanism		.817
Ensure budget allocation for DRR	.521	.685
Risk assessment and identification	.400	.790
Early warning system and risk communication	.656	.420
Capacity development for other local stakeholders	.429	.545
Raise awareness on DRR	.762	
Adopt DRR education into school curricula	.819	
Address needs of most vulnerable	.755	.418
Environment management	.871	
Develop contingency/local action plan	.812	
Ensure community has preparedness tools		.606

NOTE: Extraction Method: Principal Component Analysis.
 Rotation Method: Varimax with Kaiser Normalization.
 a. Rotation converged in 7 iterations.

Table 3.8(d) Descriptive statistics Mean and Standard Deviation

Factors	Mean	Standard Deviation
Group 1	4.16	.83
Group 2	4.01	.78

3.4.5 Major Roles of NGO

Emerging trends in managing natural disasters have highlighted the role of Non Governmental Organizations (NGOs) as one of the most effective alternative means of achieving an efficient communication link between the Disaster Management agencies and the affected community (Sharma and Khanna, 2013).

Table 3.9(a) shows that all the values after extraction are above 0.4 thus none of the components were eliminated. KMO value 0.790 shows the sample size is adequate and significance of Bartlett's test is 0.00. The reliability test result value is 0.896. The variables/ components for assessment are 12 in number grouping is preferred. As the number of components having 'Total' (Initial Eigenvalues) > 1 is only 3, 3 groups will be formed (Table 3.9(b)). After analysis, 3 factors were identified and thus 3 groups were formed. Mean values (Table 3.9(d)) show that according to respondents major roles of NGO are represented by variables of Group 2. Thus ensuring local

stakeholders involvement, establishing coordination mechanism and ensuring stakeholder involvement are mentioned as the major roles of NGOs (Table 3.9(c)).

Table 3.9(a) Extraction Values of Variables

	Initial	Extraction
Ensure local stakeholders involvement	1.000	.864
Establish coordination mechanism	1.000	.720
Ensure budget allocation for DRR	1.000	.745
Risk assessment and identification	1.000	.540
Early warning system and risk communication	1.000	.806
Capacity development for other local stakeholders	1.000	.635
Raise awareness on DRR	1.000	.503
Adopt DRR education into school curricula	1.000	.672
Address needs of most vulnerable	1.000	.722
Environment management	1.000	.788
Develop contingency/local action plan	1.000	.717
Ensure community has preparedness tools	1.000	.802

Note: Extraction Method: Principal Component Analysis.

Table 3.9(b) Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	Variance %	Cumulative %	Total	Variance %	Cumulative %	Total	Variance %	Cumulative %
1	5.705	47.546	47.546	5.705	47.546	47.546	3.979	33.156	33.156
2	1.696	14.133	61.678	1.696	14.133	61.678	2.395	19.955	53.111
3	1.114	9.280	70.958	1.114	9.280	70.958	2.142	17.848	70.958
4	.798	6.654	77.612						
5	.695	5.792	83.403						
6	.596	4.965	88.368						
7	.375	3.127	91.495						
8	.319	2.658	94.153						
9	.245	2.038	96.191						
10	.193	1.610	97.801						
11	.167	1.395	99.196						
12	.096	.804	100.000						

Note: Extraction Method: Principal Component Analysis

Table 3.9(c) Rotated Component Matrix^a

	Groups		
	1	2	3
Ensure local stakeholders involvement		.847	
Establish coordination mechanism		.846	
Ensure budget allocation for DRR			.813
Risk assessment and identification	.603		
Early warning system and risk communication	.431		.787
Capacity development for other local stakeholders		.517	.528
Raise awareness on DRR	.603		
Adopt DRR education into school curricula	.779		
Address needs of most vulnerable	.771		
Environment management	.859		
Develop contingency/local action plan	.711	.442	
Ensure community has preparedness tools	.711	.532	

NOTE: Extraction Method: Principal Component Analysis.
 Rotation Method: Varimax with Kaiser Normalization.
^a. Rotation converged in 7 iterations.

Table 3.9(d) Descriptive statistics Mean and Standard Deviation

Factors	Mean	Standard Deviation
Group 1	3.75	.87
Group 2	3.79	.78
Group 3	3.68	1.93

3.4.6 Support Needed for Local Government

Table 3.10(a) shows that all the values after extraction are above 0.400 thus none of the components were eliminated. KMO value (0.760) shows the sample adequacy and significance of Bartlett's test is 0.00). The reliability test result value is 0.897. As the variables/ components for assessment are 12 in number grouping is preferred. As the number of components having 'Total' (Initial Eigenvalues) > 1 is 3, thus representing 3 factors and 3 groups were formed (Table 3.10(b)). Table 3.10(d) shows that group 3 has the highest mean value and thereby represents the variables that respondents consider as the type of support needed for Local Government in working effectively regarding DRR. In adopting DRR education into school curricula and in ensuring that community has preparedness tools support are thus the variables (support) considered to be needed by Local Government (Table 3.10(c)).

Table 3.10(a) Extraction Values of Variables

	Initial	Extraction
Ensure local stakeholders involvement	1.000	.890
Establish coordination mechanism	1.000	.790
Ensure budget allocation for DRR	1.000	.685
Risk assessment and identification	1.000	.601
Early warning system and risk communication	1.000	.680
Capacity development for other local stakeholders	1.000	.792
Raise awareness on DRR	1.000	.649
Adopt DRR education into school curricula	1.000	.803
Address needs of most vulnerable	1.000	.503
Environment management	1.000	.419
Develop contingency/local action plan	1.000	.744
Ensure community has preparedness tools	1.000	.658

Table 3.10(b) Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	Variance %	Cumulative %	Total	Variance %	Cumulative %	Total	Variance %	Cumulative %
1	5.710	47.581	47.581	5.710	47.581	47.581	3.313	27.612	27.612
2	1.363	11.357	58.938	1.363	11.357	58.938	2.978	24.816	52.428
3	1.141	9.510	68.448	1.141	9.510	68.448	1.922	16.020	68.448
4	.906	7.547	75.995						
5	.808	6.734	82.729						
6	.618	5.152	87.881						
7	.457	3.808	91.688						
8	.324	2.699	94.387						
9	.272	2.271	96.657						
10	.184	1.533	98.190						
11	.133	1.107	99.297						
12	.084	.703	100.000						

Note: Extraction Method: Principal Component Analysis

Table 3.10(c) Rotated Component Matrix^a

	Groups		
	1	2	3
Ensure local stakeholders involvement	.925		
Establish coordination mechanism	.761	.454	
Ensure budget allocation for DRR	.750		
Risk assessment and identification		.708	
Early warning system and risk communication		.756	
Capacity development for other local stakeholders		.863	
Raise awareness on DRR	.425	.672	
Adopt DRR education into school curricula			.865
Address needs of most vulnerable	.573		.409
Environment management		.436	
Develop contingency/local action plan	.682	.402	
Ensure community has preparedness tools			.761

NOTE: Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

^a. Rotation converged in 7 iterations.

Table 3.10(d) Descriptive statistics

Factors	Mean	Standard Deviation
Group 1	4.17	.84
Group 2	4.14	.71
Group 3	4.33	.65

The Hyogo Framework for Action (HFA) 2005-2015 was one of the biggest milestones regarding DRR. This 10-year action framework was adopted by 168 Governments during the January 2005 World Conference on Disaster Reduction (WCDR) which aimed in assisting the efforts of nations and communities to become more resilient to natural hazards. It offers guiding principles, priorities for action and practical means for achieving disaster resilience for vulnerable communities (UNISDR, 2005).

While enquired to the respondents whether they are aware of or have heard about HFA, majority responded that they haven't heard about HFA (Fig. 3.16).

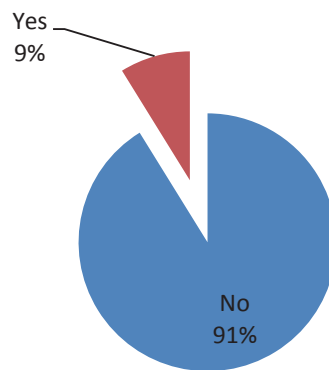


Fig. 3.16 Response on awareness of HFA

Even though the period of HFA has come to an end and have further moved on to Sendai Framework for Disaster Risk Reduction (2015-2030) post which is considered as the successor of HFA, majority of the DRR actors are still unaware of the major DRR initiatives being taken in the world. This can be considered as an inefficiency of the disaster management system itself.

3.5 Summary

CDRI assessment helped in understanding the resilience status of the entire Cuddalore district as well as its resilience status in each of its taluk. As, with the CDRI based assessment the areas or elements which need more improvement in reaching a better status for being better resilient in nature were able to identify. Thus this approach can be a major step in policy reformation and in modifying as well as creating new action plan. This indeed can enhance the resilience status of each taluk which in turn can enhance the resilience of communities within the taluks in a top to bottom type of management strategy. Local Government, NGOs, District Government as well as private sector should work hand in hand while assuring participation of respective communities for achieving the expected results. From the attempt to understand DRR based issues, along with identifying them, it was also found that there is much gap in updation of knowledge among concerned authorities who are supposed to be the main DRR actors, who holds the decisive power especially at time of emergencies and pre disaster planning. Working in collaboration with research institutes can solve this problem to a certain extent. Providing platform for academia (research) to learn more and updating assessments with time is highly recommended. This can also help the

Government in taking appropriate actions based on correct assessment results. Support needed by stakeholders that are actors of DRR are different. This difference has to be identified and employed for better and effective implementation of DRR. ‘Think Globally and Act Locally’ need to be the key idea when action plan, policies and management strategies are made and implemented.

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Chapter 4 Existing Challenges and Community Resilience Status in Research Locations

4.1 Introduction

In a country, either developing or developed, poor households are more vulnerable to natural shocks in both response and recovery phases (Fothergill and Peek, 2004; Peacock *et al.*, 1997; Wisner *et al.*, 2004). Thus even within the same community severity of impacts may vary. So, Resilience varies from place to place depending on the resources they have, challenges they face (which can be natural, social, economic or combination of these), how well prepared are they in dealing with these challenges.

Factors that diminish the adverse hazard effects must be understood, as these may improve the capacity of a community to respond to and recover from subsequent hazard events (Cutter *et al.*, 2010). Before understanding for applying it, it is more important to identify the challenges faced by a certain community so as to determine the factors that can behave as solutions. By strengthening their local capacity, it is possible to develop invulnerable communities (McEntire, 2001).

To check these household level challenges, household level survey was conducted to compare and understand how resilience varies with place survey was conducted in 2 coastal communities of Cuddalore taluk and 2 coastal communities of Chidambaram taluk and to check the variation in resilience status of communities, 2 coastal communities and 2 inland communities of Cuddalore taluk itself.

4.2 Methodology

A sample size of 60 household was taken in all the 6 communities. Face to face interview was done. Inland villages were determined inland based on their distance from sea. Same questionnaire was used for coastal and inland villages. It is said that natural disasters cause physical and socio-economic damage (Benson, 1997; De Haen and Hemrich, 2007; Lindell and Prater, 2003; Pelling *et al.*, 2002).

So questionnaire survey tries to assess physical, social, economic conditions of the selected communities and in addition the survey tries to assess the risk awareness and preparedness of those communities too.

4.3 Results of Household Survey

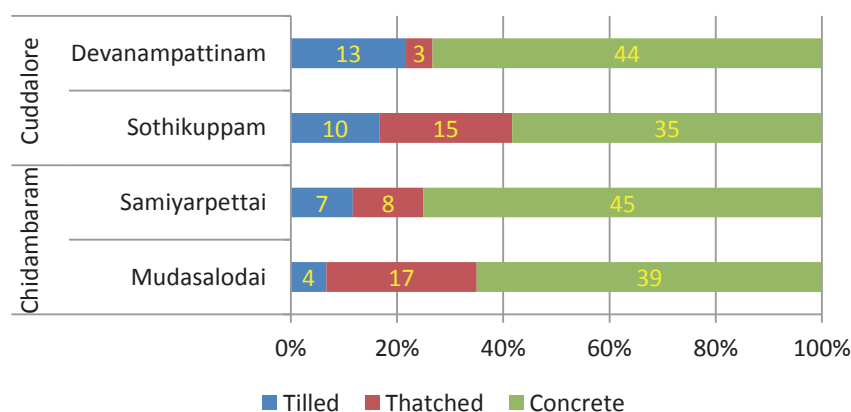
Results of the survey have been given as sections. One section (4.3.1) describes the result of coastal villages selected from both Cuddalore and Chidambaram Taluk while the other one (4.3.2) explains the results of comparison between coastal and inland villages.

4.3.1 Results of Selected Coastal Villages of Cuddalore and Chidambaram Taluk

Although there may be recognition of the hazards in many communities, risk reduction and vulnerability often are not salient concerns until after the disaster occurs (Cutter *et al.*, 2008). In tune with this statement, vulnerabilities along with initiatives for DRR were given much concern only after 2004 tsunami which shattered lives, livelihood and economic situation of many coastal communities in Indian mainland. This survey, conducted after almost one decade to check the resilience capacity, also tries to find whether the communities are in a position to respond to and cope with the impacts of future hazards.

4.3.1.1 Results on Physical Resilience

Here in order to assess the physical conditions that represent physical resilience type of houses, availability of water (as well as its related issues like quality, quantity), sanitation conditions, transportation facility were mainly considered.



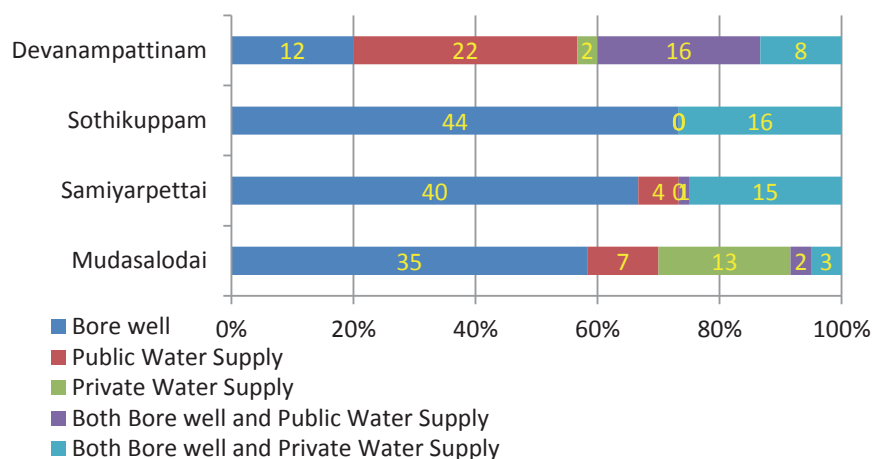
(a)



(b)

Fig. 4.1 (a) Type of Houses in each village and (b) Thatched House in Sothikuppam

Fig. 4.1(a) shows, both the taluks have all the three types of houses i.e. tiled, thatched (Fig. 4.1 (b)) and concrete. Among these concrete houses are considered more structurally strong to withstand disasters especially when cyclone is considered. Type of house also reflects the economic status. In all the four villages, majority of the houses are concrete houses. Among the selected villages of Cuddalore taluk Devanampattinam has more concrete houses and while in villages of Chidambaram taluk Samiyarpettai has more concrete houses. One major reason behind this is, Government and NGOs have built houses after tsunami 2004 for the victims in these areas.



(a)

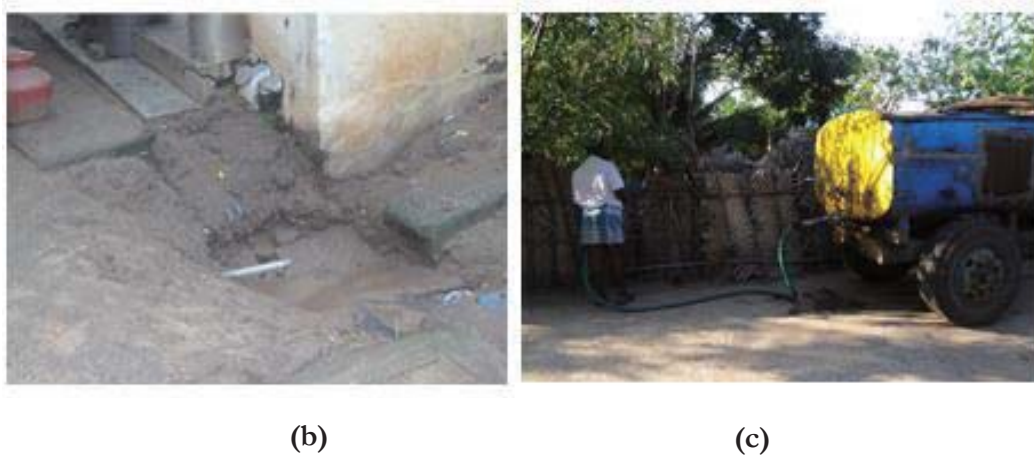


Fig. 4.2 Main source of water ((a) Source of water in each village (b) Public water supply in Devanampattinam, (c) Private water supply in Mudasalodai)

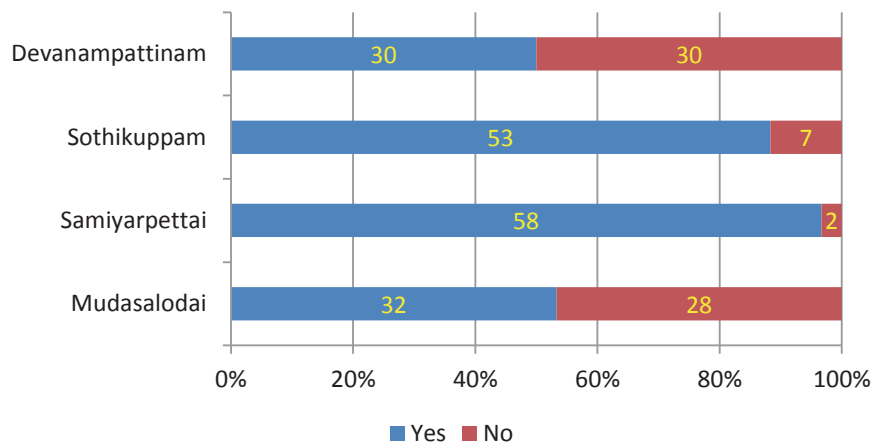


Fig. 4.3 Availability of enough water for daily use

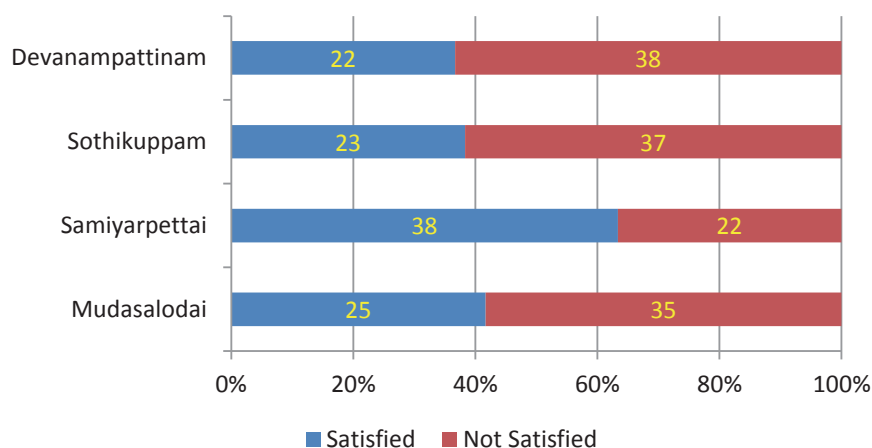
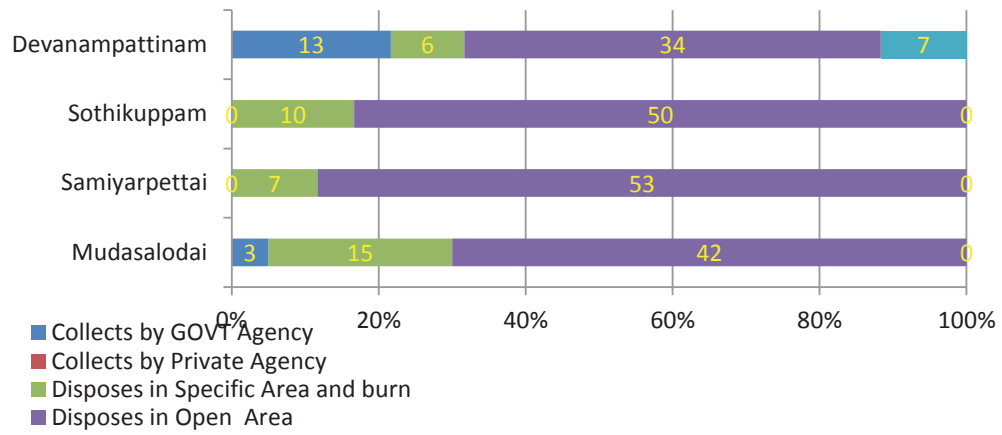


Fig. 4.4 Satisfaction in quality of water available

Water, being the elixir of life becomes an important component in determining the resilience of a community, region place etc. Thus it was tried to understand the source of water and satisfaction level in the quantity available and quality in each village. Sources of water vary with village (Fig. 4.2 (a)) and each depends on more than one source of their daily water requirements. Main sources they depend on are bore well, public water supply, private water as well as combination of bore well and public water and combination of bore well and private water.

In Devanampattinam majority of the respondents (36.66%) depend on public water supply (Fig. 4.2 (b)), whereas Sothikuppam, Samiyarpettai, Mudasalodai depend mainly on bore well (73.33%, 66.66%, 38.33% respectively) for their daily needs. In Mudasalodai it is a notable trend that 21.66% depend completely on private water supply for their daily use (Fig. 4.2.1 (c)). Even though, it is expensive non availability of public water supply to their houses and absence of bore well makes them depend entirely on private water supply.

When it comes to satisfaction level of water availability (Fig. 4.3), majority of the respondents of all the villages are satisfied. Among them Samiyarpettai shows the highest level of satisfaction with 96.66%, followed by Sothikuppam (88.33%), Mudasalodai (53.33%) and Devanampattinam (50.00%). While regarding the quality of water available (Fig. 4.4), greater portion of respondents of all the four communities shows a level of dissatisfaction. Level of dissatisfaction is highest in Devanampattinam (63.33%) while lowest in Samiyarpettai (36.66%). If comparison on dissatisfaction of water quality is done taluk wise, then the communities of Cuddalore taluk is showing greater dissatisfaction than communities of Chidambaram taluk.



(a)



(b)

(c)

Fig. 4.5 Waste disposal ((a) Method of waste disposal by each village. (b) Sothikuppam, (c) Devanampattinam)

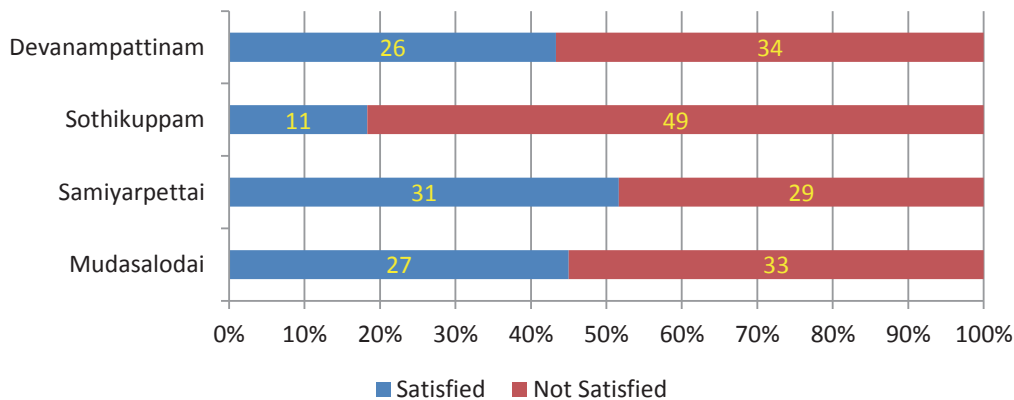


Fig. 4.6 Satisfaction in the current method of waste disposal

Proper waste disposal and management is an important issue to be taken care of as it can result in many direct and indirect effects on the well-being of a community. Direct effects can be like degrading the cleanliness and aesthetic features of that region. While indirect effects can be breeding of vectors thereby resulting vector borne diseases, improper waste disposal also causes issues like clogging of drains etc. which in turn can exacerbate the flooding condition of the community.

Through the survey it was found that, in any of the communities selected, they are not following a proper, well managed waste disposal method (Fig. 4.5.1 (b) and Fig. 4.5.1 (c)). In all the communities they are following open area disposal as the usual method they follow, which includes 88.33% of respondents Samiyarpettai, 70.00% of Mudasalodai respondents, 83.33% of Sothikuppam respondents and though lowest among the other three communities a majority of 56.66% of Devanampattinam respondents also follow this method (Fig. 4.5 (a)). In Devanampattinam 21.66% depend fully on Government agency in collecting and disposing their household waste. So, if the Government agency can take initiative in extending their service to the entire community as well as to other communities a proper waste disposal and management can be made possible. This in turn can help in reducing the ill effects of improper waste disposal. It was found that there is no contribution by private sector in these areas regarding waste management, if done private agency can positively complement the effort of Government agency.

Even though most of the respondents have shown their dissatisfaction in their current disposing method, it is surprising to notice that 43.33%, 51.66% and 45.00% of respondent of Devanampattinam, Samiyarpettai and Mudasalodai respectively are satisfied by the current method of disposal (Fig. 4.6). This may be because they are unaware or haven't taken the negative impacts of

improper waste disposal seriously. Another aspect regarding this issue is, understanding how the respondents who are not satisfied by the waste disposal method have responded towards this issue, whether they have taken any actions towards this. Mainly two types of actions were found to be taken which includes reporting to the concerned authorities as well as introducing disposal pit or bin in their area. But this was done only by a small portion of respondents whereas a majority of 73.00%, 65.00%, 61.00% and 53.00% of respondents of Mudasalodai, Samiyarpettai, Sothikuppam and Devanampattinam respectively haven't taken any action even though they are not satisfied by the present method (Fig. 4.7(a) to (d)). Respondents of communities of Cuddalore taluk has been taken more action comparing to that taken by respondents of Chidambaram taluk.

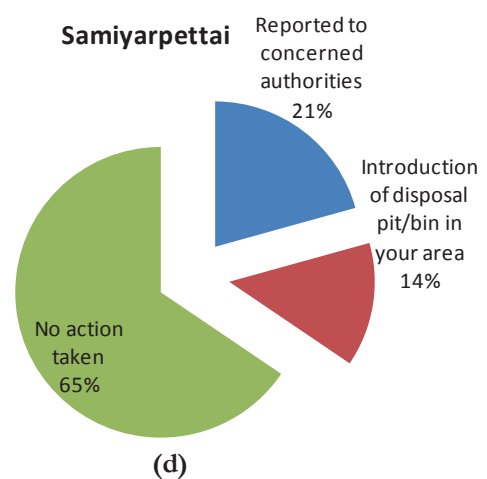
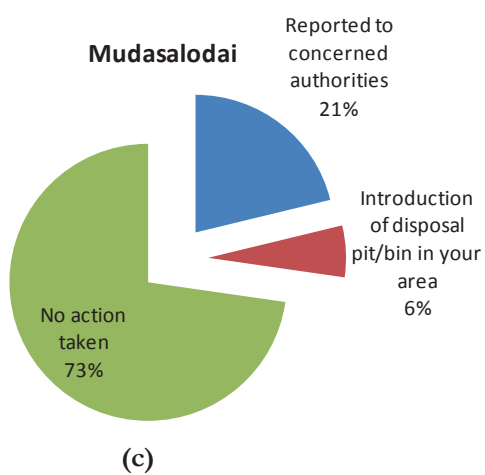
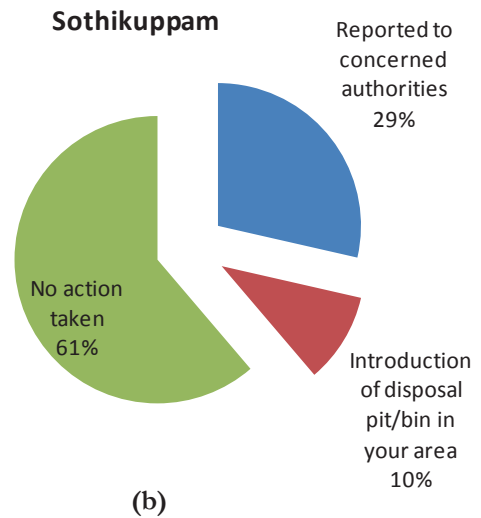
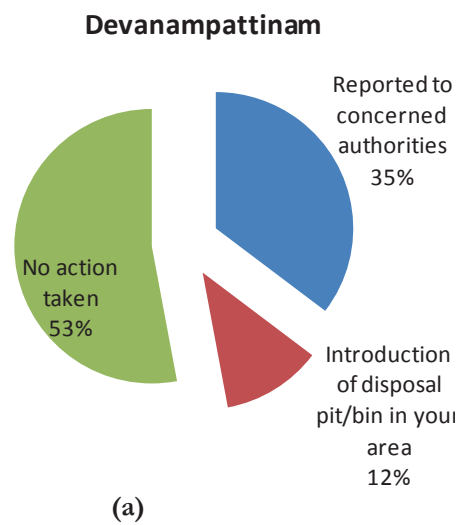


Fig. 4.7 Actions taken ((a) Devanampattinam, (b) Sothikuppam, (c) Mudasalodai, (d) Samiyarpettai)

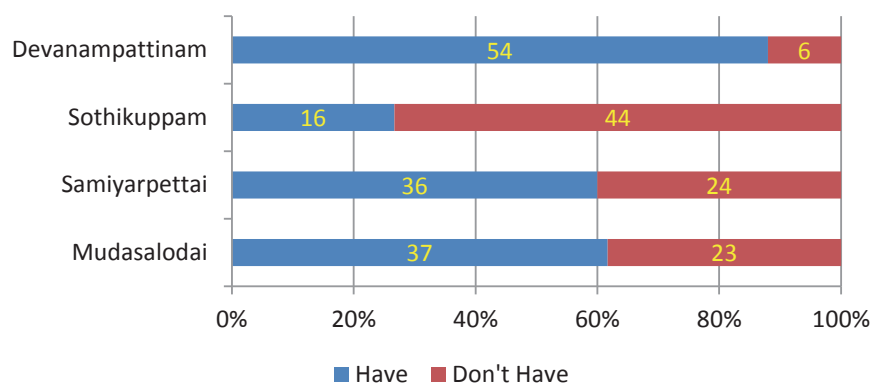


Fig. 4.8 Availability of toilet in own house

When sanitation is considered, availability of toilet is of also of much importance. Except for Devanampattinam, respondents without having toilets in their own houses are high in other communities. Situation in Devanampattinam is better as half of the respondents were from the colony constructed for tsunami victims where all houses have their own toilets. 73.33% in Sothikuppam, 40.00% in Samiyarpettai, 38.33% in Mudasalodai don't have their own toilets (Fig. 4.8). More serious issue than not having toilets is, all who don't have provision of toilet has undertaken open defecation as the parallel way.

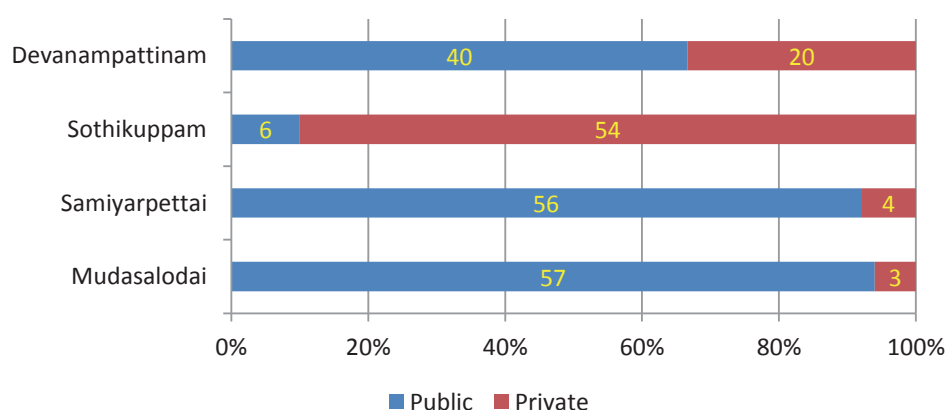


Fig. 4.9 Mostly depending transportation facility

Transportation facility is one of the basic services which help the community to get in connection with other regions for various necessities of day to day life. Transportation facility is available both provided by public (Government) and private sector. The dependence is greater on the facility

provided by public sector in Devanampattinam, Samiyarpettai and Mudasalodai. While 90.00% of respondents of Sothikuppam depend on private transportation facility as public service is less to this area. Thus when Cuddalore taluk is considered, one village depends mainly on public service (Devanampattinam, 66.66%) while the other (Sothikuppam, 90.00%) on private (Fig. 4.9). In case of Chidambaram taluk both the villages depend mostly on public transportation facility.

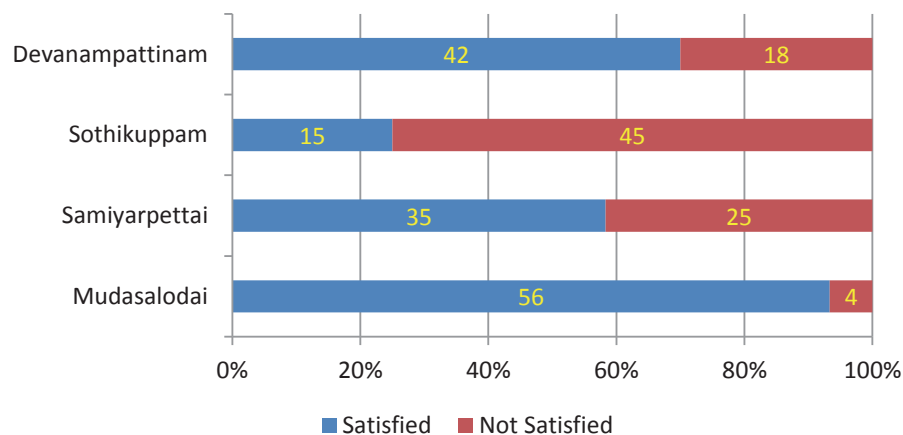


Fig. 4.10 Satisfaction on the presently depending transport facility

Regarding satisfaction level towards the transportation facility (Fig. 4.10) they depend, communities that depend on public (Government) service is showing greater satisfaction level (Devanampattinam (70.00%), Samiyarpettai (58.33%), Mudasalodai (93.33%)) than that on private service depending community (Sothikuppam 25.00%). The reason for showing dissatisfaction by the rest of the respondents were mainly because of two reasons - one, high fare and the other is non availability of service sufficiently (Fig. 4.11(a) to (d)). It was also found that high fare was selected as reason for dissatisfaction by those who depend on private service while not sufficiently available was selected mostly by those who depend on public service. In Mudasalodai 100% of the reason for dissatisfaction is non availability of sufficient service, the other community in the same taluk, Samiyarpettai also shows (96.00%) same reason for dissatisfaction. In the case of Cuddalore taluk one community mentions high fare as reason (Sothikuppam, 62.00%) however the other (Devanampattinam, 67.00%) mentions non availability of sufficient service as reason of dissatisfaction.

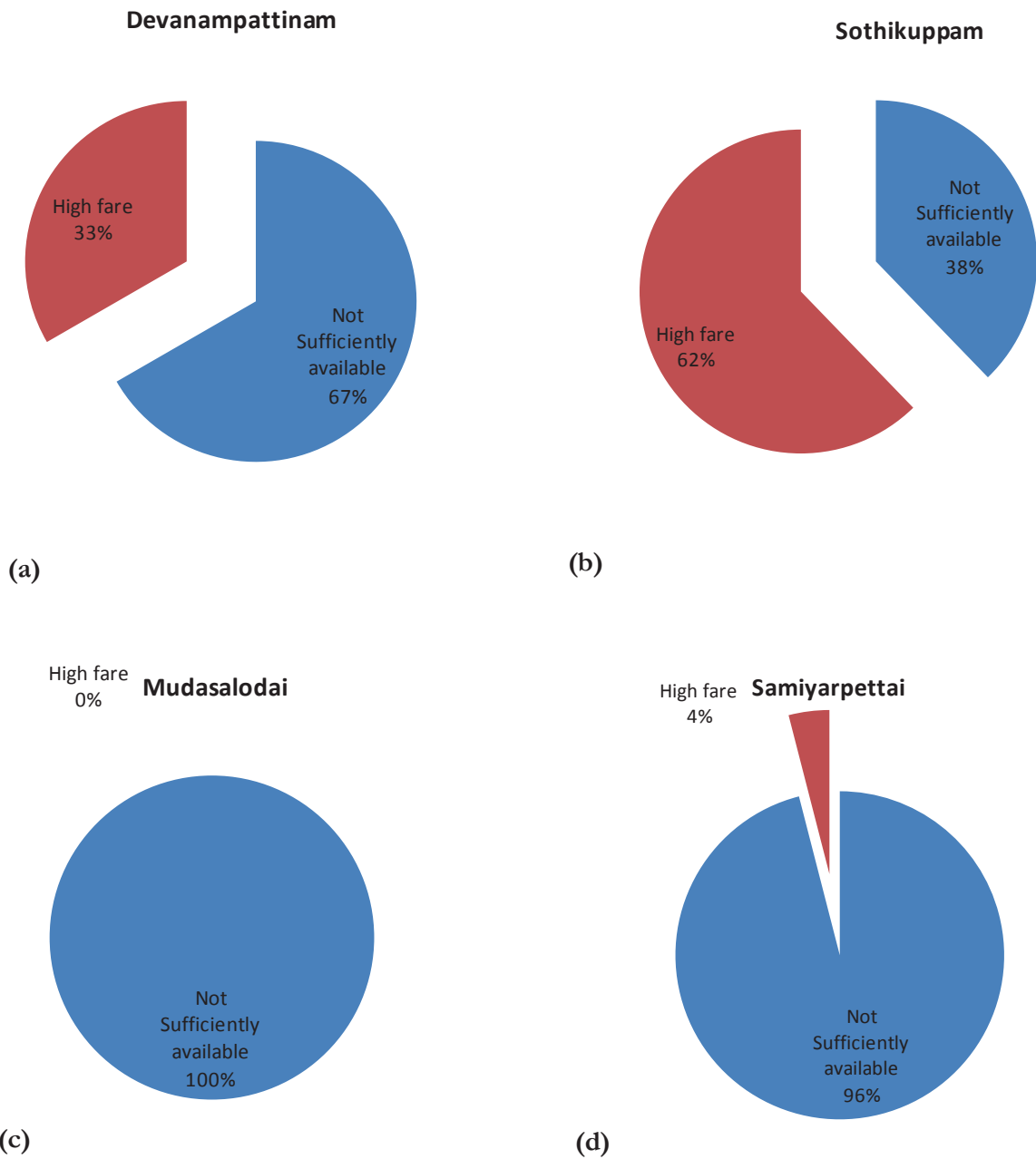


Fig. 4.11 Reasons for dissatisfaction ((a) Devanampattinam, (b) Sothikuppam, (c) Mudasalodai, (d) Samiyarpettai)

4.3.1.2 Results on Social Resilience

Social resilience mainly depends on the demographic characteristics; how well members of a community trust each other, stands as a helping hand for others, meet and socialize thus in a whole how well the members of the community can stand together as a single group and thus reflects the social resilience of that particular group. Social resilience can be increased through improvements in communications, risk awareness, and preparedness (Paton and Johnston, 2001; Paton *et al.*, 2000). Social resilience can be enhanced through the development and implementation of disaster plans, the purchase of insurance, and the sharing of information to aid in the recovery process. Some of these are a function of the demographic characteristics of the community and its access to resources.

Trust towards leaders, within community, participation in Community Based Organizations and conflicts in the community were taken as attributes in assessing the social resilience status of selected communities. Making the members stand together or guiding the members in taking decisions are usually done by the leader of that group. The leader can be a political leader, religious leader, and Government or Non Government officers. Usually a region or a place will have more than one type of leader and strongest leader among them will be the one who can be the most influential among people in that place or region, on whom they depend and trust the most. In the selected four communities, though in a varying level / different degree (from community to community), village leader was found to be the one whom the members of those communities depend the most in case of a need.

In coastal villages, the community members elect village leader and a few representatives for their village. Usually, they hold the authoritative power in taking decisions regarding that community as well as matters like disputes within the community etc. But their power was found to be varying with community. It is noteworthy that in Samiyarpettai 100% of the respondents mentioned village leader as the leader whom they depend the most (Fig. 4.12). However in Mudasalodai, the other community of same taluk, only 80% of people depend on village leader while the rest depend on leaders like panchayath representatives, police etc.

The situation of selected communities of Cuddalore taluk is quite different, there, in Devanampattinam people do depend on a variety of leaders including political representatives, panchayath representatives, religious leaders, officers of NGOs, police and a majority of 38.33% still depends on village leader. This also indicates that here the system of village leader and

representatives elected by community members themselves has become weak. Almost similar is the case of Sothikuppam also, where only 63.33% depend on village leader the most, rest they depend on other leaders.

Trust the community have towards their leaders is also an important component that determines the power and how influential that leader is in that community. The trust levels they have also do vary with community and leaders they depend (Fig. 4.13). Even in Sothikuppam, where 100% of the respondents depend on village leader in case of need, trust level is different among themselves that only about 68.33% trust fully on their leader. Like that in each community trust level varies.

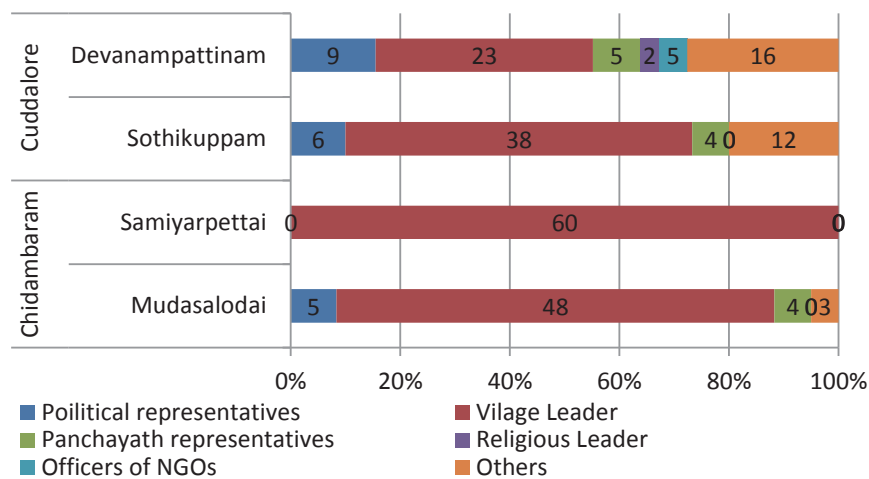


Fig. 4.12 Leaders on whom respondents usually depend in case of a need

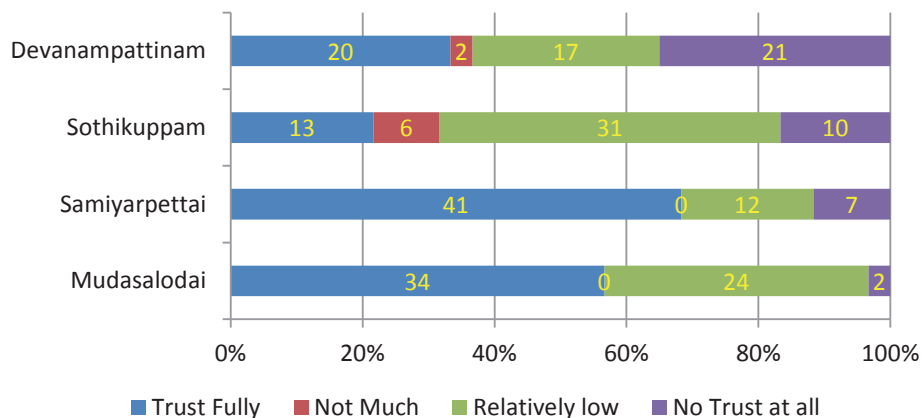


Fig. 4.13 Trust level on the leader

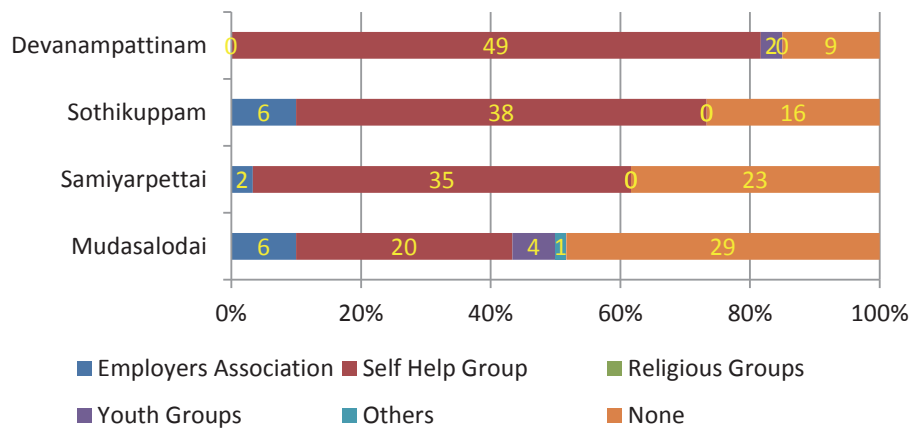
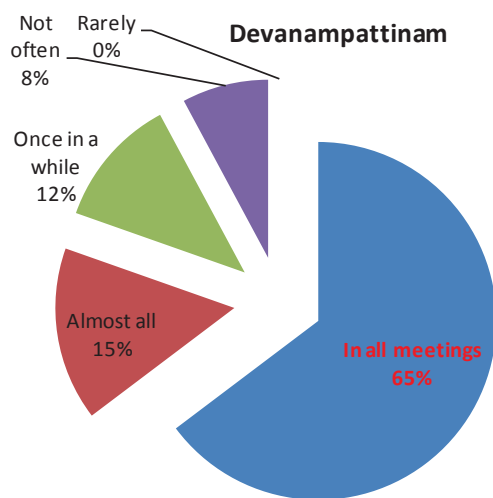


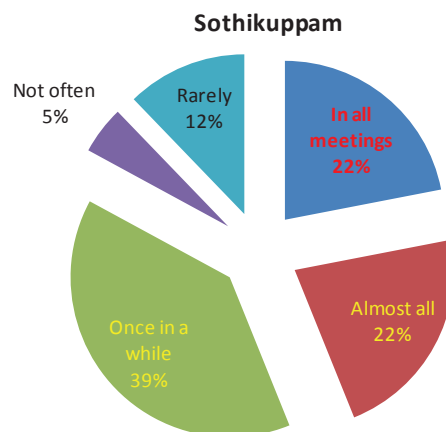
Fig. 4.14 Community Based Organization in which responders participate

A range of Community Based Organizations (CBOs) were found to be present when all communities were taken in a whole (Fig. 4.14). However it can be seen that Self Help Groups are the most prominent one with majority of participation by the respondents. Communities of Cuddalore taluk show greater participation with 81.66% participants and 63.33% participants in Devanampattinam and Sothikuppam respectively. Whereas, Samiyarpettai has 58.33% and Mudasalodai have only 33.33% participants. Moreover, 38.33% (of Samiyarpettai) and 48.33% (of Mudasalodai) respondents does not participate in any of the community based organizations. It is also notable things that, those who participate in Self Help Groups are women as Self Help Groups are usually exist only for women not for men.

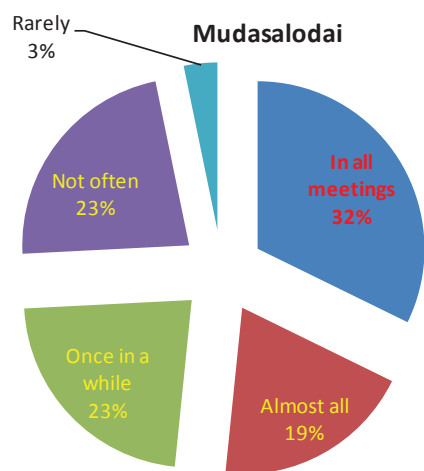
Community based organizations can serve as strong platforms where issues (which can be social issues, economic issues, issues regarding risk and vulnerability) prevailing in each community can be discussed, share opinions, take initiatives for finding solutions which in turn can help in strengthening social tie ups. In some cases such organizations can also provide economic benefits e.g. micro finance options provided by some Self Help Groups. In that case, it will be beneficial in all sense for the community, if men are also made to participate in such public platforms through such organizations.



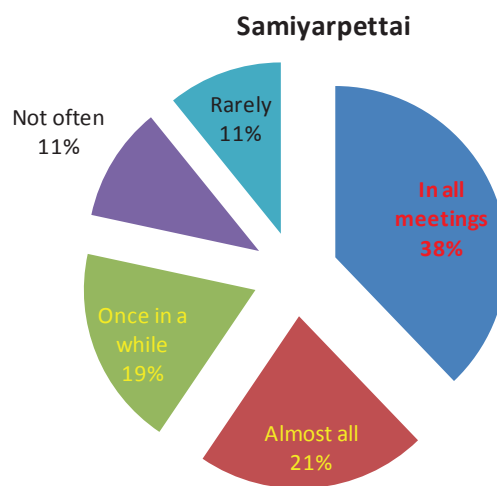
(a)



(b)



(c)



(d)

Fig. 4.15 Level of participation in CBOs ((a) Devanampattinam, (b) Sothikkupam, (c) Mudasalodai, (d) Samiyarpettai)

Strength of the organization depends on the activities they do and more importantly how actively the members in it participate. It can be found that Community Based Organizations of Devanampattinam are strong not only regarding the number of participants but also when how actively they participate is taken into account (Fig. 4.15(a) to (d)). 65.00% of the participant of Devanampattinam participates in all meetings. While in Sothikuppam it is only 22.00%, in Mudasalodai 32.00% and in Samiyarpettai 38.00% of all participants do participate in all meetings of concerned organizations.

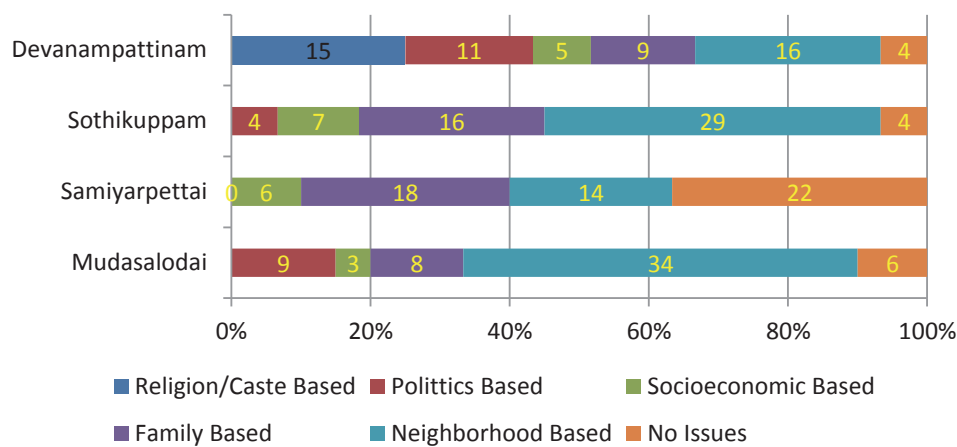


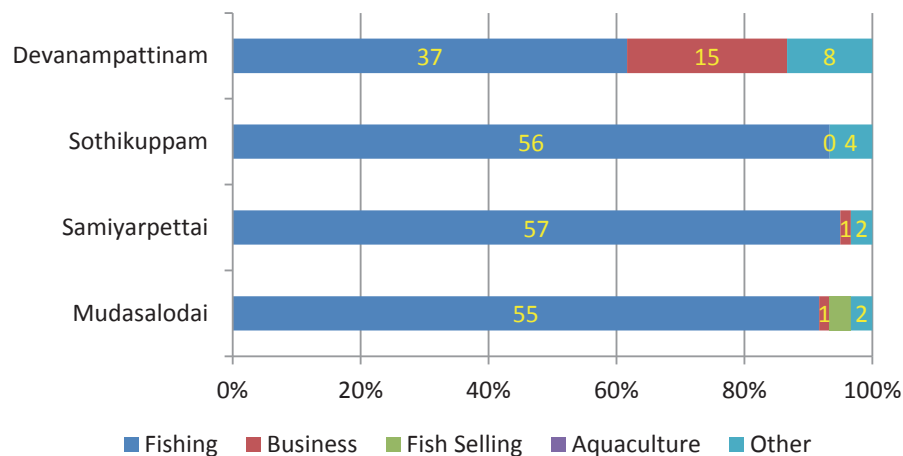
Fig.4. 16 Type of conflicts

Conflicts and disputes are not a rare thing in communities, but more the conflicts or disputes less is the social bonding; this in turn reduces the social resilience. Within each community it can be seen there are various reasons for disputes to occur. Along with that major cause of disputes in each community also varies (Fig.4.16). In Sothikuppam (48.33%) and Mudasalodai (56.66%) major cause of disputes are Neighborhood based issues. In case of Samiyarpettai it is issues with n the family (30.00%) and disputes occur mostly within the family. Differing from all the other cases Devanampattinam has 2 major reasons for disputes they are caste based issues (25.00%) as well as neighbourhood based issues (26.66%). Moreover 36.66% of Samiyarpettai respondents expressed that they don't usually face any form of disputes. Taking this into account, in terms of conflict is concerned Samiyarpettai shows highest social resilience.

4.3.1.3 Results on Economic Resilience

In assessing economic resilience, livelihood, non structural measures like savings, insurance, counter measures for financial needs and all were taken as attributes. Disasters have negative effects on

household income and expenditure (Arouri *et al.*, 2015). Most of the households that fall below the poverty trap were seen unable to come back to their initial welfare situation (Carter *et al.*, 2007). Economic development provides implicit insurance against nature's shocks (Kahn, 2003). Savings, insurance, etc. are strong non structure mitigation measures.



(a)



(b)

Fig. 4.17 (a) Livelihood of Respondents and (b) Main Livelihood - Fishing in Mudasalodai

Being coastal communities, all the four communities have fishing (Fig. 4.17 (a)) as their main livelihood (Fig. 4.17 (b)) as a source of income for their daily life. Apart from fishing, some of them depend on small businesses (like shops, flower business), fish selling and a few depend on other jobs (driving, working if foreign countries etc.). Less diversity in livelihood option in a community means dependence on few resources which can in turn result in resource depletion. During rough season in

sea for almost five to six months annually, they usually don't go to sea for work. During this period literally these communities face serious economic crisis.

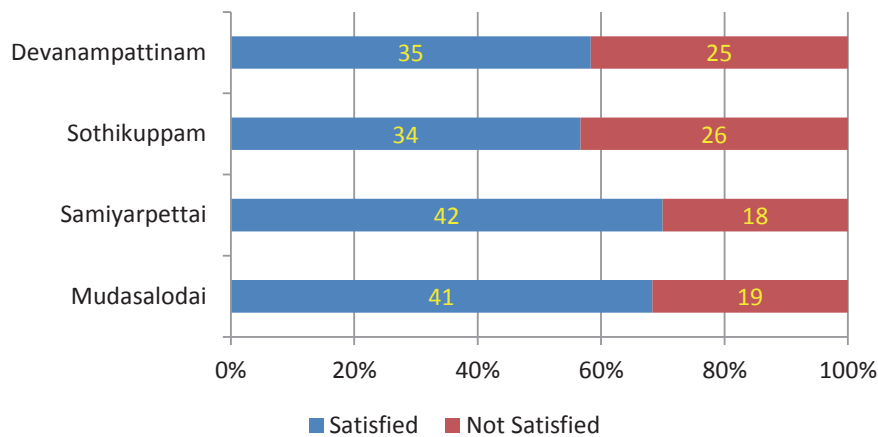


Fig. 4.18 Satisfaction on present livelihood

Apart from all these above mentioned problems, most of them are satisfied with the livelihood option they have chosen for their living. Even then, while comparing the situation of both the taluks, respondents of Cuddalore taluk have shown comparatively less satisfaction towards their present job (Fig. 4.18), which is 58.33% by Devanampattinam, and 56.66% by Sothikuppam. On the other hand 70.00% and 68.33% of respondents of Samiyarpettai and Mudasalodai shows satisfaction respectively.

Among the rest, who are not satisfied with their present livelihood, though continuing in the same job, some have undertaken mainly one of the three actions, which are trying for new job, trying for job with more payment, pursuing join oriented courses (Fig 4.19(a) to (d)). While some who don't have satisfaction is doing nothing for solving their present situation. 56.00% respondents of Samiyarpettai and 47.00% respondents of Mudasalodai who don't have job satisfaction haven't done anything on its regard.

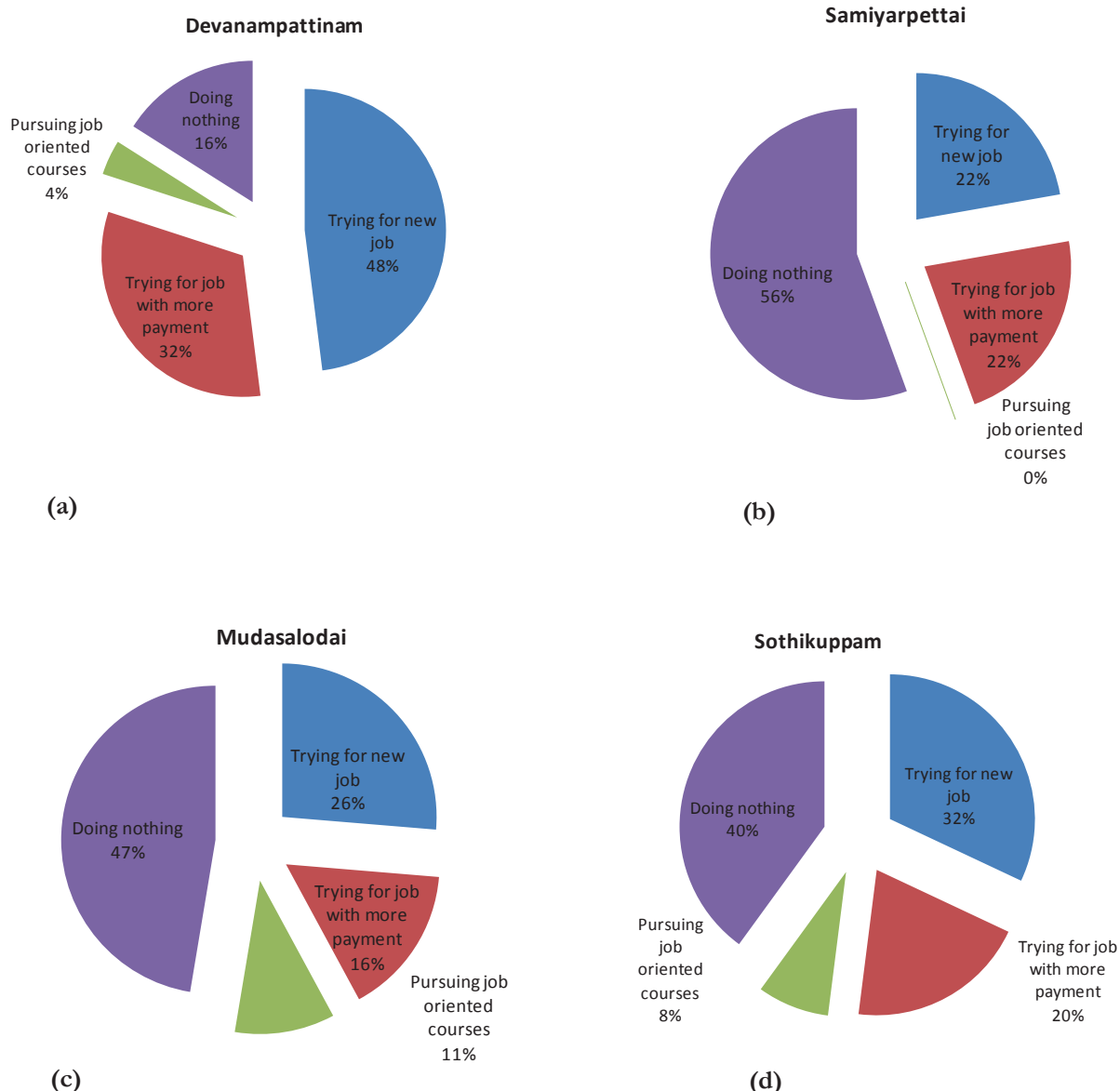


Fig 4.19 Actions taken

((a) Devanampattinam, (b) Sothikuppam, (c) Mudasalodai, (d) Samiyarpettai)

Taking the situation of communities of Cuddalore taluk into consideration, communities exhibits difference in the pattern, where 40% of Sothikuppam respondents haven't done anything as a solution for their situation of job dissatisfaction like that of communities of Chidambaram taluk but when Devanampattinam is considered only 16.00% is doing nothing rest 84.00% has taken action towards the issue of job dissatisfaction.

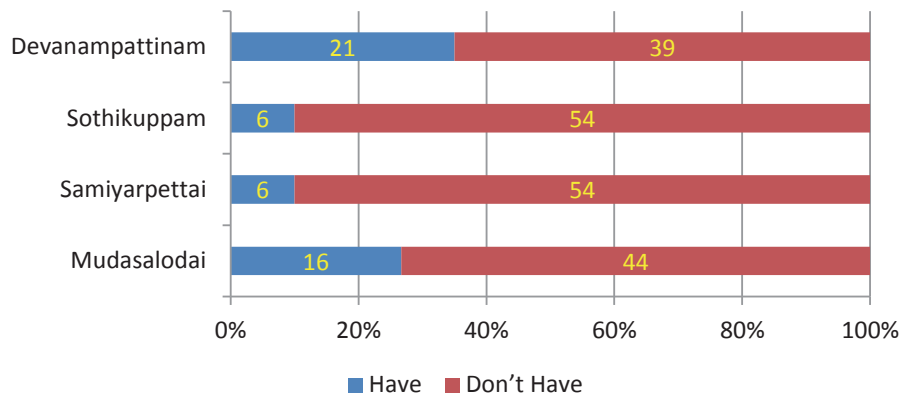


Fig. 4.20 Savings status

Savings is one such component that can assure economic backup for avoiding the situation of collapsed state during emergency situations especially in case of disaster occurrence. Though these communities experience/face disasters like cyclonic depressions, flood etc., it is not found to be having an ample trend of saving in any of the four communities (Fig. 4.20). Among them, Devanampattinam and Mudasalodai are comparatively better with 35.00% and 26.66% respondents having savings of their own. Only 10.00% respondents of other two communities have savings.

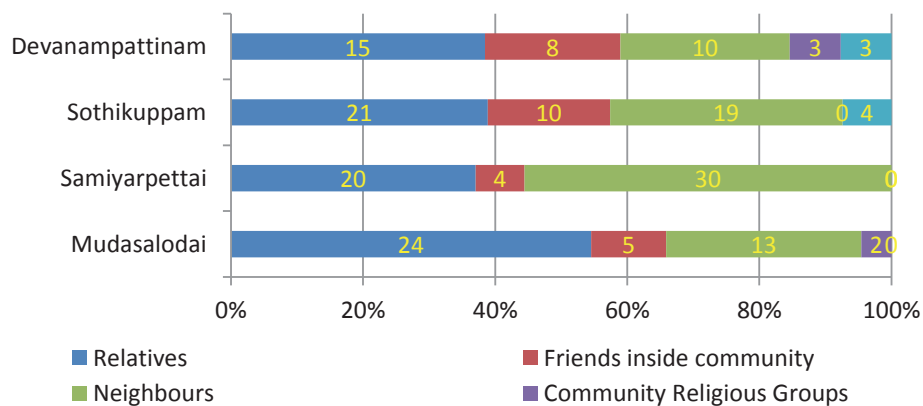


Fig. 4.21 Person who helps during financial need

As a huge proportion doesn't have savings of their own in times of emergencies they come across they depend on others for meeting their financial needs. Apart from the case of Samiyarpettai where a majority of 55.55 % depends on neighbours, all the other three communities depend mainly on their relatives for the same (Fig. 4.21).

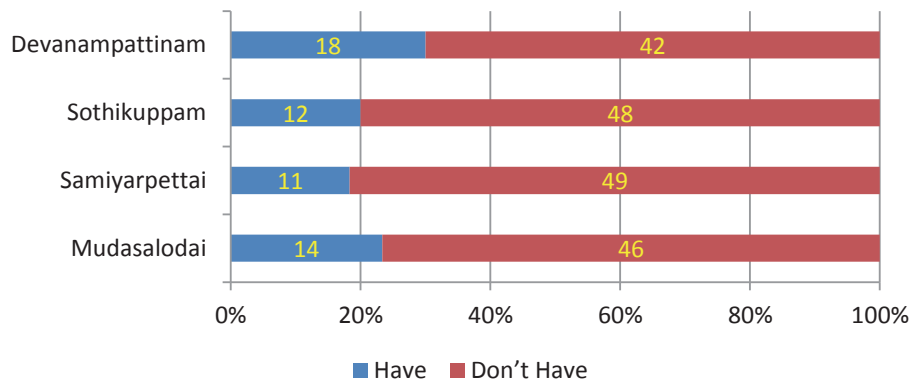


Fig. 4.22 Insurance Status

Insurance is a powerful non structural mitigation measure as well as it helps the victims in their recovery back to normal lives. In spite of these facts, collectively, all the four communities shows that insurance is considered as not an important element (Fig. 4.22), with Devanampattinam having the greatest proportion of respondents (only 30.00%), with insurance coverage.

4.3.1.4 Risk Awareness and Preparedness

Though all the communities have shown high willingness to stay (Fig. 4.23) in the same region in future also, majority of the respondents of all communities are of the opinion that their place is a vulnerable region (Fig. 4.24).

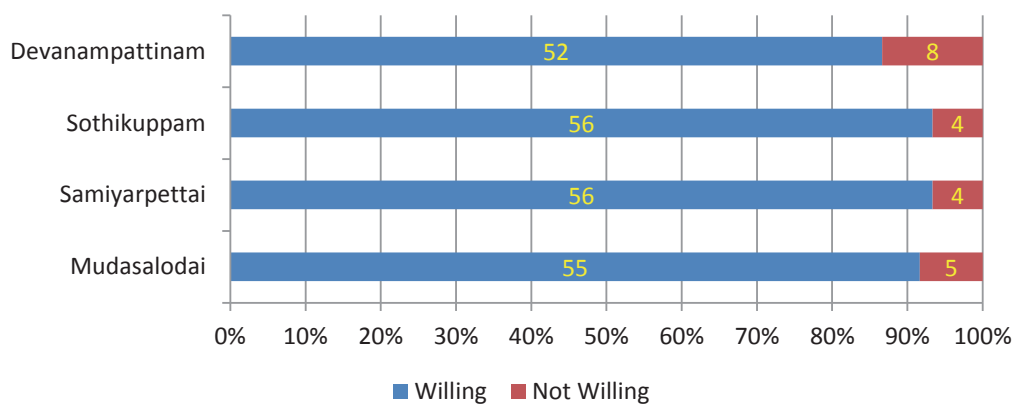


Fig. 4.23 Willingness to stay

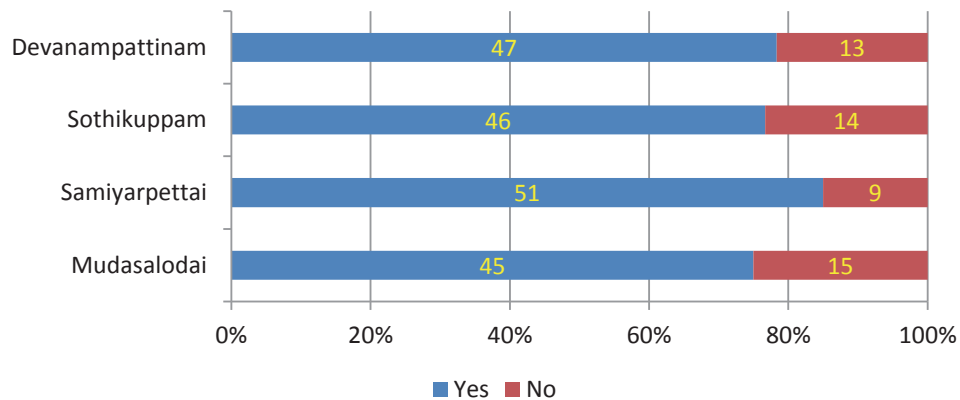


Fig. 4.24 Response to whether their place is vulnerable

Respondents have different reasons to support their opinion (Fig. 4.25(a) to (d)), in which a majority of 58.00% respondents of Mudasalodai says it is the insufficient bioshield that makes their region vulnerable. This same reason was also supported by people of Samiyarpettai (43.00%) for the vulnerability present while 41.00% also have an opinion that insufficient warning is the reason behind vulnerability.

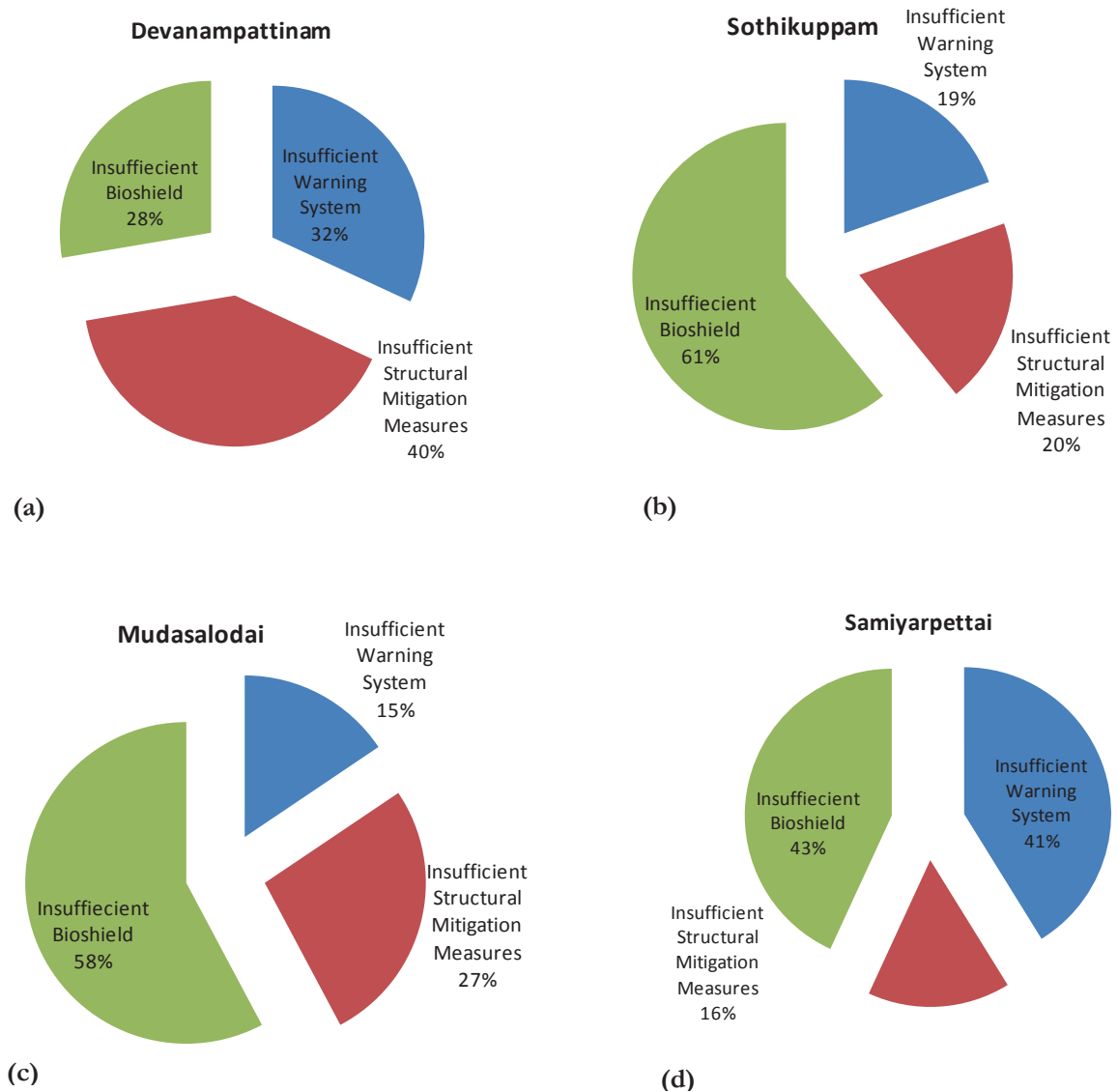


Fig. 4.25 Reasons for vulnerability ((a) Devanampattinam, (b) Sothikuppam, (c) Mudasalodai, (d) Samiyarpettai)

When, communities of Chidambaram taluk had same opinion as the major issue behind the vulnerability, on one hand Sothikuppam respondents (61.00%) say it is the insufficient bioshield as the major reason while respondent of Devanampattinam (40.00%) has a different opinion insufficient structural mitigation measure is the major reason of vulnerability.

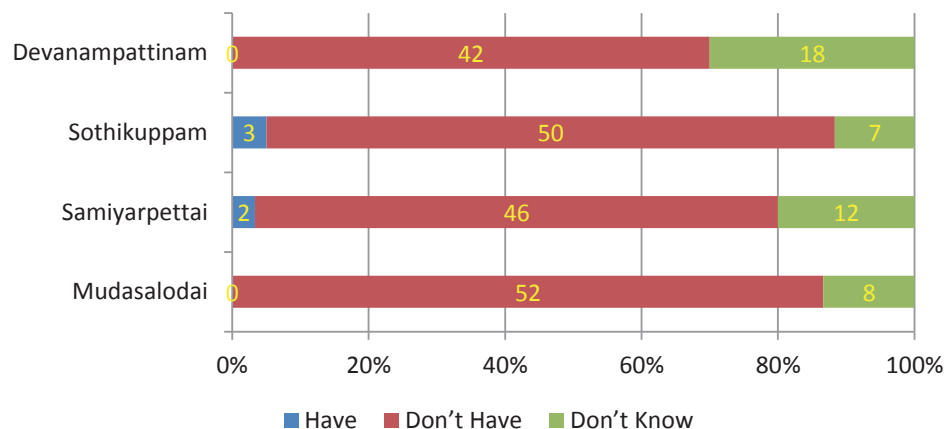


Fig. 4.26 Presence of Emergency Response Team

In reality none of the communities have emergency response team, after 2004 tsunami, when there was much intervention by organizations especially NGOs emergency response teams were formed in some communities but as time passed with no one to take the control of, they slowly diminished and later disappeared. Most of the respondents have also mentioned the same that they don't have emergency response teams but it is important to be noted that even though it is a small proportion 30.00% respondent of Devanampattinam, 20.00% of Samiyarpettai, also comparatively much lesser amount of respondents of other two communities has also mentioned that they don't know whether they exist or not (Fig. 4.26).

This is also a serious situation that has to be taken into concern as it clearly reflects that those people are not aware of what is going on/situation of their community which is a drawback when resilience is concerned. Community members has to be well informed about the challenges, facilities their community have and this has to be taken care of by concerned authorities, which can be either NGOs, Local Government, Village leader, educational institution in the community etc.

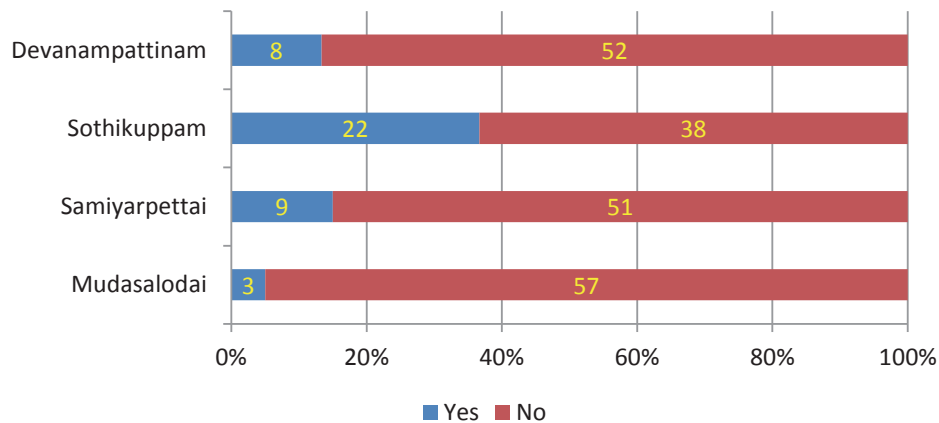


Fig. 4.27 Response for whether they have participated in Emergency drill

Though Government is organizing drill for the officials every year, it's more important to arrange such facilities for the communities who are actually the first responders of any disaster or mishap they face and as they are with a vulnerability to disasters (taking into account disasters common/probable in their area) (Fig. 4.27).

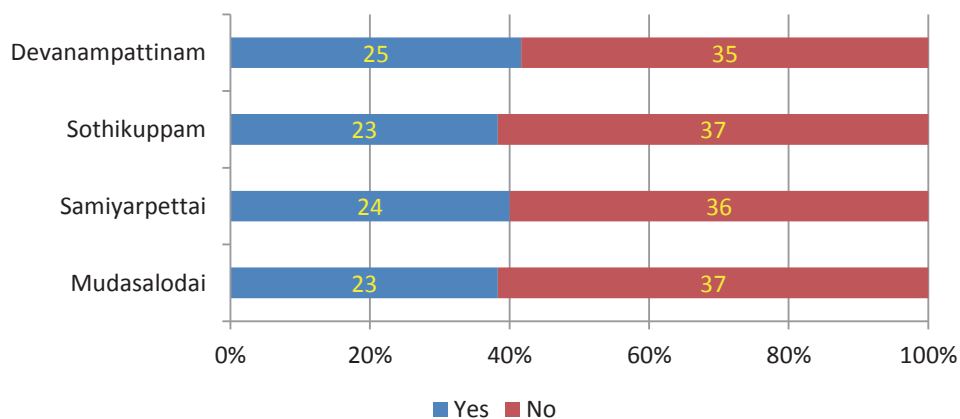


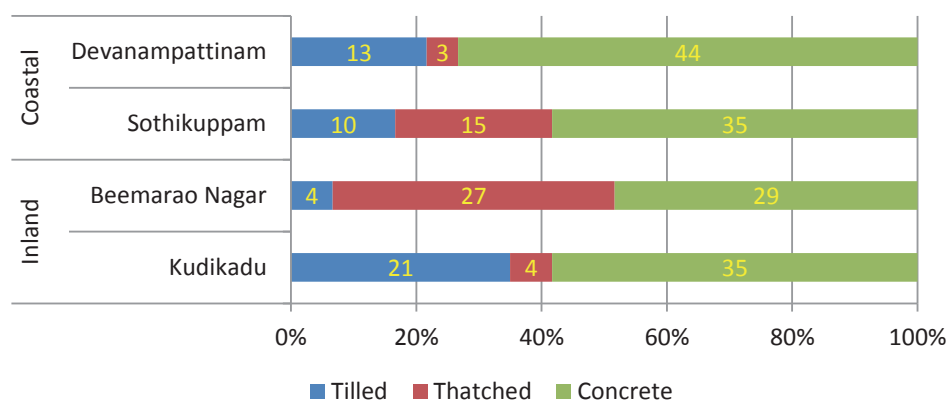
Fig. 4.28 Response about getting alternative livelihood training

Giving training for alternative livelihood options is a much important step regarding the economic resilience because such alternative livelihood can enhance their economic resilience status (Fig. 4.28). It is also important to provide alternative training to men also so they can earn income even during the rough season in sea when they usually don't go for working (fishing).

4.3.2 Analysis Results of Selected Coastal and Inland Villages of Cuddalore Taluk

Same attributes were used in assessing the physical, social and economic resilience as well as risk awareness and preparedness of inland communities as that of coastal communities. In this approach to compare the resilience of inland communities and inland communities, the assumption made was inland communities will be more resilient in all aspects (physical, social, economic) than coastal communities.

4.3.2.1 Results on Physical Resilience



(a)



(b)

Fig. 4.29 (a) Type of houses in villages and (b) A Thatched house in Beemaroo Nagar

All three types of houses (tiled, thatched and concrete) can be found in the selected inland communities as well similar with that of the other selected coastal communities of Cuddalore taluk (Fig. 4.29 (a)). But in one of the inland community, Beemaroo Nagar the number of thatched houses is higher than that of other three communities (Fig. 4.29 (b)). Here, 45.00% of the survey houses are thatched. At the same time the other inland community, Kudikadu have only 4.00% of thatched houses. As explained in earlier section, type of house sometimes stands for/ reflects the economic conditions of that place. Thatched houses represent households with less economic condition.

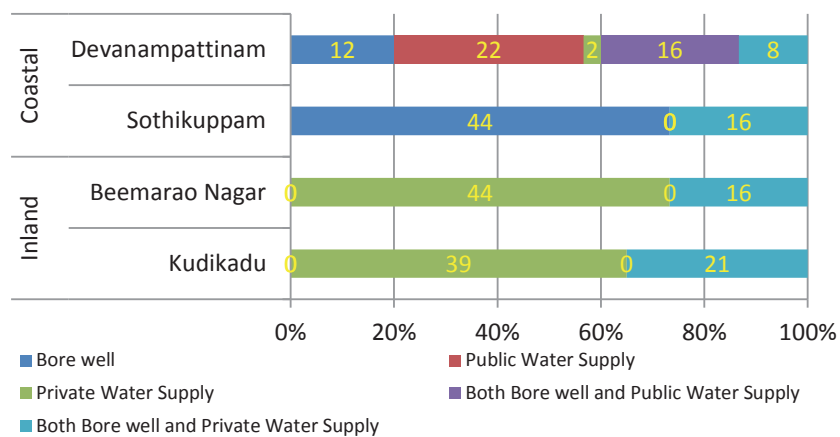


Fig. 4.30 Source of water

Coastal communities show difference in the major sources of water they depend for their daily activities. But both the inland communities depend mainly on the same source i.e. private water supply for meeting the daily needs. The survey results show that 73.33% of Beemaroo Nagar community and 65.00% of Kudikadu community depends on private water supply (Fig. 4.30).

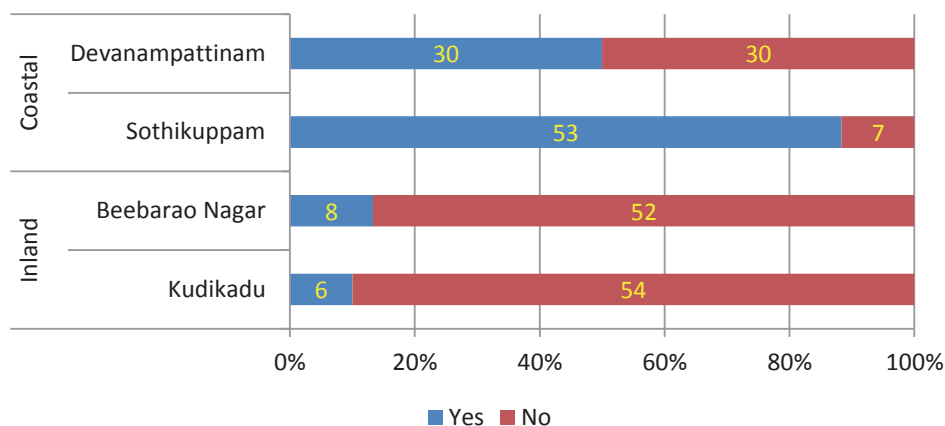


Fig. 4.31 Availability of enough water for daily use

Regarding the satisfaction of quantity of water available also, response is different for coastal and inland communities. Among coastal communities, majority of the respondents have satisfaction, but 86.66% of respondents of Beemaroo Nagar and 90.00% from Kudikadu responded that they are not satisfied by the quantity of available water (Fig. 4.31).

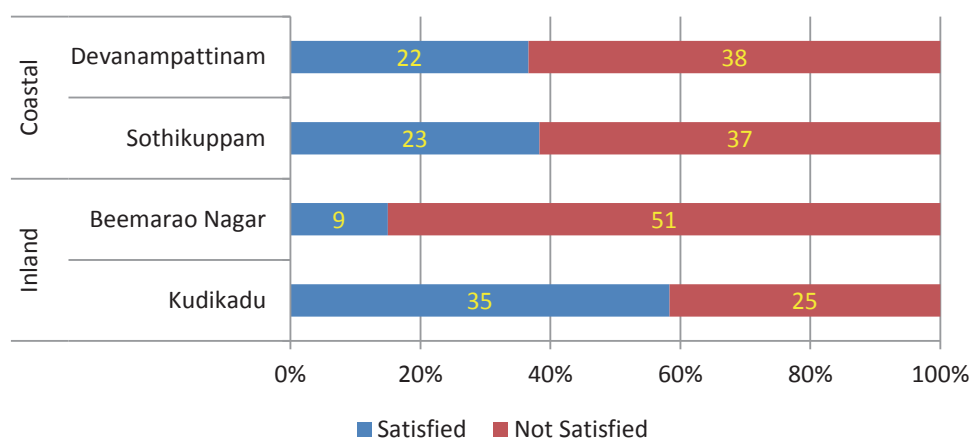


Fig. 4.32 Satisfaction in quality of water available

Except Kudikadu, other three communities are not much satisfied by the quality of the water presently available, which is reflected through their response where Beemaroo Nagar shows the greatest degree of dissatisfaction of 85.00% (Fig. 4.32). If coastal and inland communities are compared, it can be seen that, both coastal communities show similar pattern of more dissatisfaction (Devanampattinam, 63.33% and Sothikuppam, 61.66%) while Inland communities shows different pattern of response, with 85.00% of Beemaroo Nagar showing dissatisfaction and majority (58.33%)

of Kudikadu community showing satisfaction in the quality of available water. It is noteworthy that in Kudikadu the major source of potable water is that provided by the Pharmaceutical Company nearby (Shasun Chemicals & Drugs Ltd) as the company has resulted in contamination of ground water making it unfit for daily activities especially for cooking purposes and more importantly for drinking.

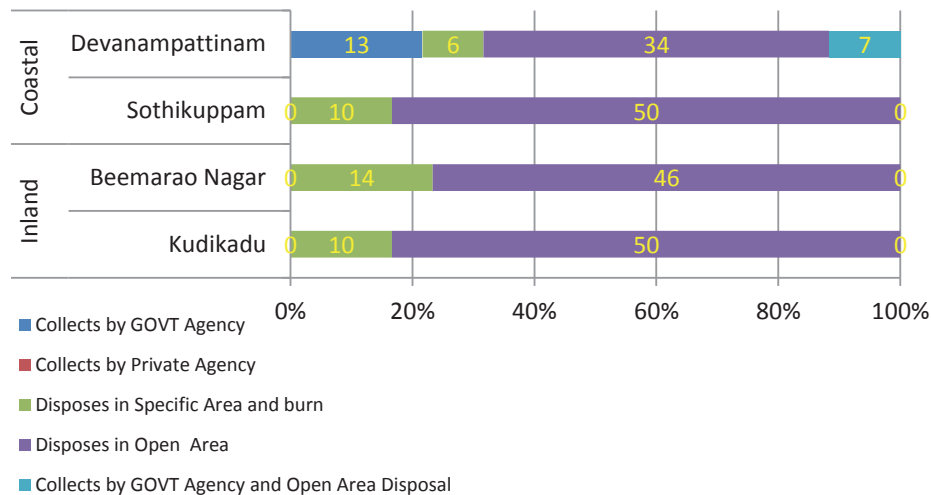


Fig. 4.33 Method of waste disposal

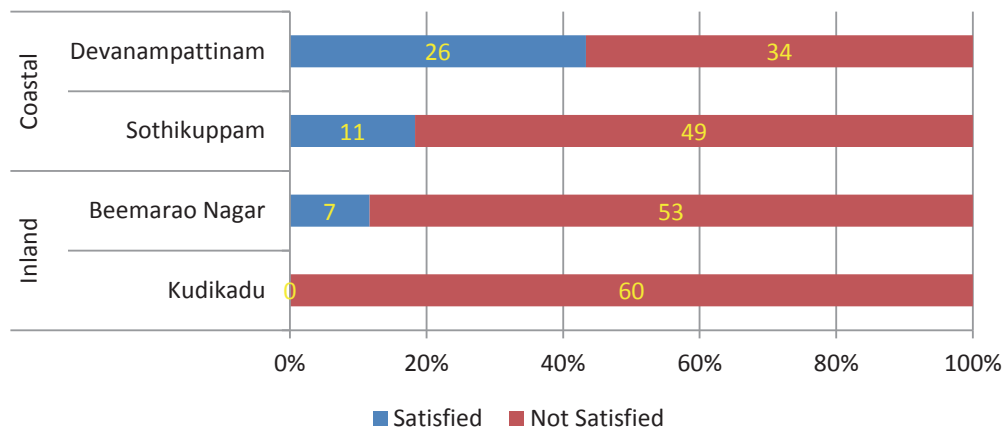


Fig. 4.34 Satisfaction in the current method of waste disposal

Except Devanampattinam, all the other three communities depend mainly on two methods for waste disposal (Fig. 4.33). Among the two methods, majority (83.33% of Sothikuppam and Kudikadu, 76.66% of Beemaroo Nagar) depends on open area disposal which indeed is not a healthy way of waste management as it can induce sanitation issues and even health issues. Differing from

others, Devanampattinam has facilities like collection of waste by Government agency as well as by private agency which is a better method than disposing waste in open area. Even then it can be noticed that in this community also majority is depending on open area disposal.

When each community's satisfaction about their present waste disposal method is taken (Fig. 4.34), though there are many adversities for the present method adopted, much of them are satisfied with that which itself is not a sound attitude. To bring in a better waste management approach and to make it work successfully, authorities should first work in changing their mindset towards waste management. Still there are people who are not satisfied with their present method of waste disposal. Fig. 4.35(a) to (d) explain about the actions they took in response to their dissatisfaction.

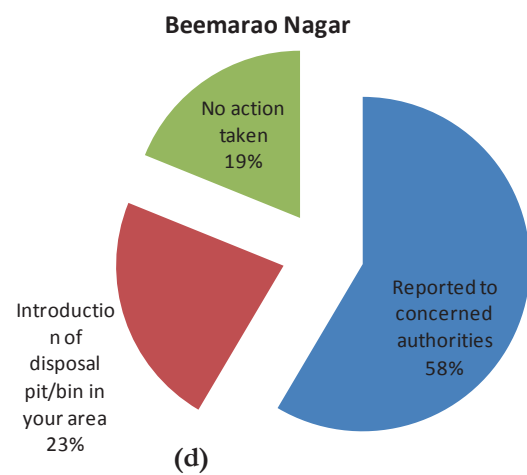
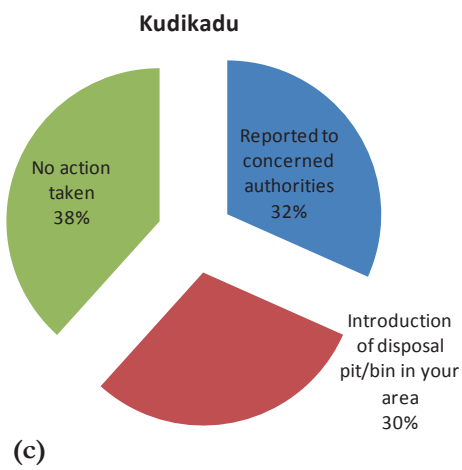
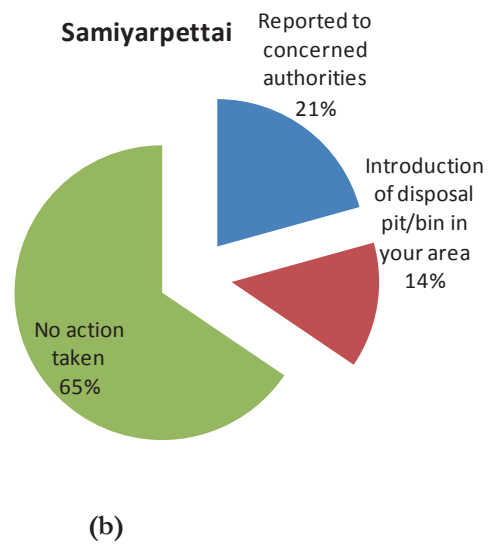
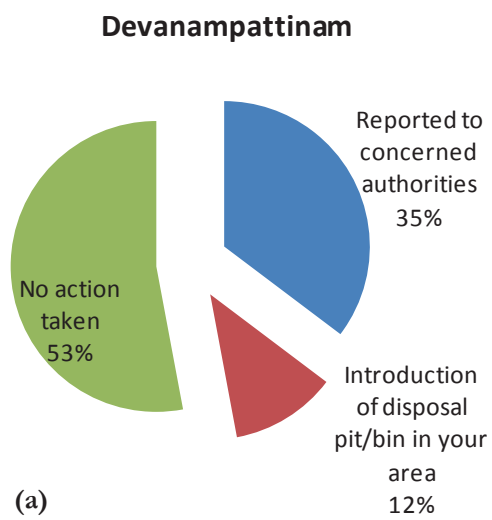
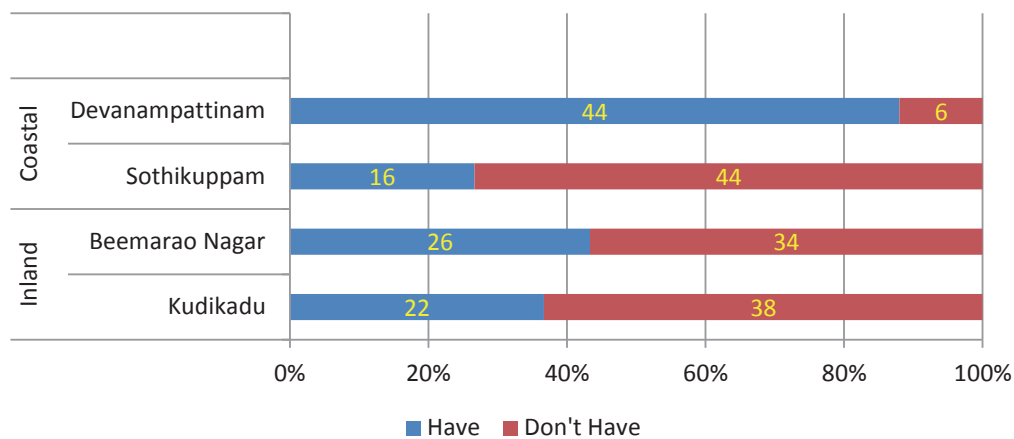


Fig. 4.35 Actions taken ((a) Devanampattinam, (b) Sothikuppam, (c) Kudikadu, (d) Beemaroo Nagar)

It can be seen that, reporting the prevailing waste management issue to concerned authorities and introduction of disposal pit/bin in their area were two major actions taken by some of the people who were not satisfied with their present disposal method. This can be considered as a positive move from those people. At the same time there are people who didn't took any action even though they are not satisfied and this trend can be seen high in coastal communities than inland communities.



(a)



(b)

Fig. 4.36 (a) Availability of toilet in own house and (b) Typical Bathroom facility without Toilets in Kudikadu

Fig. 4.36 (a) reveals that, even in this 21st century, there are households without having access to toilet facility, which is a prime necessity towards a healthy sanitation condition. Apart from Devanampattinam, a majority of all the other three communities, even inland communities, lack

toilets (Sothikuppam 73.33%, Beemaroo Nagar 56.66%, Kudikadu 63.33%) in their households (Fig. 4.36 (b)). The reason why Devanampattinam is better in this case is because of the reconstruction occurred after 2004 tsunami

Thus this is a perfect example showing that even in vulnerable areas; reconstruction can help increase resilience of an area in better way more than inland areas which is better in their resilience in most of the facilities when compared.

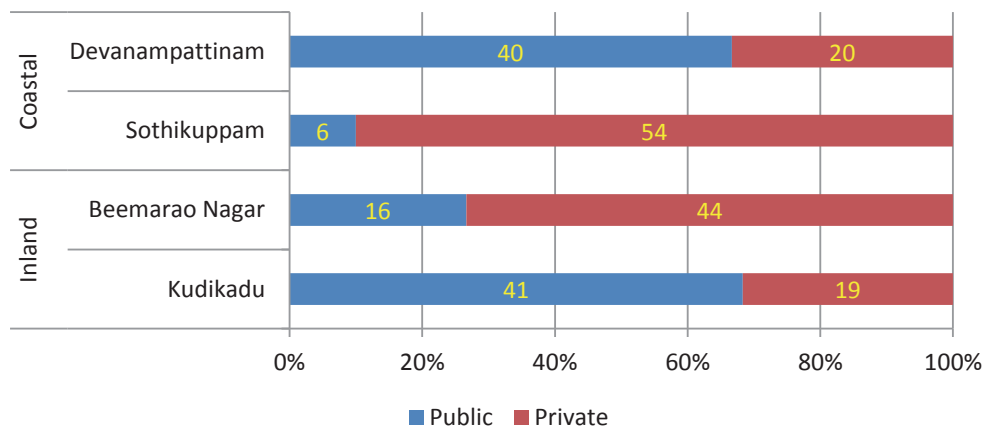


Fig. 4.37 Mostly depending transportation facility

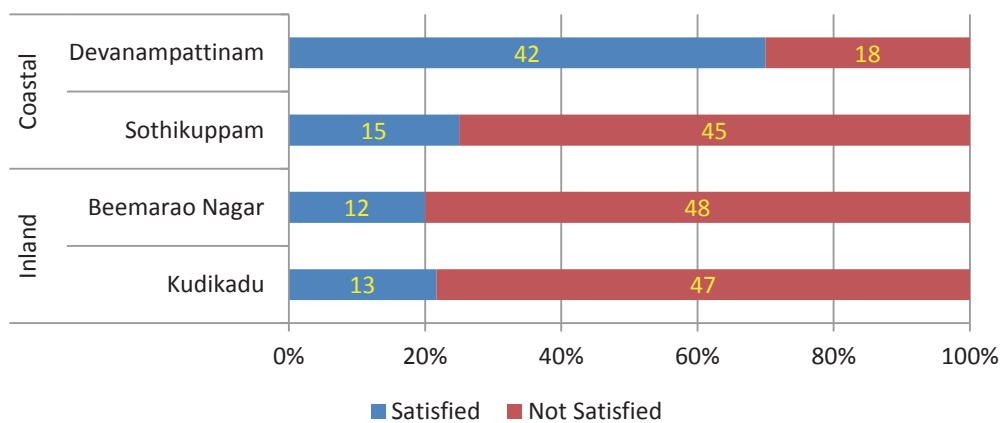


Fig. 4.38 Satisfaction on the presently depending transport facility

Regarding the transportation facility, people use both public and private transport. But the dependence on each sector varies from community to community. Fig. 4.37 shows that one coastal community (Devanampattinam, 66.66%) and one inland community (Kudikadu, 68.33%) has greater dependence on public transport while other two communities have higher dependence on private sector (Sothikuppam 25.00% and Beemaroo Nagar 20.00%). Hence, no specific pattern is shown by coastal and inland communities. Here the major factor that determines the dependence is the proximity of community to main road. Meanwhile, only Devanampattinam (70.00%) shows a better level of satisfaction in the availing transportation facility.

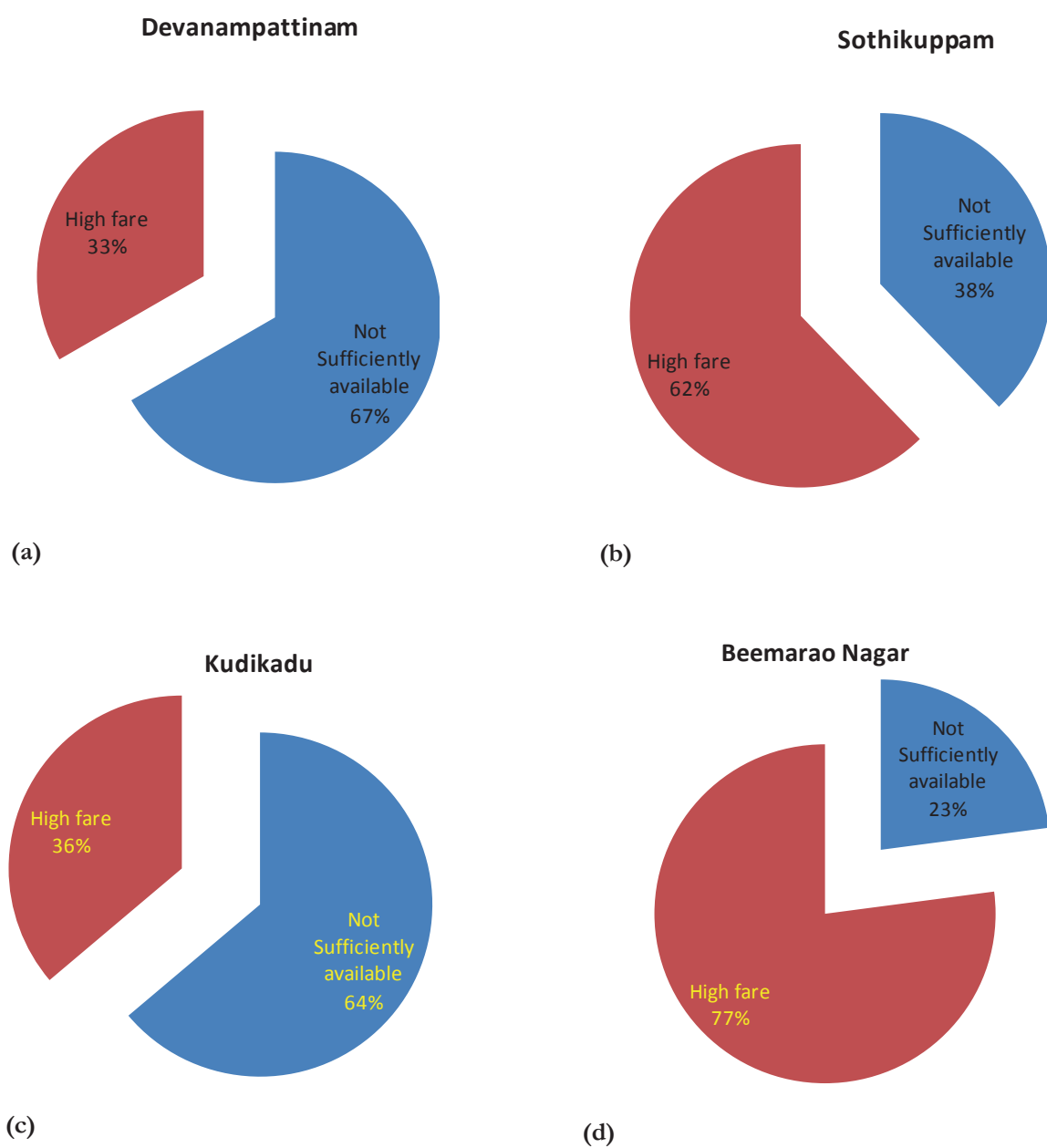


Fig. 4.39 Reasons for dissatisfaction ((a) Devanampattinam, (b) Sothikuppam, (c) Kudikadu, (d) Beemaroo Nagar)

Fig. 4.39(a) to (d) show reason behind the dissatisfaction towards the transportation facility they depend the most. It can be seen that, for communities that depend mainly on public transport, non-sufficiency in availability is the main reason while for the communities that depend mostly on private transport, high fare is the major reason for their dissatisfaction.

4.3.2.2 Results on Social Resilience

Fig. 4.40 shows that there are a wide range of leaders on whom each community depend the most. Coastal communities depend the most on their village leader (Devanampattinam 38.33% and Sothikuppam 63.33%) while in inland communities they depend most on panchayath representatives (Beemarao Nagar 43.33% and Kudikadu 60.00%). When trust level is considered, there is no such pattern shown by coastal and inland communities as that shown for leaders they depend (Fig. 4.41).

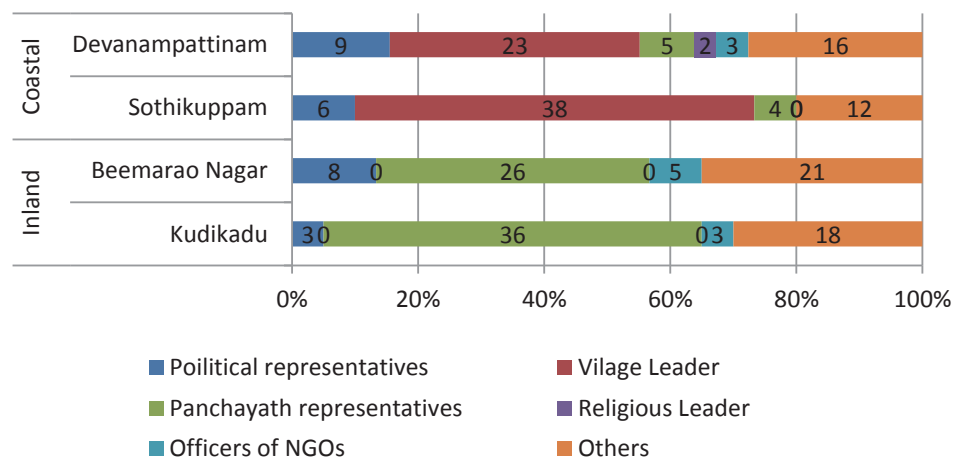


Fig. 4.40 Leaders on whom usually responders depend in case of a need

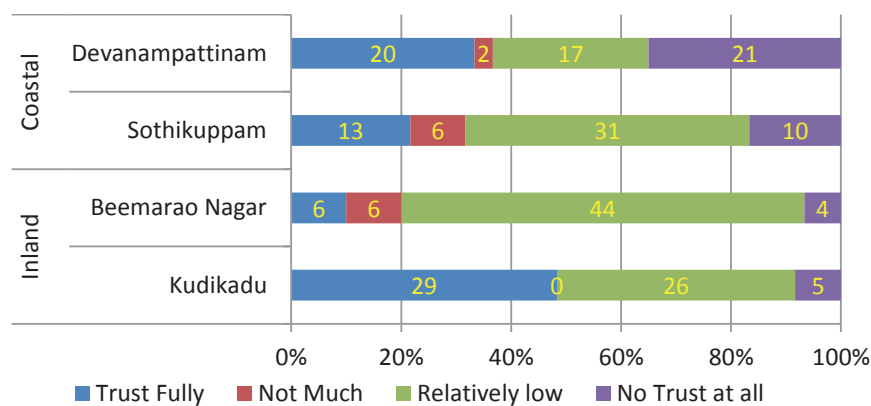


Fig. 4.41 Trust level on the leader

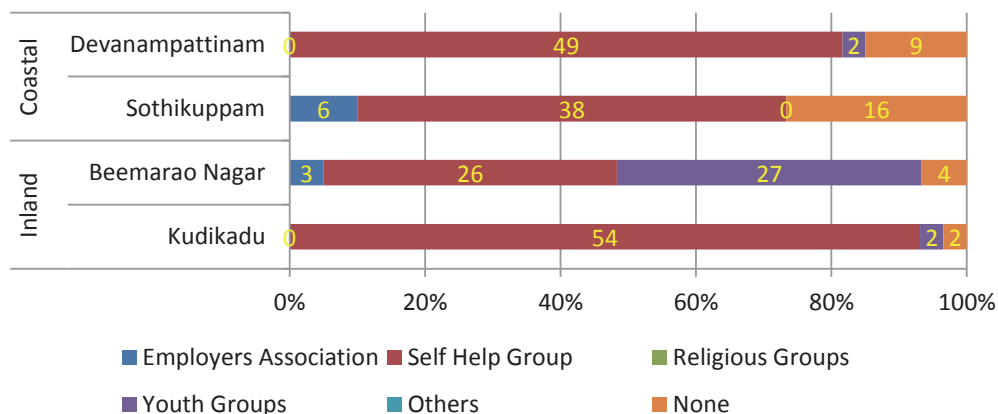
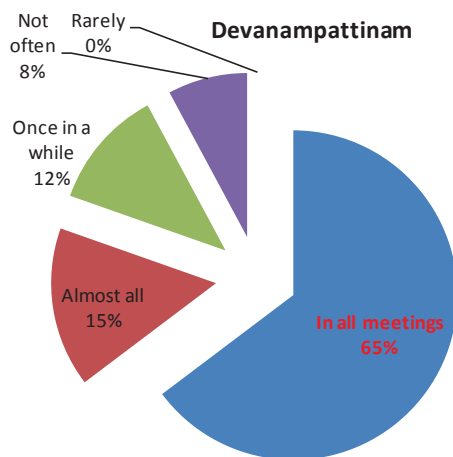


Fig. 4.42 Community Based Organization in which responders participate

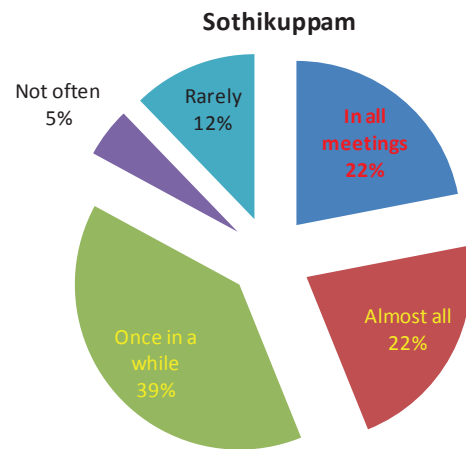
Fig. 4.42 describes about the community based organizations each community have and says that Self Help Groups are the most popular and common community based organization among communities. Along with that, in each community there are people who don't participate in any of the community based organizations at all. Regarding this, coastal communities have more people who don't belong to any of the community based organization with Devanampattinam having 15.00% and Sothikuppam having 26.66% of such people but comparatively Beemaroo Nagar (6.66%) have only and Kudikadu have only (3.33%) of such people.

Active participation of members of each community based organizations is as important as having community based organizations itself. Fig. 4.43(a) to (d) explains about the participation of

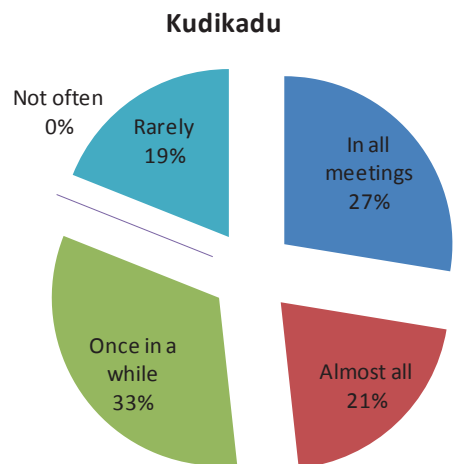
community members in community based organizations. Except in Devanapattinam where majority of people (65.00%) that are members of community based organizations participate in all meetings, in all the other three communities majority of people (Sothikuppam 39.00%, Kudikadu 33.00%, Beemaroo Nagar 46.00%) shows a character of participating in CBO activities only once in a while.



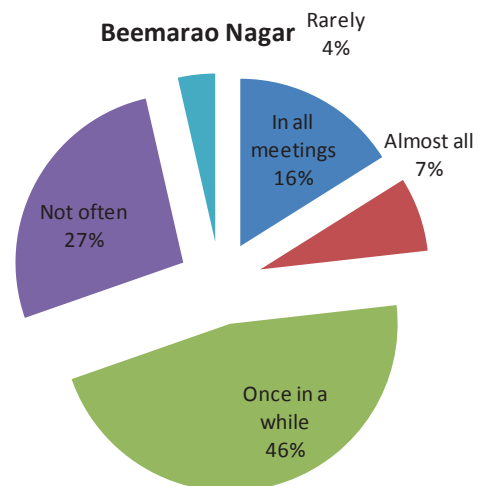
(a)



(b)



(c)



(d)

Fig. 4.43(c) Level of participation in CBOs ((a) Devanampattinam, (b) Sothikuppam, (c) Kudikadu, (d) Beemaroo Nagar)

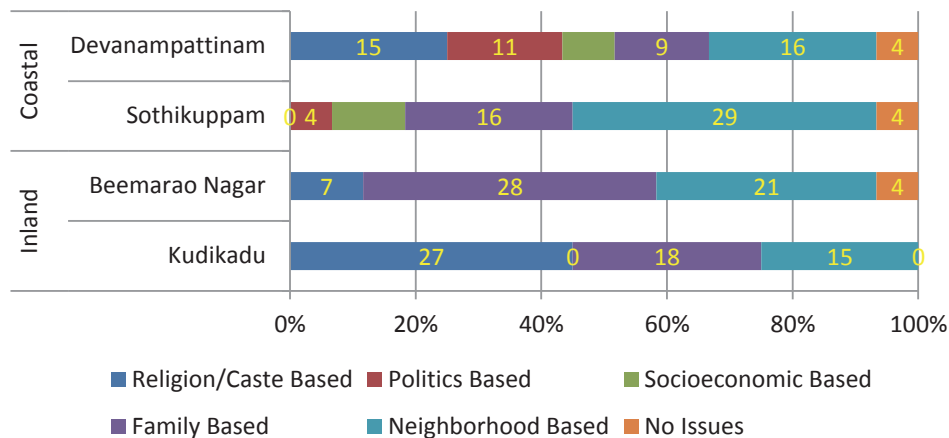


Fig. 4.44 Type of conflicts

Conflicts in a community can degrade the social resilience status of that particular community. Fig. 4.44 is all about the type of conflicts found in each community. We can see that coastal communities have more types of conflicts which is not a healthy trend. Major types of conflicts are neighborhood based and family based.

4.3.2.3 Results on Economic Resilience

When it comes to livelihood, Fig. 4.45 shows that livelihood diversity is low in coastal communities especially for Sothikuppam. Even then satisfaction towards their present job is high among coastal communities where 58.33% of Devanampattinam and 56.66% of Sothikuppam shows satisfaction. At the same time, satisfaction level is low in inland communities with satisfaction of 15.00% in Beemaroo Nagar and 40.00% in Kudikadu (Fig. 4.46).

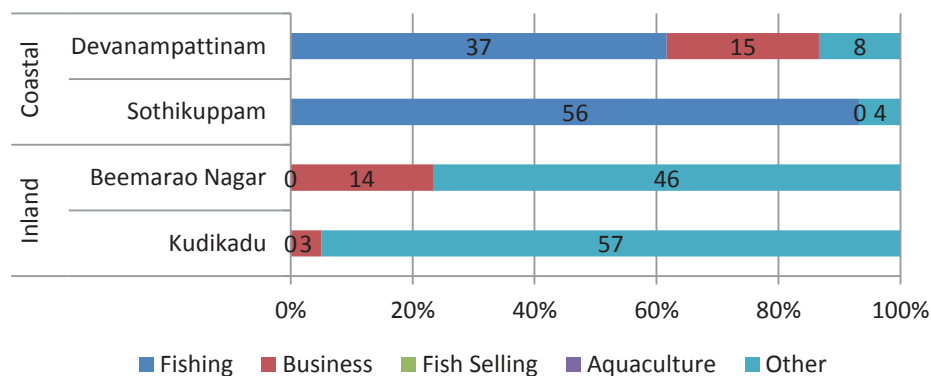


Fig. 4.45 Livelihood of responders

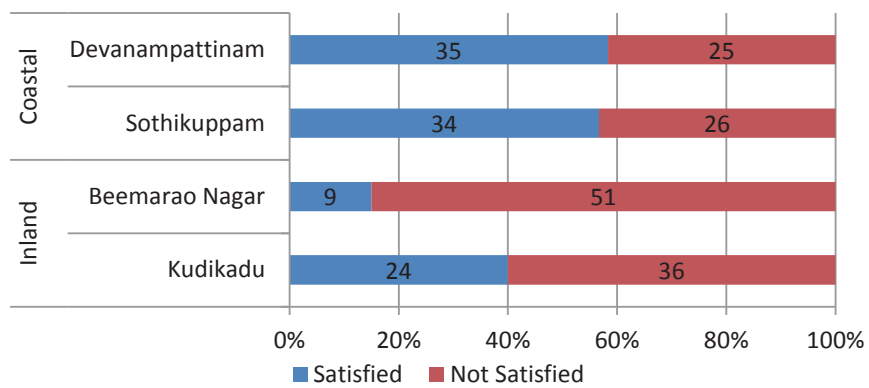


Fig. 4.46 Satisfaction in present livelihood

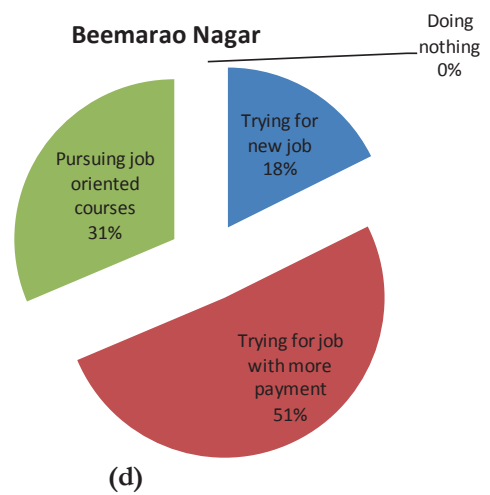
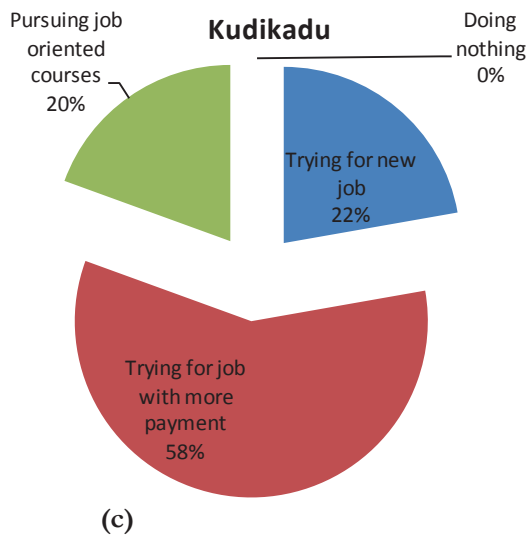
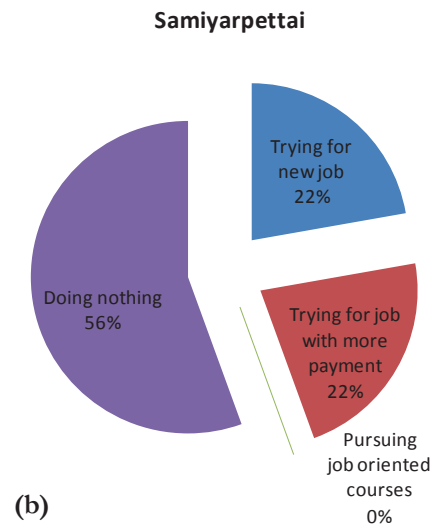
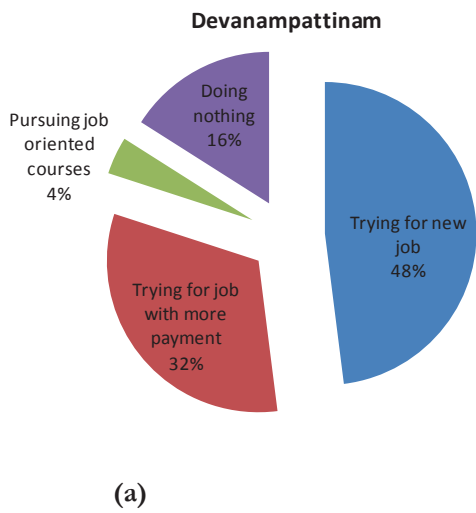


Fig. 4.47 Action taken ((a) Devanampattinam, (b) Sothikuppam, (c) Kudikadu, (d) Beemaroo Nagar)

Fig. 4.47(a) to (d) describe about the ways in which people who are not satisfied have responded to their situation. In both the inland communities, the majority of the unsatisfied persons (about their present job) are trying for job with more payment (Kudikadu 58.00% and Beemaroo Nagar 51.00%). While in the case of coastal communities, majority (48.00%) of such people in Devanampattinam is trying for new job and more worsely 40.00% in Sothikuppam is doing nothing to change their situation. Moreover, in both the inland communities there is no one doing nothing to change their present situation, which itself is a positive sign.

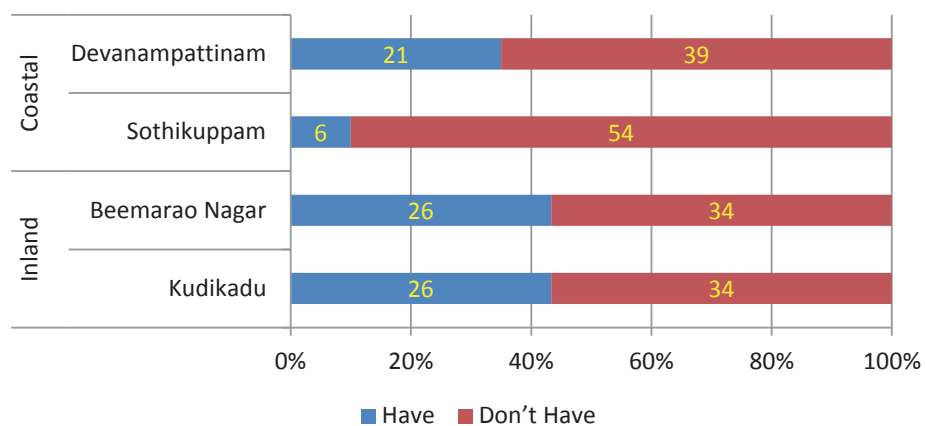


Fig. 4.48 Savings status

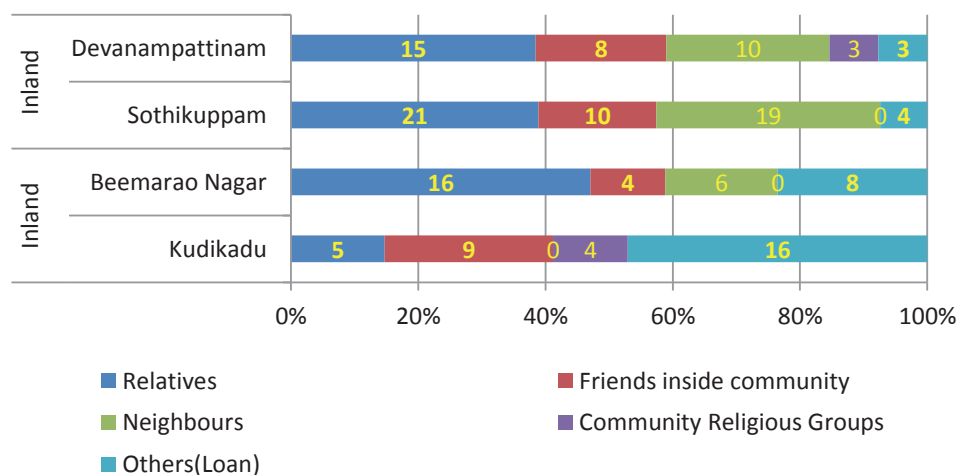


Fig. 4.49 Person who helps during financial need

Saving practice can be considered a measure which have the capacity in lowering not only the economic adversity but also help in facing and coping with the all types of impacts caused by disasters. Fig. 4.48 shows that majority don't have saving practice both in coastal as well as inland communities. Even then if compared it can be seen that inland communities (Beemaroo Nagar and Kudikadu 43.33%) exhibits more saving practice than coastal communities (Devanampattinam 35.00% Sothikuppam 10.00%). In case of people who don't have saving practice to deal with their economic needs in general especially after a disaster, they depend on their relatives, friends inside community, neighbours, community based religious groups or on loan facilities (Fig. 4.49).

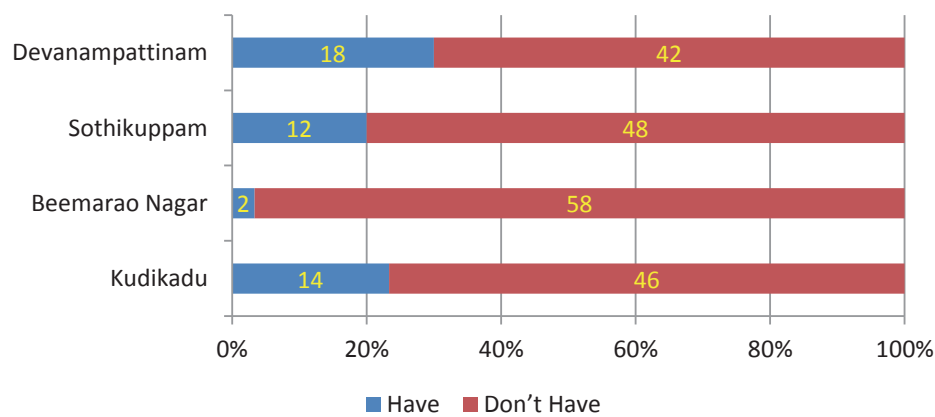


Fig. 4.50 Insurance Status

Insurance is another nonstructural mitigation measure that can help a household / community to cope with the disastrous situations. Even then popularity of insurance and its benefits can be seen very low (Fig. 4.50) among communities from the low proportion of insurance holders in both inland (Beemaroo Nagar 3.33% and Kudikadu 23.33% and coastal communities (Devanampattinam 30.00% and Sothikuppam 20.00%).

4.3.2.4 Risk Awareness and Preparedness

When it comes to awareness about the status of vulnerability of the place they live in, they share not unanimous but different opinions and in all cases majority have the opinion that their community faces vulnerability and risk (Fig. 4.51). 78.33% respondents of Devanampattinam, 76.66% of Sothikuppam, 56.66% of Beemaroo Nagar 100% of respondents of Kudikadu are of the opinion

that their community, the place they live in face risk and vulnerability. Even they know their place have vulnerability; the willingness to stay in the same place is really high (Fig. 4.52)

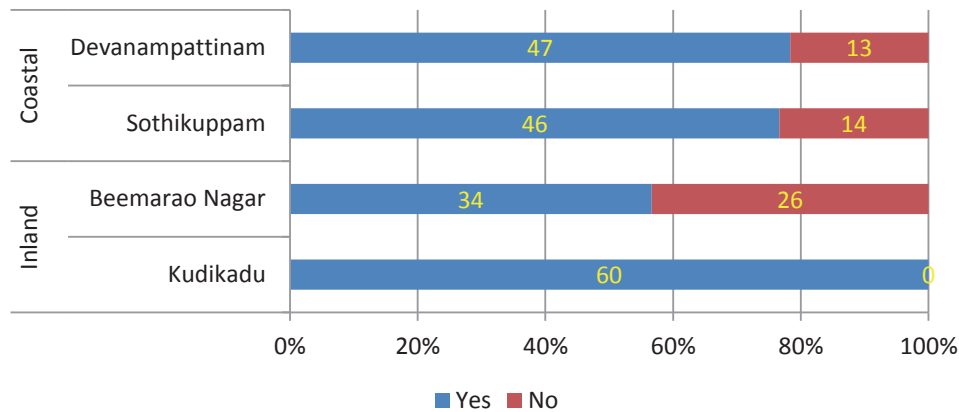


Fig. 4.51 Response to whether their place is vulnerable

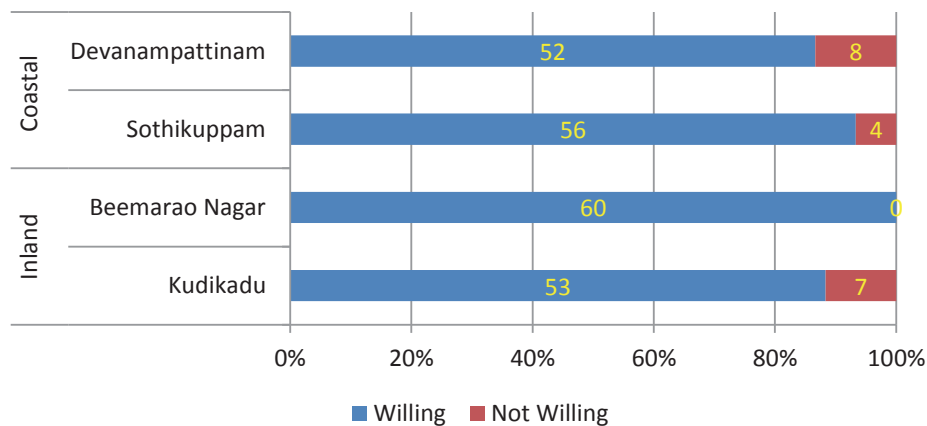
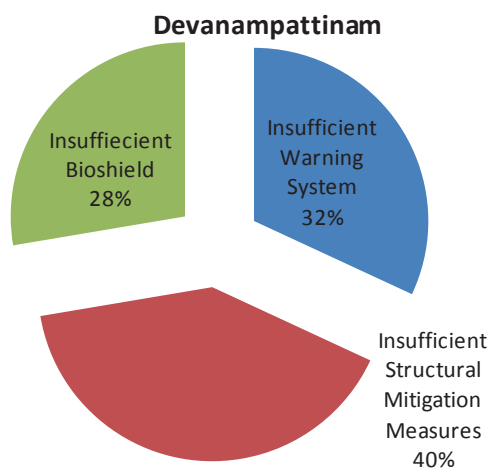
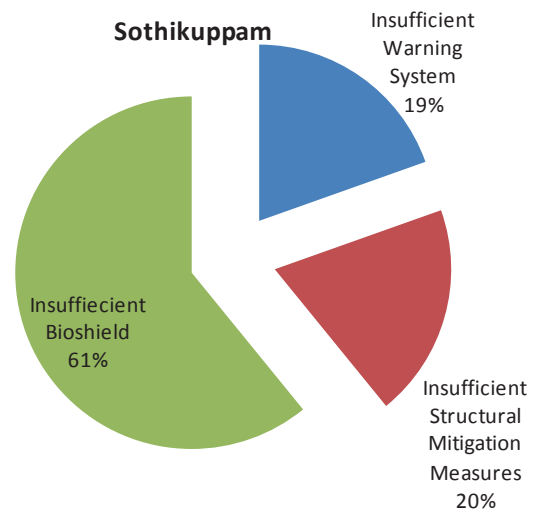


Fig. 4.52 Willingness to stay

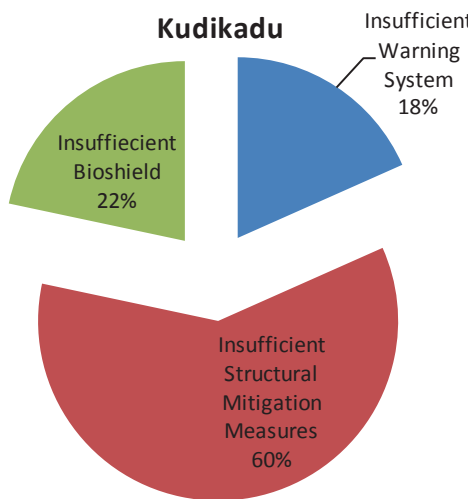
Each community has their own distinct opinions about the factors that are responsible for the prevailing vulnerability and risk. The three major factors identified are insufficient bio shield, insufficient warning system and insufficient structural mitigation measure (Fig. 4.53(a) to (d)). In both inland communities (Kudikadu, 60.00% and Beemaroo Nagar, 59.00%) insufficient structural mitigation measure is identified as the major factor that contributes to vulnerability.



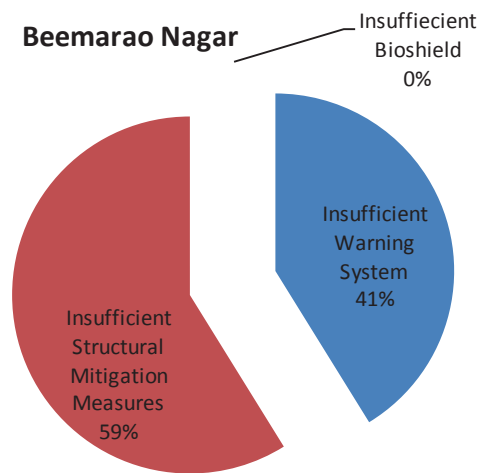
(a)



(b)



(c)



(d)

Fig. 4.53 Reasons for vulnerability ((a) Devanampattinam, (b) Sothikuppam, (c) Kudikadu, (d) Beemaroo Nagar)

Thus, from the survey results of both coastal and inland communities, it can be inferred that, the assumption of inland communities will be more resilient than coastal communities in all aspects (physical, social, economic resilience, risk awareness) is not right in its full sense. There were cases, where inland communities show less resilient traits in certain aspects than coastal communities (e.g. Water quality of Kudikadu shown in Fig. 4.34 (Physical resilience), Trust level shown in Fig. 4.41

(Social Resilience) to point out a few). Therefore, while more attention is given to coastal communities (taking its natural vulnerability into account) in enhancing their resilience, ample attention is required in assessing resilience challenges and empowering communities of inland areas also, especially inland communities seen adjacent or close to coastal communities. This in turn can help inland communities to enhance their resilience level and more importantly respond better in case of a disaster by helping adjacent coastal communities especially at the time of emergencies as well as post disaster phase.

4.4 Summary

A community's strength is based on its resilience to any event expected or unexpected (eg. A disaster or any other mishap) that has the capacity to disrupt the community's physical, social or economic condition. So a community should always have a well-managed and maintained resilience status. For this a community should be good at its physical resilience, economic resilience and social resilience, and should also be good at risk awareness and preparedness towards it. At the same time for maintaining a well-managed system in each community, the problems and challenges they face has to be found out and addressed in order to rectify those and thus for enhancing resilience.

Solutions for enhancing or strengthening resilience cannot be generalized. Even when it is for similar communities like coastal communities, inland communities, mountainous communities, riverine communities, the issues they face vary with individual community. The results of survey itself are an example for the variations in issues, vulnerabilities faced by two coastal communities as well as by two inland communities. So when we take whole communities of a district or much higher administrative division like state the variation in issues the communities face and type of solutions they require varies a lot and the management becomes complex. The resources, natural features, social bonding, attitude of community members, and so many factors decide the challenges and its severity they encounter with. So solutions should be more localized. Thus organizations working in grass root level can be the greatest contributors of solutions to issues a particular community has. Even then there may be features common for similar communities (coastal, mountainous etc.) for them general solutions can be recommended and successful solution adopted by one community should be or can be suggested to other community sharing the same problem.

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Chapter 5 Need, Significance and Inculcation of Disaster Education at Community Level

5.1 Introduction

Whether a disaster is major or minor, or of national or local proportions, the people in the community suffer most of its adverse effects (Victoria, 2009). Disaster management initiatives, policies, and frameworks are designed and implemented as well as other community based activities are carried out by governments, along with other effective stakeholders like non-government organizations (NGOs) and civil society organizations; all aimed at empowering communities in one way or another (Ismail *et al.*, 2014). For materializing the success of disaster management paradigms, any of these initiatives requires DRR in its most genuine sense. In addition, always starting from people is essential if community disaster risk reduction is to flourish (Ferdinand *et al.*, 2012).

To ensure the sustainable empowerment of communities, educating and making people aware of risks and vulnerabilities they face and how they can better prevent these adversities through risk preparedness are ways which can even support the efforts to build a resilient community. The United Nations International Strategy for Disaster Reduction (UNISDR) places considerable emphasis on building the resilience of communities as a necessary component of disaster risk reduction (DRR) (UNISDR, 2015). It is always better to implement DRR activities and community resilience-enhancing activities through, or along with local bodies (making the community the “core group”) and whoever is working at the grass-root levels, (which may vary by place and region and within different regions of the same Country); they are more likely to know the geographical, economic, and social background in detail (Mohammad and Oo, 2014; NDMA, 2010; Scolobig, 2015). Moreover, there is a growing recognition that to be successful, such DRR efforts should encompass the knowledge and perspectives of local communities and citizens (Ismail *et al.*, 2014). Thus, the main objective of this is to discuss about the educational tool prepared and its application in field by conducting the awareness workshop to illustrate its use in “real world” circumstances as well as its efficiency and limitations.

5.2 Education in Disaster Risk Reduction

Disaster risk reduction is described as 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) the adverse impacts of hazards, within the broad context of sustainable development (UNISDR, 2004). Education should always be treated as a sustained learning experience for everyone throughout life (Smyth, 1996). Education can be both direct and indirect. Direct education being taught by institutions such as schools, colleges, universities or other similar organizations with an established structure (syllabus), but indirect education is that learned through one's own daily activities, extra-curricular activities, traditional knowledge, and other experiences in life. Any form of education has the potential to bring about changes in the level of one's awareness, attitudes, and critical thinking, as well as in problem-solving capacities.

It has been widely acknowledged that education takes on a pivotal role in reducing disasters and achieving human security in the attempt to achieve sustainable development (Shaw *et al.*, 2011). Broadly based on the lessons learned from experiences, it can be said that: (i) education is a process for effective disaster reduction; (ii) knowledge, perception, comprehension, and actions are the four important steps; (iii) schools and formal education play an important role in knowledge development; (iv) family-, community-, and self-education are important for comprehension of knowledge and implementation of risk reduction actions; and (v) holistic education includes actions at local level as well as its policy integration (Shiwaku, 2009).

During the 1990s, which was designated as the International Decade of Natural Disaster Reduction (IDNDR) by United Nations, significant public education efforts emerged in many nations, and “hazard education” took root in science classes in schools (Petal, 2009). Moreover, the theme of “Disaster Reduction, Education and Youth” was introduced during the UN World Disaster Reduction Campaign in 2000 (UNISDR, 2015). After that, late in the 2006–2007 “Disaster Risk Reduction Begins at School” campaign, the UNISDR not only attempted to highlight the importance of integrating DRR into formal education, but also emphasized the importance of community participation in order to achieve sustainability within the community (UNISDR, 2014).

Besides the education provided to youth through their formal education in educational institutions, it is widely advocated that education of the community is essential to ensure sustainable DRR. Towards this, in Hyogo Framework for Action (2005–2015) in its priority of action 3, focuses on the

“use [of] knowledge, innovation and education to build a culture of safety and resilience at all levels”, thus emphasizing the strength of education and knowledge in DRR (UNISDR, 2014). In addition, it is also important to realize that the goal of developing “disaster-resilient communities” is widely understood to depend heavily on the success of DRR education (Petal, 2008). DRR education can be seen to be rendered in various ways. Schools have an important role in knowledge development for building community resilience and it is also important to continuously provide disaster education in school (Oktari *et al.*, 2015). The role of family and community participation is also very crucial for the enhancement and the sustainability of disaster education (Takeuchi *et al.*, 2011). When it comes to DRR at the community level, it is usually addressed by forming community-based disaster organizations and training individuals in disaster management courses (Ferdinand *et al.*, 2012).

Living in an era of technological breakthroughs, the availability of information is plentiful but only proper sharing of information and its proper utilization can help in replicating the benefits. The efficiency of disaster education lies in sharing information, cooperation, and collaboration among various institutions, agencies, and other bodies (government, non-government, *etc.*) working towards achievement of the same goal—“DRR”. Thus, educators with a handful of information on both risk and its reduction measures are not always sufficient to ensure success in the initiatives taken. Awareness programs and formation of sustainable disaster risk management communities under the supervision of concerned authorities can be an effective way to deal with DRR and its educational needs.

Being the first respondents at any kind of disaster, it is the active participation and involvement as well as the awareness of community members is of prime importance for the success of any initiatives. However, it is difficult to engage the public with regard to programs like emergency preparedness, as rural residents perceive the information as redundant (Cole, 2014) even though all the available knowledge resources will be fruitful only when the information reaches the society/community and brings positive changes to them by creating safer communities that are more empowered and resilient, which have self-help capacities to respond appropriately to the disasters yet to come. Thus, it is always recommended that planning and designing educational programs should focus on the risk and vulnerabilities of a particular community, the feasible risk reduction activities that can be implemented, and how these measures can improve the community’s social, economic, physical (resilience) status if they are adopted. This can be a way of invoking

interest among community members to learn more about the possibilities and opportunities offered by DRR activities, and make them participate and practice the risk reduction approaches. Educational programs and tools like workshops and brochures can be made appealing to the target audience by including images and maps (Google maps, hazard maps showing vulnerabilities).

In order to be truly responsive to the needs of local populations, including marginalized groups, programs must involve some kind of decentralization, which is to be understood as devolution, *i.e.*, a transfer of decision-making authority from central to local governments, or a transfer of authority within central administrative structures (e.g., from the headquarters of a ministry to its district offices) (Crook and Manor, 1998; Turner and Hulme, 1997). Fund mobilization for conducting such awareness programs can be a hurdle, especially if the awareness program is conducted on a small scale in selected communities. There will be budgetary constraints for the local and district governments in making such programs happen. To this end, they have to make efforts to bring in essential policy reforms; decentralization can also be a good solution that brings about considerable impacts. It has also been advocated that populations directly affected by environmental hazards should decide on and develop policies to deal with them (Winser *et al.*, 2004).

Along with various means of implementation, there are various disaster education materials described as “educational tools”. As one form of disaster education, awareness-raising programs and awareness workshops are widely conducted or provided by NGOs (Kurita, 2007). Along with the use of action-oriented, participatory techniques, due importance should be placed on the indigenous knowledge of the respective communities. However, the point to be noted is that the success level of education depends on the efficiency of the mode of execution, how the community conceives it, and their level of interest so the selection of the mode of execution is particularly important. The mode of execution and what is to be conveyed or taught should be chosen appropriately according to the target group, their needs, and existing constraints. Disaster education has to aim at shaping out empowered and resilient communities against disasters by making them realize their own potential as well as enabling them to find solutions to the problems they are facing. Partnerships or collaborations among government bodies (especially local government) and NGOs in such situations can ensure better educational initiatives which can further bring synergistic effects to the expected outcome among communities.

5.3 Educational Tools of Disaster Risk Reduction

Following adoption of the Hyogo Framework for Action, various disaster educational materials, described as “tools” of various forms were developed; these included printed materials (booklets, leaflets, textbooks, handbooks/guidebooks, and posters) and non-printed materials (activities, games, and practices) (UNISDR, 2014). So far, numerous institutions have developed DRR educational tools ranging from national governments, research institutions, and the UN to national as well as international NGOs. These tools are expected to be used from the international to the local level for the welfare of communities around the world (Kurita *et al.*, 2007; IFRC, 2015).

Since the turn of the millennium, especially as a result of communication and information-sharing opportunities facilitated by the internet, DRR champions have produced a plethora of educational materials for school children and the general public alike (FEMA, 2015; Winsor, 2006). UNISDR in collaboration with other partners has developed games like Stop Disasters, Risk Land and Educational Toolkit and Magnitude. The question that arises is: “Are we utilizing these educational tools in the expected way?” The responsibility that now remains is the proper management, sharing, and use of these tools in its most appropriate way to make these tools reflect in actions at implementation of disaster reduction activities.

While converting these tools into actions, it should be assured that knowledge and information is flowing in both directions *i.e.*, from practitioners or concerned authorities to the community as well as from the community to concerned authorities regarding their indigenous knowledge, local wisdom, needs, constraints, etc. This can help in modifying and improving the tools further. At this point, it has to be noted that, it was only very recently that the value and necessity of exchanging scientific and technical knowledge with indigenous knowledge could be articulated (Petal, 2009). Sharing of information and educational tools among communities, especially those facing similar problems (hazards) in different corners of the world, can help in multiplying the benefits and achieving the aims of each tool to a greater extent.

It is also important that the type of DRR tool fits the locality and is focused on the underlying risk; matching the local context, as hazards, vulnerabilities, risks, and capacity level will vary from region to region. So while implementing the tool, it should be altered to adapt it to the particular context. When altering an educational tool, the target audience, their cultural background, the vulnerabilities

they face, and the major resources available should be the essential factors in deciding the modifications needed.

5.4 Disaster Reduction Hyperbase-Asia Application and the Educational Tool Developed

Disaster Reduction Hyperbase-Asia application (DRH-Asia or simply DRH) is a web-based knowledge base of disaster reduction technology information. The development of DRH-Asia was initiated by the launching of the DRH Project based on the proposal of the Japanese Government at the UN World Conference on Disaster Reduction (WCDR, 2005; Kameda, 2011). DRH-Asia addressed international promotion of the “disaster reduction portfolio,” which was an effective information platform of disaster risk reduction (Kameda, 2011). The proposal was intended to contribute to implementing the Hyogo Frame of Action for 2005–2015 adopted at the WCDR.

Thus the product DRH-Asia was designed as a vehicle to compile and disseminate useful disaster reduction technology and knowledge and to facilitate its implementation. DRH-Asia is being operated at <http://drh.edm.bosai.go.jp> since 2008 (Kameda, 2011). Disaster Management Technology Database (DRH Exercise) is one of the interdisciplinary seminars under the Global Center for Excellence—adaptation, resilience, for a sustainable/society program (GCOE-ARS) offered by Kyoto University. Students enrolled after getting acquainted with the DRH-Asia contents have to develop their own DRR educational tool. This section explains the educational tool developed for conducting an awareness workshop using DRH-Asia contents.

The title of the educational tool prepared was “Awareness Workshop: A Step towards Enhancing Community Disaster Resilience”. The main objective was to develop an educational tool for the coastal community to enhance their knowledge about disasters they usually face the significance of the disaster reduction approach, and how it can be undertaken. As the main purpose of the tool is to generate awareness among the selected target group, the tool is designed not as a self-learning type of tool but as a training material that can be used by any NGO or any awareness-raising organizations for conducting awareness workshops. Even though the tool was prepared for the coastal community, it provides complete flexibility to the users to bring in modifications by changing the target group to any other community and to change the hazards as required.

Lecture/presentations, field trip and group discussion are the main methods to which the educational tool suggests adhere to in enhancing knowledge and awareness. Lectures can be used to generate awareness about hazards, especially those which are prevalent in that specific area. It is also important to include lessons on disaster reduction methods and their significance in the lectures. Lectures should be conducted in such a way that they invoke knowledge, interest, and desire among community members to learn about disaster, its management, and DRR approaches and processes. Instead of simply lecturing, presentations can be used as the media for conducting the lecture, which can help in attracting more attention, describing things more deeply, making the audience understand more clearly and helping them retain more in their memory for a longer time than a lecture would.

Being an action-oriented approach, conducting field trips can help in identifying and assessing the vulnerabilities of the selected area. Group discussions can help in bringing out new ideas from the participants. As the saying goes, “A photo is worth a thousand words”, displaying original photos or newspaper clippings, downloaded images from the Internet of past disasters, its recovery and reconstruction phases of different places within the country, or best examples from other countries can help in generating curiosity to know more and improve the effectiveness of the workshop. After the workshop, it is advisable to provide pamphlets to the participants with the main points that have been covered (especially the awareness generation section), which can help in remembering the things learned after the workshop. These can always be an information capsule in a simplified form.

Awareness Workshop Structure and Guidelines for Conducting the Workshop

The proposed workshop of the educational tool has been designed to cover three days, which can be changed depending on the situations where the workshop is to be conducted and the existing constraints. As shown in Box 1, the major activities of the workshop will be done over three continuous days. On the first day, the lecture (presentation) by the facilitator from the organizing group and the discussion based on the presentation are the activities to complete. In an introductory session, participants and the organizing group members can introduce themselves, which will help in rapport building. Subsequently, any of the organizing members can explain briefly about the workshop activities. Before the presentation, questionnaires prepared to check the awareness level of the participants have to be distributed and answers should be collected. Sample questions which can be included in the questionnaire for pre- and post-evaluation assessments are listed in Table 5.2.

Table 5.1 Major activities of the workshop

Day 1 Lecture(presentation), group discussion based on lecture
Day 2 Field visit, group discussion, presentation
Day 3 Formation of disaster management group and group discussion

Table 5.2 Sample questions for the questionnaire

(1)List out the natural disasters that affect your village
(2) Mention whether they affect annually or not? If not annually when did that disaster occurred for the last time (mention the year)
(3)If it occurs every year in almost which month or months do they occur?
(4)Which spots in your village do you think is the most dangerous?
(5)List other dangerous spots in your village?
(6)Name some safe places in your village that can be used for evacuation or evacuation shelter
(7)Name the latest severe cyclone (any other major hazard common in that particular area) that affected your area
(8)List 3 safety measures for each disaster you listed

After conducting the pre-evaluation test to generate knowledge and correct understanding about disasters, risk reduction methods, and related issues the presentation can be delivered. It can be broadly divided into two parts. The first part will be for basic awareness generation about hazards. Topics that have to be covered include, for example: (i) What are disasters? How and why do they occur? (ii) Common disasters in that particular place and their timings; at which time of the year does those disasters (e.g., floods) usually strike the area? (iii) Safety tips for each disaster common to that particular place.

Topics that have to be covered in the second part include: (i) familiarizing participants with existing mechanisms in other parts of the world e.g., conference mechanisms (DRH51), cyclone early warning dissemination at the community level in Bangladesh (DRH19). This will help participants to understand that around the world people are facing adversity because of disasters and how they are coping with such difficulties. This discussion will give new ideas and/or help people to develop their own management methods or adopt methods followed by people elsewhere. This can generate the

attitude or will power among participants that they can also cope with disasters; (ii) The significance of DRR—this can make communities aware of how the DRR approach can make a huge difference to the impacts they have to face after the usual disasters; (iii) What should be done to ensure DRR? This can help the community to increase their coping capacities.

As preparation for the second day's activities after the presentation and general discussion, groups can be formed for the field trip. Field trips can help explore the disaster-related risk and vulnerability issues in the target area, and reinforce what participants have learned through lectures. To ensure everyone is participating efficiently, it is best to divide the total number of participants into small groups (e.g., five participants and one supporting person, NGO member, or any person from the organizing community in each group). When forming groups, it will be better to try distributing participants evenly from all categories (e.g., male, female, student, and elder) into each group. Make preparations based on the already prepared checklist (e.g., base map, markers, camera, pen, pencil, sticky notes, *etc.*).

The second day will focus mainly on the fieldtrip. To prepare, divide the whole target area (e.g. part of the village) into four sub-areas. Each group will have a predetermined time allowed (e.g., 45 min) for visiting and examining situations in each area (division of the target area and time duration for the visit can be altered according to the number of participants and the size of the target area). Activities to be done in the field include: (i) identifying the vulnerabilities/dangerous spots (for example, Fig. 5.1(a)); (ii) identifying safe spots; (iii) understanding local issues such as sanitation and waste management issues *etc.* (see Fig. 5.1(b))



(a)

(b)

Fig. 5.1(a) River mouth and (b) Improper waste disposal

Based on the field visit, discussion should be undertaken within each group about what they have seen, what can be done to reduce disaster risks in the target area, about evacuation routes to the safe places they have identified. After the discussion within each group, each group should present what they have discussed and their conclusions and remarks. After that, the main facilitator can make the concluding remarks based on the presentations of all the groups, and a general discussion for further clarification and interpretation can be conducted. Formation of the disaster management group and group discussion will be the main activities on the third day. A workshop for two or three days will not be able to assure community resilience in its full sense. For building a disaster-resilient community, further actions are required from both the community and the experts in the field. The formation of permanent disaster management groups in the community can lend help in this regard. As a part of the group formation, the selection of members has to be done. After the group formation, the next step is holding a group discussion on how to make the group work together, and for ensuring a well-coordinated functioning. The role allocation for the selected members can be an added advantage for the group to function smoothly. To check the changes in their awareness level, a post-evaluation exercise has to be done using the same questionnaire; and answers have to be collected from the participants again. Finally pre-prepared pamphlets with the main points from the presentation can be distributed.

5.5 Awareness Workshop in Devanampattinam: A Case Study

With reference to the educational tool prepared for DRH, a one-day awareness workshop on “Disaster Risk and its Management” was conducted in Devanampattinam of Tamil Nadu, India on February 22, 2015. Even though the workshop proposed in the educational tool was designed for a three-day workshop, due to constraints in conducting a workshop of that length in that village, the tool was modified and a one day awareness workshop was conducted. Devanampattinam (Fig. 5.2) is a coastal village of Cuddalore District that was severely affected in the 2004 Indian Ocean tsunami and in the 2011 Thane cyclone; it also faces cyclonic depressions almost every year. In the 2004 tsunami, 42 women and 21 men died (Oxfam International, 2015) in Devanampattinam village itself. Unsurprisingly, houses were significantly damaged in this coastal fishing village built barely 50 m from the shoreline at sea level (Sheth *et al.*, 2006). While due to Thane cyclone, 41 lives were lost in Cuddalore District (Cuddalore District Government Report, 2011). The tsunami colony built for the 2004 tsunami victims also faces flooding every monsoon season owing to reconstruction failures.

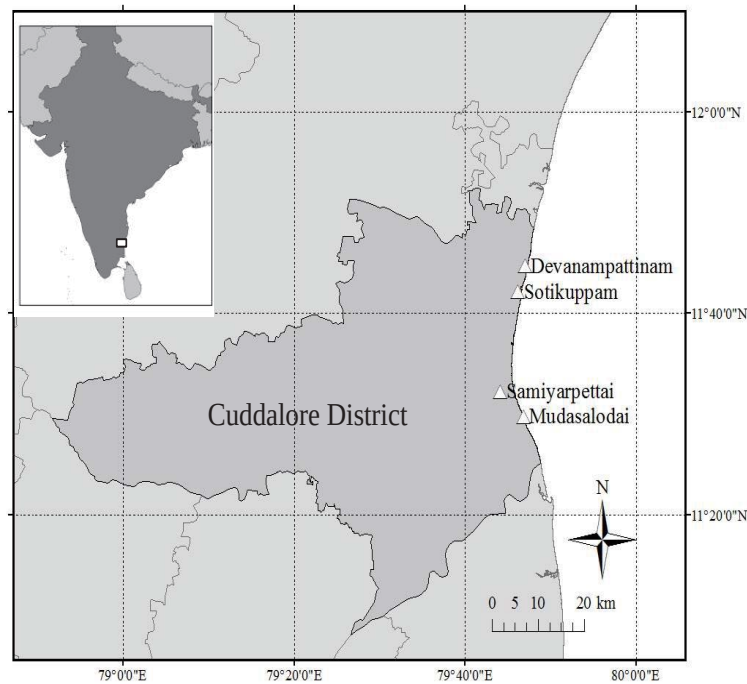


Fig. 5.2 Location map of Devanampattinam

The target participants were community members who consisted of men and women, students ranging from high school to university levels, representatives of NGOs, and village representatives. The main objective behind the workshop was to enhance their knowledge about disasters they usually face, DRR measures, their significance, and how these measures can be implemented. Media selected for the workshop included a presentation, as presentations are one of the best ways to describe things more deeply through giving more emphasis to pictures, images and illustrations; this allows the audience to understand things clearly and for information to remain in their memory for a longer time than an oral talk (Paivio and Foth, 1970). In addition, groups of participants were required to prepare a hazard map (Fig. 5.3(b)) of their village; each group identified the safest and most vulnerable areas on the map they prepared. A total of 42 community members and four representatives of NGOs participated in the workshop. To check the general awareness level relating to disasters, an evaluation was done with a predesigned questionnaire at the beginning of the workshop (Fig. 5.3(a)). In this evaluation, students who were studying below high school level and NGO representatives were exempted. Thus, a total of 30 community members took the evaluation

test. The youngest participant was 12 years old and the eldest was of 62 years. The majority of the participants (40%) were between 21 and 40 years old (Fig. 5.4).

To check the change in the awareness level of participants as well as to check the effectiveness of the workshop, a post-evaluation test was carried out with the same questionnaire and same participants at the end of the workshop.



Fig. 5.3(a) Distributing questionnaire for pre evaluation and (b) Preparing map

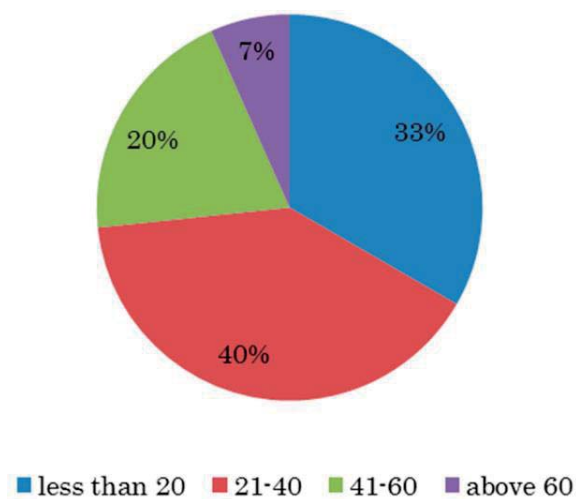


Fig. 5.4 Age distribution of participants

5.6 Results

In the pre-evaluation test, 53% answered correctly that receding of sea water is a natural warning sign of a tsunami while 13% and 7% answered that rise in seawater temperature, and changes in seawater colour, respectively, as the natural warning signs of a tsunami (Fig. 5.5). The rest (27%), answered that they didn't know. However, after the workshop, 100% of the participated answered correctly that the receding of the sea water exposing the sea floor was a natural warning sign (Fig. 5.5).

As for the most effective media to receive information and updates, participants expressed quite different opinions (Fig. 5.6). The majority, about 73% of participants, answered that it is television that they consider the most effective media compared to the Internet, newspaper, and radio. About 17% answered that the Internet was the most effective while newspapers and radio were cited by 7% and 3%, respectively. In the post-evaluation test, 100% of the participants unanimously chose radio as the most effective media for getting disaster information and updates compared to television, newspaper and the Internet (Fig. 5.6).

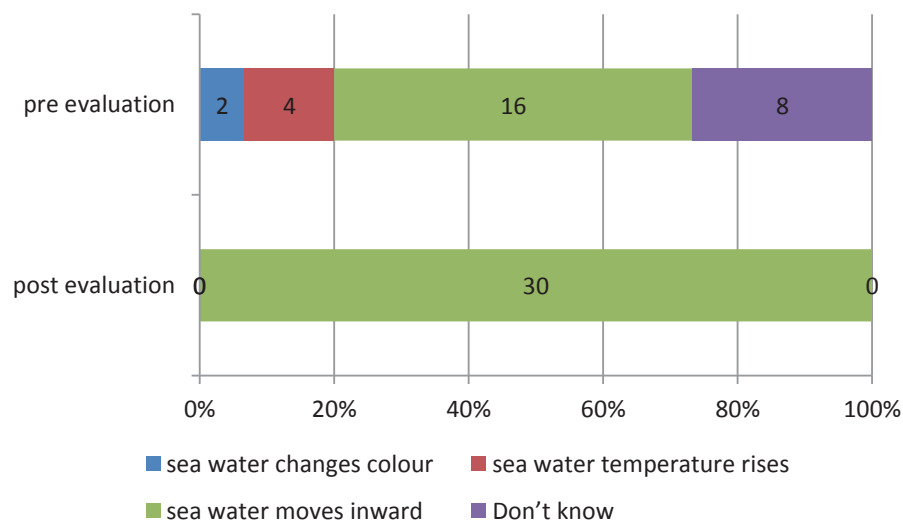


Fig. 5.5 Response of pre and post evaluation about natural warning sign of tsunami

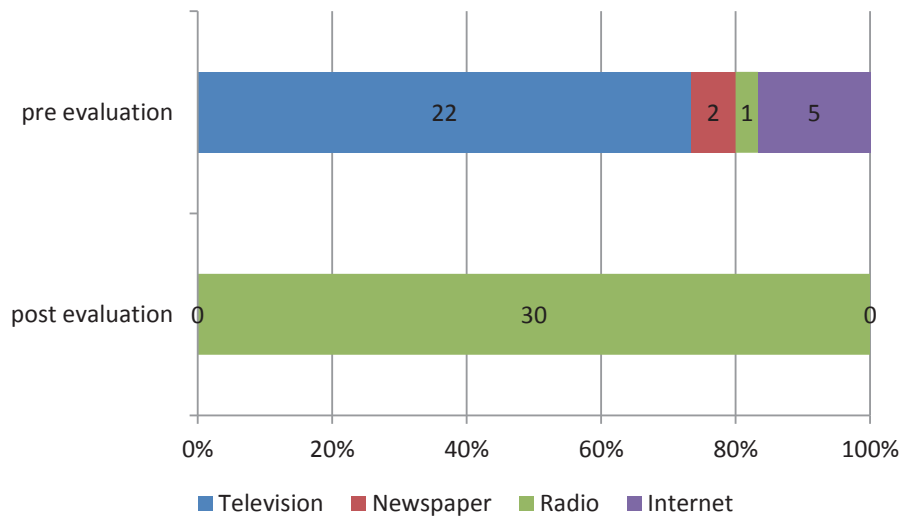


Fig. 5.6 Response of pre and post evaluation about most effective media to get disaster information and updates

Though living in an area affected by flood, all of the participants stated that they had not heard about flood insurance before (Fig. 5.7). After the workshop, there was a change in the response level (from 0 to 90%) among those who responded that they had heard about flood insurance (Fig. 5.7).

As the workshop was organized for a coastal community, their opinion about which was the better alternative livelihood option, marine or non-marine resources, was asked. The primary response during the pre-evaluation test was that 70% had an opinion that marine resources were a better choice for an alternative livelihood. Another 13% chose non-marine resources as better while 17% responded that they did not know which was better (Fig. 5.8). However, in the post-evaluation test, 97% agreed that non-marine resources were better than non-marine resources (Fig. 5.8) as they can lessen the pressure on existing marine resources, and income can be earned even in the off season (the “rough season” is almost five to six months annually, when people usually do not go to sea for work). Meanwhile, 3% still answered that they didn’t know which was better between marine and non-marine resources.

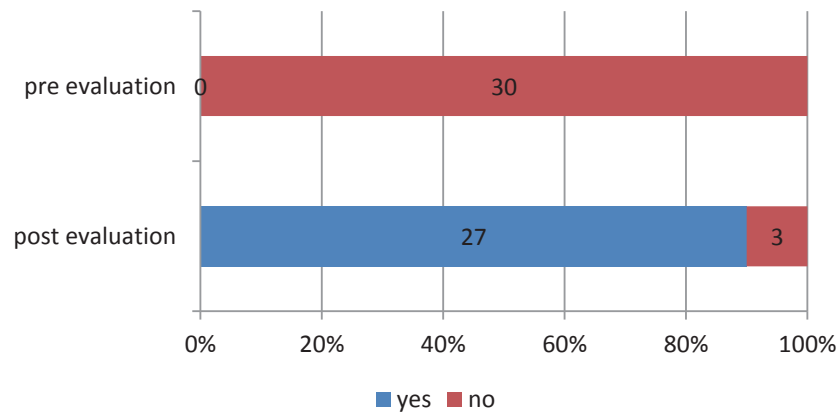


Fig. 5.7 Response of pre and post evaluation about awareness on flood insurance schemes

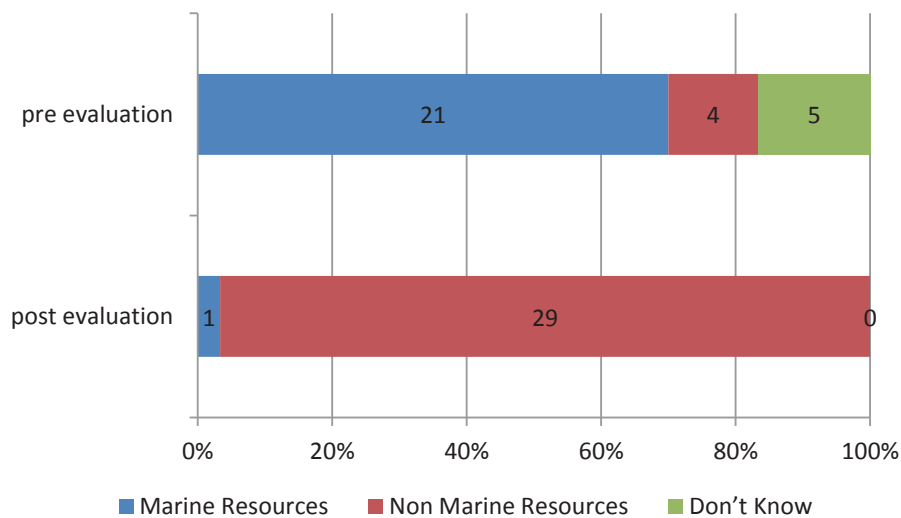


Fig. 5.8 Response of pre and post evaluation about better resources for alternative livelihood

To check the perception of participants about disaster occurrences, they were asked to select the most appropriate statement among the following options: yes, we can stop disasters; no, we cannot stop disasters; and, disaster risks can be reduced. In the pre-evaluation test, 46% participants answered that disasters cannot be stopped, which is quite understandable, but more significantly, the appropriate statement, given the options, is that disaster risk can be reduced, and only 27% of participants selected this as their answer. Of the other options, 7% answered that disasters can be stopped and 20% didn't know. Drastic variation was found in the post-evaluation answers, in which 90% believed disaster risk could be reduced, and 7% believed disasters could not be stopped. The rest, 3%, expressed the belief that we can stop disasters (Fig. 5.9).

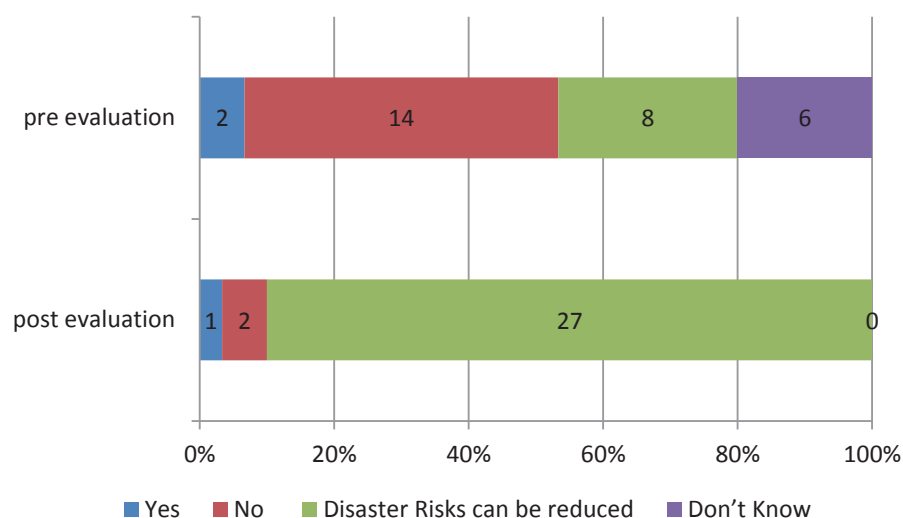


Fig. 5.9 Response of pre and post evaluation about most appropriate answer for the statement - ‘We can stop disasters’

5.7 Discussion

Considerable difference was found in the answers between the pre- and post-evaluation test. As explained earlier, pre-evaluation test was taken before the workshop and in the workshop, topics regarding the prevalent disaster risk issues in the village, possible disaster preparedness, mitigation and risk reduction methods were discussed. The participants were also made to discuss those topics and their perceptions. So, this could be the reason for the considerable variation, shown in their answers of post-evaluation test taken after the workshop.

A community should be aware of all the possible disasters that may affect their community and more importantly, the early warning signs of each of them. Even though not a frequent disaster; as a disaster that has badly affected the community, the awareness of warning signs of a tsunami was checked through the evaluation test. Unsurprisingly, the majority (53%), gave the right answer in the pre-evaluation test itself. Regarding the case of effectiveness of media; during the workshop, the merits and demerits of each type of media for getting disaster updates and information were explained and discussed. The effectiveness of media can vary with the local conditions. As per the Cuddalore District Government Report on the Thane cyclone (2011) (Cuddalore District

Government, 2011), the entire district suffered a lack of power, and it took one entire month to restore the power supply. In such cases, depending on television or the internet is ineffective. In such situations, battery-powered radios are most effective. The participant's change in perception regarding this can be seen as evident in their response (Fig. 5.6).

Awareness of possible mitigation measures is always necessary in a disaster prone community. Insurance is one such non-structural mitigation measure that can help the victims recover back to their normal lives. Various insurance policies are available these days each serving specific purposes. India being a country where over 40 million hectares of area are prone to floods, it is not a surprising fact that flood insurance is available (Sharma and Khanna, 2013), though not so popular in rural areas. This is mainly because of their weak economic condition which makes it difficult for them to buy insurance. In such cases, micro-insurance facility can be a big boon in solving the issue. For micro-insurance options to serve the community in their hard times, especially in situations like disasters, government, insurance companies and NGOs have to work hand in hand in establishing special schemes availing the needs of communities and popularizing the schemes among communities. Under such circumstances, proper awareness has to be given to vulnerable communities about the available insurance provisions and their significance. This should be considered part of the authorities' responsibilities as it can bring about positive effects to the societies concerned. Lack of such awareness in the community was able to be seen clearly in Fig. 5.7. While coming to alternative livelihoods, they can act as the backbone of a society in hard times, especially if the society is depending mainly on one or two resources for their income, and especially if they are not dependent on the formal sector (such as government jobs) for income. Dependence of a community on the resources available for their livelihood and alternative livelihood purposes can be detrimental in the well-being of the community as such. The knowledge they gained regarding the selection of resources for their alternative livelihood, reflected in the results as well (Fig. 5.8). To confirm statistical significance of the results, a McNemar-test, which is a simple and robust statistical test for paired nominal data and which would be appropriate to verify the results was applied in each of the results of Fig. 5.5 to 5.9, and all results were found statistically significant with $p < 0.001$.

Preparation of hazard maps by the participants in different groups and the presentation by each group proposing the evacuation route to the safest places they had identified provided an

opportunity for them to discuss each group's perceptions and to come to conclusions about the most dangerous and safest areas in their village, and the route they have to consider as an evacuation route during disasters (Fig. 5.10). Discussions like this can help in building the community's capacity to express their views as well as help increase their problem-solving capacities. There is already a growing recognition that to be successful, DRR efforts should encompass the knowledge and perspectives of local communities and citizens (Texier-Texier *et al.*, 2014). Platforms such as this allow an opportunity to directly hear from the community about their perception and concerns, which can further help the organization to guide them along the right path.



Fig. 5.10 Presenting the prepared map with proposed evacuation route

Usually, in awareness workshops, criteria for selection of participants will be mainly based on age, gender, students, occupation (e.g., teachers, fishermen, social workers), *etc.* However, for the current workshop, first of all, there were no such criteria, members of that particular community of different age groups, gender and occupations were selected. It was done like this as authors believe that for generating a better exchange of thoughts, followed by sound discussion, as well as generation of new ideas, requires participants of all age groups, gender and various occupational backgrounds. Secondly, not all awareness workshops did the evaluation test, especially before and after the workshop, but, for this also; considerable importance was given in the present workshop conducted. Authors

consider both of these positive indicators of the current workshop developed, which makes it different from other usual workshops.

When it comes to the limitations found in the workshop, it was (apart from students) the non-participation of men that was identified. The main reasons behind this may be the requirement on men to be the main income earners in the family as well as the low economic status they give more importance to work rather than such awareness programs. Communities that are still striving to attain their basic necessities have less likelihood of showing interest in, and placing importance upon protecting themselves against disasters through risk preparedness well in advance of such occurrences. Lacking even the basic necessities for life, the implementation of risk preparedness programs in these communities will be ineffective in a way, and can bring some element of dissatisfaction into the community (Asharose and Saizen, 2015). Another reason for lack of participation could be the low level of risk perception among men. This fact can be clearly explained as if the public does not perceive the presented risks as real, no action will be taken and the information will be ignored (Britton, 1998).

Another possible concern regarding the participants of the workshop would be; even though Devanampattinam is a big village with a population of more than 9000 (PMSSS, 2015), the number of participants who attended the evaluation test was only 30 in number. The main reason behind this is that it is always advisable to have a control over the number of participants and to keep it around 10 to 30 (Chatty *et al.*, 2003; NICE, 2015) especially in an awareness-raising kind of workshop, as, if the number of participants increases further beyond this, it will be difficult to ensure active participation of each participant (Chatty *et al.*, 2003). At the same time, for confirming the awareness of that (an) entire village, it will be better to consecutively conduct such workshops with certain time intervals as well as with different set of participants, because awareness raising is not a short term affair.

For the formation of educational institution-based disaster management clubs, an absence of funding authorities was identified as an obstacle. Such groups, if formed, can be useful in the pre-disaster phase for preparedness and risk reduction activities as well as in the post-disaster phase for rescue, rehabilitation, and recovery activities that can help assure the sustainability of DRR educational initiatives. Ensuring the sustainability of disaster education is a task that cannot be

compromised, and UNESCO has emphasized the importance of facilitating networking and collaboration among stakeholders involved in it (UNESCO, 2015). Such disaster management groups can also improve social cohesion that, in turn, can improve the communities' social resilience.

For ensuring expected outcomes from such awareness programs, proper designing and execution of community-specific educational programs has to be undertaken by building collaboration between educational institutions, and the community as well as other important stakeholders (Fig. 5.11). First of all, major activities to be done for community-specific educational tool selection have to be determined. Depending on how this is done, stakeholders who will be capable of justifying the activities have to be identified. Together, the appropriate combination of stakeholders can design the tool by discussing and consulting over the requirements to be satisfied. While designing and executing disaster educational programs, special focus should be given to the social, economic, and physical vulnerabilities of a particular community, how it contributes to disaster risks, and the risk reduction measures that are feasible. Along with this, as mentioned earlier, the approach taken should never be one-sided. Information and knowledge should flow in both directions from stakeholders to the target group as well as *vice versa*, a point that can further help in modifying the educational tool. More importantly, this measure can help in bringing about necessary policy reforms for a more promising DRR continuum. On the whole, disaster education and DRR are complementary to each other.

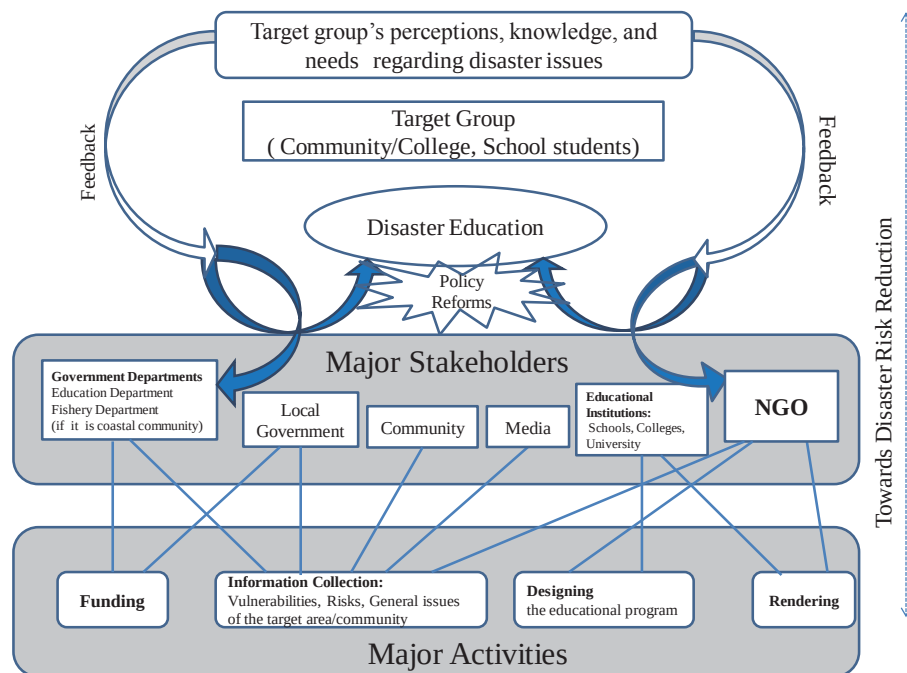


Fig. 5.11 Disaster education and disaster risk reduction framework

In spite of the availability of various frameworks and approaches of public education on disaster emergency management and DRR, past efforts taken to educate and inform the public have had mixed results (Murphy *et al.*, 2005; Nathe, 2000; Paton and Johnston, 2001). Compared to successful public education initiatives such as the seat belt campaign, it is safe to say that disaster emergency education has not always been as successful (Nathe, 2000). Even though efforts to build resilience can ensure DRR to a greater extent, the concept of building resilience has actually been considered key to reducing the risk of disaster (Ferdinand *et al.*, 2012).

Ensuring Sustainability

From the results of the workshop, we can see that it is hard to change community understanding completely all of a sudden. In itself, this indicates that awareness generation is not a one-day event or short-term affair. It takes time to inculcate correct understanding about disasters, risk reduction measures and for people to act accordingly. Thus, the sustainability of awareness-generating programs is a significant factor in helping communities overcome such situations by maintaining continuation in disaster education projects and programs (Fig. 5.11). For ensuring the sustainability of disaster resilience in the community, it is important to work further through all possible measures

and consider innovative ideas (Hansmann, 2010). At the school level, continuity of the activities can be maintained through formation of disaster management clubs in schools, and collection of materials regarding disaster preparedness, mitigation, vulnerability assessments, types of responses, management strategies from newspapers, the internet or other sources; these can be presented or used to prepare posters, competitions (poem writing, essay writing, slogan writing), and games (like cross words). In the community as a whole, continuity can be maintained through monthly meetings of direct and indirect users who can review activities done, plan preparedness activities, for example, to be taken before the usual flood season, and update information on the number of vulnerable people (e.g., old people, children, disabled) and damage caused. Even though there are disaster preparedness measures and safety tips to bring all these activities into effect, it requires working with these and making them more familiar to the community through engaging their participation. At the regional level, the disasters, vulnerabilities, and available resources vary. Thus, it is advisable to prepare work/action plans specific to each vulnerable area under the supervision of concerned authorities or stakeholders. On top of everything, there should be an assessment of how far DRR and education about it has contributed in improving community resilience.

5.8 Summary

Core of empowering a community to a resilient one is rooted in disaster risk reduction and its education imparted using various educational tools, mainly through awareness and training programs. Conveying the available knowledge resources to the community by transforming it to the way that matches with the local context to build a so called culture of safety is the hardest part to be dealt with. It becomes the responsibility of the disaster management experts, concerned authorities and researchers to focus more on disaster education by making the resources available to vulnerable communities. It was found that such workshops can bring a positive change in the level of understanding about disaster and significance of disaster risk reduction measures. While at the same time it emphasizes that awareness generation is not a short term affair. Sustainability of educational projects and programs is essential in inculcating the disaster risk reduction as a part of their life culture.

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Chapter 6 Suggestions for a Better Implementation of Disaster Management at District level

6.1 Introduction

Every disaster provides an opportunity to strengthen the affected community's capacity to appropriately respond to the next disaster. To make that happen it has to be ensured that those opportunities are being used in its true sense. The Indian Ocean Tsunami spurred the growth of disaster management activities in India. Obviously, all of these efforts were intended to reduce the risk of future disasters, through empowering communities and increasing their resilience to disasters. An array of Questions that hails in, at this point of time are: did these efforts achieve their ultimate goal; have communities been empowered? If so, then to what extent? By further examining certain communities, gaps can be found which needs yet to be filled. A study on the coastal communities of Cuddalore District, Tamil Nadu, reflects the gaps and pitfalls that further underline the lack of sustainability in the implemented disaster risk reduction programs. The results clearly underpins that the communities striving even for their basic necessities gives least priority to disaster risk awareness and preparedness comparing to physical resilience as well as economic resilience. Thus implementation of disaster risk reduction programs in such communities will be ineffective. This chapter will focus on the challenges in molding a disaster-resilient community and the solutions for solving those issues.

This chapter also intends to have a look into the present disaster management strategies both in national and district level undertaken after the Indian Ocean Tsunami in India as well as the disaster management issues in selected coastal villages of Tamil Nadu (the worst affected state in the country) and its implications on the community. This chapter also discusses about the required improvements in the management strategy level.

6.2 Disaster Management in India

A strategic approach to disaster management strategies, as well as well-coordinated action, is an essential factor for ensuring the safety of communities, property, the environment, and the sustainable growth of a country. When it comes to India, its geographic position and diverse geographic and climatic conditions make it prone to almost all types of disasters, and thus one of the

countries that is worst affected by disasters. Furthermore, its rich cultural diversity makes acting and planning accordingly a requisite.

Droughts, floods, earthquakes, and cyclones have, with grim regularity, devastated the country year after year (Metri, 2006). Almost all of India's regions have experienced one or more of these events (Gupta, 2003). As much as 60% of India's land is prone to earthquakes of varying intensities, over 40 million hectares are prone to floods, about 8% of its total area is prone to cyclones, and 68% of its area is susceptible to drought (Ministry of Home Affairs, 2004). These data show the need for a systematic and strategic approach to reducing vulnerabilities to, and the risks posed by, hazards, as mentioned in the Hyogo Framework for Action.

India has its own disaster management system and approach, established decades ago, to dealing with the aftermath of each and every disaster it has faced. In earlier times, it had a post-disaster centric approach that gave emphasis to the allocation of compensation funds, relief, and rehabilitation. To achieve these targets, the Government established the National Crisis Management Committee, the Crisis Management group, the Control Room, the Contingency Action Plan, State Relief Manuals, and a well-planned Funding Mechanism through the formation of a Calamity Relief Fund in each state (Menon, NDMA).

With major steps taken at the international level—such as the declaration of the Decade for the Reduction of Natural disasters (1990) in August of 1999—India, too succeeded in bringing changes to its disaster management policy priorities through the formation of the High Powered Committee, which prioritized pre-disaster actions for disaster preparedness, prevention, and mitigation, along with post-disaster relief and rehabilitation activities. Even so, the Orissa Super Cyclone (October 1999) and Bhuj Earthquake (January 2001), revealed the inefficiency and pitfalls of the built institutional and policy framework. Later, the National Committee on Disaster Management reviewed the High Powered Committee Report and approved some of the recommendations, one of the most significant of which being the shift of the primary responsibility for disaster management from the Ministry of Agriculture to the Ministry of Home Affairs in Government of India (Menon, NDMA).

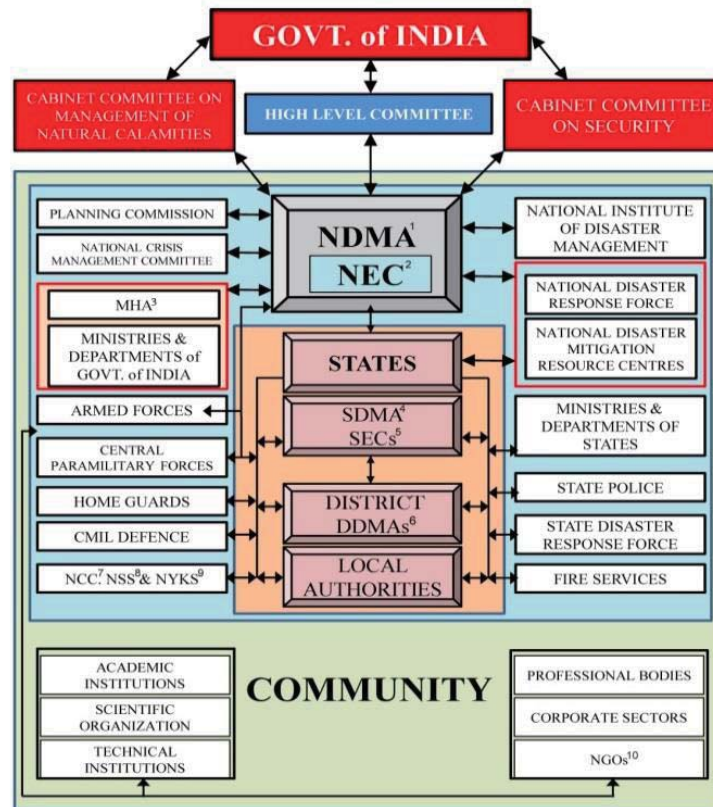
After the mass devastation brought about by the Indian Ocean tsunami in 2004, the Indian Government further strengthened its Disaster Management Framework to ensure more effective management at national, state, and district levels through the enforcement of the Disaster

Management Act in 2005. As per the act, the government formed a hierarchy of authorities (Fig. 6.1). Among the hierarchy, the National Disaster Management Authority is the apex body, chaired by Prime Minister; it is followed by the State Disaster Management Authority and then the District Disaster Management Authority for each state district.

Going further, under the DM Act 2005, the Government established the National Institute of Disaster Management for planning and promoting training and research in the area of disaster management, as well as the development of a national-level information base relating to disaster management policies, prevention mechanisms, and mitigation measures, and a National Disaster Response Force that provides specialist responses to disasters (IFRC, 2005). Each of these institutions has their own assigned duties and functions, to be rendered at concerned authority limits. The integration and mainstreaming of disaster management with development planning was the other major venture after the 2004 Indian Ocean Tsunami.

The growth of the nation's disaster management perspectives clearly demonstrates how the 2004 Indian Ocean Tsunami influenced and spurred disaster management initiatives, policies, framework, and activities in the nation. In any country, the prime beneficiaries of all of the formulated policies, programs, frameworks are supposed to be, and should be, the communities. It is crucial to confirm that these actions positively influence communities, and that their objectives can be considered achieved, only if they have contributed in the capacity building and empowerment of communities towards a resilient one.

Changes brought in the nation's disaster management strategies reflected positively in the strategic disaster management approaches of all its states. Thus each state has its own State Disaster Management Authority as well as District Disaster Management Authority in each district. As shown in Fig. 6.1 disaster management authorities at various hierarchical level formulated plans which helped states to focus more on the issues to prepare, mitigate and respond in a much better way than in the past. For materializing these strategies in its real sense, communities require to play a pivotal role. Taking this into consideration, National Disaster Management Authority has brought a shift in its emphasis from a government-centered approach to decentralized community participation (Rahman, 2012).



¹National Disaster Management Authority, ²National Executive Committee, ³Ministry of Home Affairs, ⁴State Disaster Management Authority, ⁵State Executive Committee, ⁶District Disaster Management Authorities, ⁷National Cadet Corps, ⁸National Service Scheme, ⁹Nehru Yuva Kendra Sangathan, ¹⁰Non Government Organizations

Notes: This diagram reflects the interactive linkages for synergized management of disasters, rather than a hierarchical structure. Backward and forward linkages, especially at the functional level, are made with a view to optimize efficiency.

Fig. 6.1 Present Disaster Management Structure in India

(Source: Pune Division Disaster Management System (partly edited by author))

6.3 Present Disaster Management Approach and Communities

In order to know how the so-called paradigm shift from a post-disaster management centric approach to a pre-disaster management approach has affected or influenced communities that are supposed to be the beneficiaries of these ventures—as well as how the 2004 Tsunami spurred disaster management policies, strategies, programs, and actions—Focus Group Discussions (FGDs) were conducted in four coastal villages (Fig. 6.3 (a) and Fig. 6.3 (b)). Focus Group Discussions was used as the information collection method to solicit views, insights, and recommendations of the community. Its flexible format helped exploring unanticipated issues and provided checks and balances, thus minimizing false or extreme views. Sotikuppam, Devanampattinam, Mudasalodai, and Samiyarpettai, all falls in Cuddalore District. Among these, Sotikuppam and Devanampattinam are coastal villages of Cuddalore Taluk, and Mudasalodai and Samiyarpettai are coastal villages of Cidambaram Taluk (Fig. 6.2).

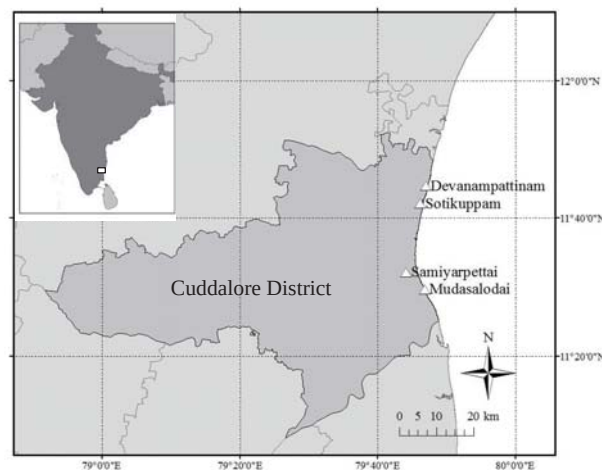


Fig. 6.2 The location of the selected coastal villages for focus group discussion

In addition, these discussions were aimed at determining the community's present problems, issues, and immediate needs. Discussions were conducted with a focus group consisting of 10-15 people in each village. To avoid bias, care was taken to include members from both genders and ensured participation from various age groups, village level representatives (such as the Village President, Village Assistant), and leaders (usually coastal villages in this region have a village leader (non-official) elected by the community).



(a)



(b)

Fig. 6.3 Focus Group Discussion (a) At Sothikuppam of Cuddalore Taluk, (b) At Mudasalodai of Chidambaram Taluk

6.4 Focus Group Discussion Results

The identified problems and issues (Fig. 6.4) were classified under different categories: Economic Resilience, Social Resilience, Physical Resilience, and Risk Preparedness and Awareness (Table 6.1).

Table 6.1 Summary of village level responses and the related resilience type

Resilience Type*	Response/Solution
Sothikuppam	
1	Water facility, hospital facility, diseases like fever, malaria, dengue (drainage facility, mosquito repellent fumigation), garbage facility, toilets for houses and schools, transportation facility.
2	No warnings (warning/ alarm for disasters), the sea has advanced further up the shoreline, releases from industries have polluted the air and environment leading to vomiting, skin diseases (itching), and breathing problems ought to occur
3	Need alternative livelihood.
Devanampattinam	
1	Sometimes brownish, mud-colored water is found in public supply system, private water supply is expensive (clean and quality water from Govt.), Dengue,

	Chickengunia (mosquito repellent fumigation, hospital).
2	Proper warning before disasters (should be provided by authorities), first aid training needed.
3	Soil quality decreased, so they cannot rely on main business of flower production (soil testing/treatment by Govt.), alternative livelihood needed (small-scale industries), sea erosion (planting trees).
Samiyarpettai	
1	Drinking water facility (quality water by Govt./public supply system), maintenance of tsunami and cyclone affected houses still pending, shortage of bus services (improved transportation facility needed).
2	Sea erosion (planting of trees), locker facility for storing documents during cyclone/disaster prone periods, proper warning facility.
3	Fish preservation facilities, livelihood options for women.
Mudasalodai	
1	Private water supply expensive (public water supply needed), hospital facility needed, improvements to transportation facility.
2	Cyclone shelter needed, sea erosion (jetty to be extended).
3	Not able to conduct fishing because of sediment deposition in river mouth (deepening to be done by Govt.), alternative livelihood option during non-working hours, fish preservation methods needed (cold storage facility by Govt.).

*1: Physical Resilience, 2: Risk awareness and Preparedness, 3: Economic Resilience.



Fig. 6.4 Major Issues mentioned by participants of Focus Group Discussion in Devanampattinam

In general, the major issues noticed were

- 1 . The elements that ensure physical resilience are considered the most important by the four villages. Next, they placed importance on elements for economic resilience. They gave the lowest priority to risk preparedness and awareness, even though they have been severely affected by various types of previous disasters.
- 2 . The results also show that basic requirements like water, proper housing, and toilet facilities are all things that the communities regard as most important. Therefore, finding a solution that meets their basic requirements is of much importance, along with making the community aware of and prepared for risks.
- 3 . It can also be stated that they are neither particularly aware nor concerned about future disasters and the significance of the positive changes that risk preparedness can bring into their lives and into the community as a whole.
- 4 . The results underline the need for communities (i) to make themselves realize their potential, (ii) to increase awareness of the risks and vulnerabilities that they face, and how they can better prevent these adversities through risk preparedness and community empowerment, thereby making their community more resilient.

Poor people without having much access to resources are more vulnerable to disasters. Here, the results clearly underpins that the communities that are still striving for their basic necessities have a lesser chance of showing interest in, and placing importance on, protecting themselves against disasters through risk preparedness well in advance. Lacking even the basic necessities for life, the implementation of risk preparedness programs in these communities will be ineffective in a way and bring an element of dissatisfaction into the community.

The identified issues underpin the gaps that need to be filled and the challenges faced when molding a resilient community within these villages. The lack of sustainability seen in the implementation of the Disaster Risk Reduction programs is the major factor for yet to be met challenges in the concerned villages.

Apart from these, the other areas that need to be addressed in order to lead to an increased sustainability include:

a) Gaining Knowledge About Local Needs and Constraints

Taking time to understand a community's needs and constraints can be beneficial in providing the actual necessities by preventing the misuse of time, unwanted efforts, and the usage of inappropriate resources. It is advisable to do this well in advance of possible disasters, during normal (pre-disaster) periods, and as soon as possible after a disaster (the early stages of the post-disaster period). This can be accomplished by concerned local authorities, and could be forwarded to higher levels in order to ensure the integrated management of issues. Therefore, before the formulation of policies, programs, decisions, and their implementation, the local needs and constraints should be assessed to determine the effectiveness of all of the aforementioned stages.

b) Prevailing and Possible Livelihood Options

Community empowerment, and through it resilience, always has strong binding with a secured income source. Livelihood plays a big role in this. Furthermore, livelihood diversity in the community is essential for ensuring the generation of stable income in the community. Prevailing and possible livelihood options that have yet to be utilized should be identified. Additionally, plans to make use of possible livelihoods, to bring maximum livelihood diversity, and to improve the efficiency of prevailing livelihood have to be well conceived and implemented. At the same time, the sustainable use of resources should be assured.

c) Socio-Economic Situation

The socio-economic situation, or status, reflects the capacity of a community to cope with a disaster or any other unexpected event that may affect the community. It should always be borne in mind, while designing action plans (for making communities aware of risks and risk preparedness and reduction measures), that their socioeconomic uplift is equally important. Both the government and non-governmental authorities should take establishing action plans towards these ends seriously.

d) Cultural Background

Any management strategy can be well executed if and only if it is in tune with the cultural background and traditions of the concerned community. A well-planned approach to cultural issues therefore becomes a requisite in this case too. This should not be considered a simple step in a country like India, which is rich in cultural diversity.

e) Correct Selection of the Approach

The correct selection of an approach that implements the plan, ensures community participation, and increases community understanding is pivotal to the success of action plans. The approach can be based on discussions, awareness programs, Participatory Rural Appraisal tools, presentations, posters, pamphlets, booklets, workshops, and any other innovative ideas that assure the community is completely reached while making them involved and interested. The approach should vary depending on the target groups and objectives such as increasing awareness among students, acquiring ingenious knowledge or local wisdom from elders, etc. Even after implementing well-planned and accurate action plans, strategies, and similar activities, two major problems are usually observed following implementation: (i) a lack of sustainability in the implemented activities, and (ii) a lack of assessment.

Following each disaster, an enormous inflow of resources and money can be seen. What is required most at this point is to properly channel those inflows. Similarly, soon after the event, numerous programs and projects sprout up, of various dimensions and implemented by various authorities or organizations, be they government or non-governmental. These projects and programs usually complete within 3–4 years. Outside of the work done during the project period, follow-up programs are rarely seen. At a minimum, there should be an assurance that the community has reached the level needed to maintain the activities and processes implemented that can be regarded as sustainable before the completion of these projects. There is always the need to assess whether a project promotes a continuous process of development. Thus, assessment should be an integrated part of disaster management strategies, and assessments should be conducted at pre-determined time intervals. This time interval can be determined based on the purpose of the assessment. It will be better to include community members in these assessments to assure sustainability.

6.5 Suggestions for a Better Implementation of Disaster Management

To strengthen the disaster management framework, it is essential to find the pitfalls of the pre and post-disaster management strategies that were undertaken in previous disasters (Asharose and Saizen, 2014). For betterment of Disaster Management it requires focus on bringing in improvements of planning and execution strategies on all phases of disaster starting from pre disaster phase to post disaster phases, Even then as pre disaster paradigm requires special attention in reducing the impacts. For this capacity building of associated stakeholders is really important. General suggestions for a better disaster management are:

- Efforts for improving District Disaster Management Authority (DDMA) committee especially by improving both the awareness of DDM members and channelizing responsibilities
- Submission of Disaster Risk Reduction reports every year (by every DDMA committee member and presentation in District Disaster Management annual meeting)
- Policy revisions should be made based on the updates of disaster management challenges faced by the district and thus bringing in policy reforms
- Networking offices for better database management and for an efficient response system especially during real time emergencies
- Introduction of a practice accepting Disaster Risk Reduction and Management Proposals from members working within District Disaster Management Committee (their experience in dealing with real time disaster situations can help them in generating new creative ideas for a better disaster risk reduction and management possibilities).
- Finding out more possible methods and sources for Fund Mobilization for structural and non-structural mitigative measures.
- Conducting Awareness Programs as part of International DRR day as well as competitions for children, essay, posters
- Linking Academia more close to District Disaster Management (Including them in meetings, special session and discussion forums, including in working areas, Project works, Providing scholarships based on their contribution in the disaster management sector)
- Follow up Programmes- in Reconstructed Areas, Affected Areas of the district
- More space for Local Government in Disaster Risk Reduction platform,-like by having a have a close link with NGOs working in their area and their Reports, while, making it mandatory for Local Government for their Local Government officials to report the DRR activities done annually
- Opening a complaint forum on DRR Disaster issues

- Updating with International activities on DRR sector (assigning duty to selected officials in or out of DDMA like revenue division officers)
- Direct conversation with community before disaster risk seasons (may be through internet facilities like Skype). Thus creating a platform for the involvement of community members further in decision making process (thus reflecting true value of democracy and transparency in governance) and in taking concerned actions.
- Usage of technologies like GIS and remote sensing for a better management in pre and post disaster scenarios/actions
- Creating Alternative livelihood schemes
- Establishing close link between research institutions and District Disaster Management Committee
- Providing funding/scholarships for research in disaster management arena every year
- [Clause for] promoting disaster research in the district (allowance, support, data provision)
- Report preparation and presentation on major issues raised by communities and actions proposed (can be / can include those by community, research centers, officers, DDM members) and actions taken. Annual review on progress in Disaster Management actions of the district
- Creating a platform for discussion with community and stakeholders prior to annual DM meeting

6.6 Summary

It is true that disasters, especially the 2004 tsunami, have spurred disaster management activities in India. Still, there are communities that strive for even basic necessities, which in turn makes them vulnerable to disasters. There are pitfalls and gaps yet to be filled. Each disaster provides an opportunity to strengthen our capacity to respond appropriately the next time. We have to ensure that we are capable of making use of these opportunities in their true sense. To accomplish that, it is essential in finding out the pitfalls in the post-disaster management strategies that were undertaken in response to previous disasters. Government decisions to shift the focus to pre-disaster planning

has been well-established through the formulation of policies, strategies, and actions, but now it's high time to ensure the communities' concern more to be shifted towards pre-disaster paradigm. This requires a tiresome amount of effort in educating and making them aware of the significance of pre-planning. Management strategies should be designed focusing on the community, their culture, their need and vulnerabilities where they have to be more strengthened. Hence, multidisciplinary approaches to disaster management strategies are indispensable, as they can ensure community empowerment, in its true sense, which can lead to resilient societies that can, in the long run, make the entire nation resilient.

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Chapter 7 Conclusion

The key purpose of this research was to understand community issues and how they are linked with and affect (positively or negatively) community disaster resilience. Thus, the present research addressed various contexts and perspectives in regard to disaster management: following macro-level (taluk- and district-level) assessments to identify resilience status and issues regarding disaster risk reduction, micro-level (household- and village-level) assessments were conducted in regard to resilience issues and challenges faced by communities. The assessment results clearly indicate that efforts to enhance resilience are significant for creating more self-resilient communities. A research becomes fruitful in every sense when the research target, which can be a community, a group of people, or a place (target varies depending on each research) is benefitted by that particular research. So, to make the target community benefited from this research, an educational tool was prepared; in addition, an awareness workshop was conducted based on the educational tool. This was also a mere initiative for making the community aware of the current opportunities for disaster risk management to bolster against vulnerabilities they face. With the notion of the prime need in improving the present disaster management framework followed at the district level, the research has also formulated suggestions for modifying the present management framework to a better one, thus for an enhanced resilience status in the district as a whole. This study's results and suggestions can lay a foundation for taking firm action and approaches in formulating new policies and strengthening existing ones.

The key findings of this research

Apart from the natural features attributes such as geomorphologic, topographic, and climatic conditions, the level of institutional setup, policy approaches, its level of implementation, and community approaches can play a great role in the disaster resilience status of a region. Thus, as addressed in Chapter 3, with the variations in these attributes, resilience can also be seen differing from region to region. Improving risk reduction measures can positively contribute to existing efforts taken in lessening the social, economic, and environmental impacts of disasters. Moreover, for ensuring a better implementation of disaster risk reduction (which can help upgrading resilience status), the type of support needed for each stakeholder is different. This research emphasizes that

the enhancement of disaster resilience cannot be made possible only by concentrating only on disaster preparedness and disaster mitigation; rather, efforts must be made to enhance the resilience of attributes that define the physical, social, economic and institutional setup of a region or community.

Solutions for enhancing or strengthening resilience cannot be generalized. Required solutions vary based on the challenges, issues and vulnerabilities a community or a region has. Even when communities such as coastal communities, inland communities, mountainous communities are grouped together based on their similarities, to a certain extent, the issues (challenges) they face may vary with individual community. So when we take whole communities of a district or much higher administrative division like state the variation in issues the communities face and type of solutions they require also varies a lot and thus making the management much complex. Resources, natural features, social bonds, attitudes among community members, and so many other factors determine challenges and its severity they encounter with. Thus, it is highly recommended that, solutions should be more localized for an efficient and effective management.

Alongside the formulation of more locality-based solutions and grass root level implementation, it is always important to find more entry points for initiating DRR activities in communities and making use of such possibilities is of utter importance. Action-oriented, community-based disaster management initiatives like awareness workshops, games, and competitions can be used as tools for bringing in a positive change in the awareness level regarding disasters and the significance of disaster risk reduction measures. Sustainable educational projects and programs are essential in inculcating disaster risk reduction as a part of everyday life.

This study reveals that, in India, there are still communities that strive for even basic necessities; which itself is an indicator of prevailing low resilience level (of those communities) and thus can further increase their vulnerability to disasters. After 2004 tsunami, through the formulation of new policies, strategies, and actions by the Government, we can notice a clear shift in its focus towards pre-disaster paradigm; however, now its high time to ensure that communities also give importance and shift their towards the pre-disaster paradigm. Multidisciplinary approaches of disaster management strategies are indispensable that can ensure community empowerment for an increased community resilience, in its true sense, which can result in more resilient societies that can, in the long run, enhance the disaster resilience of the entire nation.

Future Research Scope

As discussed earlier, the attributes that determine the resilience of a particular place are many. The present research has only attempted to explore and discuss about how only a few selected attributes of physical, social, economic, institutional and natural dimensions affects disaster resilience. While at the same time, natural attributes like geomorphological, topographic, and climatic conditions have great potential in imposing the vulnerability and risk in a region, which can have direct effect on the resilience of the community residing there. Especially when discussing about coastal communities in particular, and also when presently living in a century where in which climate change and sea level rise issues are hot topics and considered of paramount importance, the fact that this research excluded a consideration of these makes it incomplete. At the same time, this opens the door for future research, which can consider these attributes to elicit new research findings on resilience.

GIS and remote sensing can together be a great tool in achieving this, which can lead to a more accurate, more detailed understanding of resilience challenges and issues with lessened uncertainties. Methods like vulnerability mapping, digital elevation modelling can help take adaptation actions, not only based on present conditions but also depending on simulated future scenarios.

In addition, the present research discussed about the lack of proper and sufficient data; in certain cases (namely, the CDRI-based analysis), led to analysis based on perceptions of respondents. Thus possibilities and ways for a better data management system by incorporating both social and scientific data systems has to be stipulated which can improve the management system by proper decision making with more precision, especially in the case of emergency management and for an upgraded humanitarian assistance.

Combining these two concepts(incorporating GIS and remote sensing tool in assessment and stipulating ways for a better data management system), in future, research can wide open the chances of a systematic and updated way of management system with more clear and more concrete solutions, suggestions, and policies inclined to a proactive focus.

