Issues Related to Natural Disasters, Gender, and Coping Behaviour of Women

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CERTIFICATE

This is to certify that the thesis entitled **"Issues related to natural disasters, gender, and coping behaviour of women",** submitted by **BINCY GEORGE**, ID No. **2018PHXF0019H** for award of Ph.D. of the Institute embodies original work done by her under my supervision.

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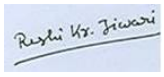
Signature of the Co-supervisor 

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Abstract

Natural Hazards are uncontrollable forces of nature, such as earthquakes, tsunamis, floods, and hurricanes. Natural hazards become natural disasters when these natural hazards occur and disturb inhabited areas. The intensity of natural disaster can be diverse based on their type, occurring countries and the periods in which it happens. This diversity can be because of infrastructure, population growth and prevailing poverty in different countries. Hydro-meteorological natural disasters like cyclones, floods and droughts are on the rise across the world. Floods are among the natural disasters that result in property and life losses frequently with great financial, environmental, and social consequences.

The climate change-induced disaster risks (CCIDR) are faced by nations across the world (Chan, 2018; Dodson et al., 2020), which leads to unequal impacts on ecosystems, humankind, societies, nations and economies (Pörtner, 2021; Whyte, 2021). The developing countries over the years have been exposed to and suffered from damages due to extreme climate events (ECE), and India also witnessed the aftermath of recurring ECE in the region (Islam et al., 2022) in the forms of recurrent cyclones floods, storm surge among other natural disasters with escalating loss and damages (Bouwer et al., 2007; Gaag, 2013).

Based on the Global Climate Risk Index 2021, developed by the organisation Germanwatch, India ranks 7 out of 10 in terms of the most affected countries in 2019 (Eckstein et al., 2021). India, one of the most disaster-prone countries in the world, has recorded the highest mortality and damages due to hydrological disasters ever since the 1990s (Patankar, 2019). Kerala, the southern state of India, witnessed devastating floods during the monsoon seasons of 2018 and 2019(Vijaykumar et al., 2021). This 2019 flood is an example of how global warming has affected this region leading to intense rainfall, causing a more significant threat to the vulnerable western ghats area. The scientific studies confirmed that this 2019 flood was an event of mesoscale cloudburst (MsCB) never reported before in Kerala, which usually occurs in northern parts of India. Such events due to global warming can recur in this southern state of India (Vijaykumar et al., 2021).

Against this background, the focus of the thesis is to contribute to the literature on determinants of natural disasters in India, gender vulnerability in the face of extreme weather-related events and coping strategies adopted by women and its determinants and tries to figure out whether

empowerment has anything to do with the coping strategies adopted by women which remains an understudied area and more so in the Indian context. This thesis explores the impact of natural disasters at the international level, the Indian context and how the frequent and sudden flood disasters impacted the gender in the Indian state of Kerala. Also, this thesis focuses on the determinants of coping mechanisms women adopt in Kerala.

The first objective explores the determinants of the impact of natural disasters in India and SAARC countries. India is becoming more vulnerable to disaster every year because of its high population and increasing urbanization (UNDRR & CRED, 2019). This thesis tried to discover the determinants of the impact of natural disasters in SAARC countries and India using disaster data from the EM-DAT database between 1969 to 2018 using panel data analysis and found out how the variable like GDP, population density, urban population, education, and gross capital formation influences disaster impacts in these countries. Some economic variables which can affect disaster fatalities are education, urban population, and population density.

The second objective assesses the gendered effect of natural disasters in Kerala based on vulnerability. Here I tried to find out the vulnerability of respondents based on the index, which includes five capital asset dimensions. Access to financial assets, government assistance and information tools helps people to be prepared to cope when a sudden disaster strikes. The lack of resources and inadequate access to information tools makes individuals vulnerable during a disaster. This highlights that efforts should be made to make people more aware of the financial products available and encourage their use by these individuals.

Further, exclusive information campaigns targeting these disaster-prone areas can reduce people's vulnerability to these events. The efforts to improve the incomes of the people in disaster-hit areas can also contribute. The frequent climate-related disasters have increased the vulnerability of the people in the region. This necessitates the shift of focus from relief centric approach to an active and inclusive policy and action which covers prevention, mitigation, and preparedness for response and recovery (GoK, 2019).

The third objective measures women's empowerment in selected Wayanad and Alappuzha districts of Kerala and see whether empowered women cope better with disaster. The capacity to cope with disaster is an important aspect that influences individuals' and communities' vulnerability during

the disaster. The primary purpose is to examine which are the factors that determine women's choice of flood coping strategies to reduce the negative impacts of floods in the Wayanad and Alappuzha districts of Kerala, India. The three coping strategies, access to credit, government assistance and reduced food consumption, were influenced by several factors such as the level of empowerment, occupation, political and general awareness, religion, income, phone usage and place of residence. A binary association exists between the three coping strategies used and some selected independent variables. But after controlling, even if the direction is the same, they are sometimes insignificant. Women in the same area face different problems based on their socio-economic status, family relations, employment, education, and cultural differences. So basically, different women faces or experience environmental changes disproportionately. So, it is important to have separate implementation bodies at the regional and local levels to address the specific needs of women in this area. Here in this analysis, one can see that as empowerment increases, women take up credit as a coping strategy. Thus, making empowered women less vulnerable to disaster impacts. More political and general awareness, providing job opportunities, and increased income can be helpful in choosing different coping strategies for women in the flood-hit region.

The fourth objective compares the level of women empowerment in Alappuzha and Wayanad, districts of Kerala and Indian states, using NFHS data. Over the years, India has improved in a few gender-related indicators as an improvement in the ratio of female literacy and involvement of women in grass roots democracy. Still, we are yet to reach the level accomplished by developed and many developing countries. While comparing the two districts of interest in Kerala, one can see that Wayanad shows better performance than Alappuzha. This is in accordance with the results from chapter 5. In chapter 5, women in the Wayanad district are more empowered compared to the women in the Alappuzha district. Those women who used credit as a coping strategy are women with high empowerment scores. Also, one can see that women in the Wayanad district adopted availing credit as a coping strategy more than those in the Alappuzha district. This signifies the importance of the empowerment of women, especially during frequent climate change-induced disasters. This calls for policy actions focusing on the needs of women in this particular area, which can improve their level of empowerment, ultimately reducing their vulnerability and aiding coping mechanisms adopted by them.

This thesis has made an academic contribution by adding to the existing literature on climate change, vulnerability and coping strategies adopted by women. Also, this thesis is based in the Indian context, where a dearth of such research works exists, which is gaining attention slowly, and now climate-related research is gaining momentum. This thesis additionally provides the future direction of research, which will help address and better understand climate-related impacts on people.

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Abbreviations

BP-LM	Breusch-Pagan Lagrange multiplier
BSF	Bio Saline Farming
CCC	Climate Change Committee
CCIDR	Climate Change-Induced Disaster Risks
CIFOR	Poverty-Environment Initiative
COP	Conference of the Parties
CRED	The Centre for Research on the Epidemiology of Disasters
CWC	Central Water Commission
DFID	The Department for International Development
DMI	Decision-Making Index
EM-DAT	Emergency Events Database
ECE	Extreme Climate Events
ESCAP	The United Nations Economic and Social Commission for Asia and the Pacific
ESI	Economic Security Index
FAO	Food and Agriculture Organization
GDP	Gross Domestic Product
GFDRR	The Global Facility for Disaster Reduction and Recovery
GIAHS	Globally Important Agricultural Heritage System
GoK	Government of Kerala
HAZ	Height-For-Age Z-Score
HDI	Human Development Index
HH	Household Head
IANS	Indo-Asian News Service
IPCC	Inter-governmental Panel on Climate Change

KCC	Kisan Credit Card
MDG	Millennium Development Goals
MI	Mobility Index
MsCB	Mesoscale Cloudburst
NFHS	National Family Health Survey
NGO	Non-Governmental Organization
OBC	Other Backward Caste
OLS	Ordinary Least Squares
PAR	Pressure and Release model
SAARC	The South Asian Association for Regional Cooperation
SC	Scheduled caste
SDG	Sustainable Development Goals
SHG	Self-help groups
ST	Scheduled Tribe
UN	United Nations
UNDP	The United Nations Development Programme
UNDRR	United Nations Office for Disaster Risk Reduction
UNEP	The United Nations Environment Programme
UNESCO	The United Nations Educational, Scientific and Cultural Organization
UNSDR	United Nations Strategy for Disaster Risk Reduction
WB	World Bank
WDR	World Development Report
WEI	Women Empowerment Index
WHO	World Health organization

Chapter 1

Introduction

Natural Hazards are uncontrollable forces of nature, such as earthquakes, tsunamis, floods, and hurricanes. Natural hazards become natural disasters when these natural hazards occur and disturb inhabited areas. The distinction between natural hazards and natural disasters is that the former relates to any geophysical event, such as volcanic eruptions, floods, earthquakes, or tsunamis. In contrast, natural disaster involves the interaction of natural hazards and social construction (Auffret & Turk, 2003). To be a disaster, a hazard should affect humans, for instance leading to casualties and messing up the food supply (Kelman, 2008). Natural disasters harm all living beings, and the impacts of such natural disasters are aggravated by human land practices. The intensity of natural disaster can be diverse based on their type, occurring countries and the periods in which it happens. This diversity can be because of infrastructure, population growth and prevailing poverty in different countries.

In various countries, regions and time periods impacts of natural disasters can be different. This can be due to multiple reasons existing in a particular place at that time, like population growth, existing infrastructure, and poverty level. Furthermore, the impact of natural disasters is similar, and they vary in shape and size, which can range from fire in small area to tsunami, which is large scale disaster. For that reason, comparing the effect of different disaster types is thought-provoking. To express the nature and gravity of extreme weather events across the globe, various terms are used like disaster, catastrophe, calamity, and cataclysm. The terms are given based on feelings, knowledge, and experience about the climate events (Caldera, 2017).

There are a few global databases to record disaster events which include the EM-DAT (CRED), Sigma (Swiss Re) and NatCatSEVICE (Munich Re), plus ITOS/GIST, the Joint Research Center (GDACS) and UNDP/GRIP. The Center for Research on the Epidemiology of Disasters (CRED) describes a disaster as "a situation or event which overwhelms local capacity, necessitating a request to a national or international level for external assistance; an unforeseen and often sudden event that causes great damage, destruction and human suffering" (Below et al., 2009). Natural

disasters can be classified based on their origin: biological, extraterrestrial, climatological, geophysical, hydrological, and meteorological (Below et al., 2009; Hristidis et al., 2010).

Natural disasters are destructive as it results in loss of lives and livelihoods. Both developed and developing countries are hit by disasters (Sawada & Takasaki, 2017), where it damages people's livelihoods. When a disaster strikes, poor people will be at risk, whether in a developed or developing country (World Bank & United Nations, 2010). In line with many reports on climate change, hydro-meteorological natural disasters like cyclones, floods and droughts are on the rise across the world (Cavallo & Noy, 2009; Kellenberg & Mobarak, 2011; Stromberg, 2007; World Bank, 2013).

Floods are among the natural disasters that result in property and life losses frequently with great financial, environmental, and social consequences. Following an intensive storm or rainfall, if abundant water exists over the earth's surface more than the capacity of surface or artificial conveyance system (stream and river basins, creeks, estuaries, wadis, valleys, canals, channels, culverts, dams). Aside from the flood caused by rainfall, floods can happen because of snowmelt, sea surge and tides, tsunamis, groundwater level rise, urban sewer capacity overflow, dam breaks, and confined aquifer overflows. Unusual flood is triggered by climate change. This results in irregular timing, patterns, and intensity of rainfall and especially the occurrence of precipitation, like for how many days and with what vigour it will occur. Floods now happen in regions where it was never reported before. This owes to global climate change.

The climate change-induced disaster risks (CCIDR) are faced by nations across the world (Chan, 2018; Dodson et al., 2020). Unstable weather conditions like heavy rainfall, floods, cyclones, droughts, and sea level rise lead to chaos (Perkins-Kirkpatrick et al., 2022; Stott, 2016). The developing nations over the years have been exposed to and suffered from damages due to extreme climate events (ECE), and India also witnessed the aftermath of recurring ECE in the region (Islam et al., 2022) in the forms of recurrent cyclones floods, storm surge among other natural disasters with escalating loss and damages (Bouwer et al., 2007; Gaag, 2013). The impact of climate change-induced disasters can be different for individuals. To better understand the impact of climate change on individuals, a gender analysis is necessary.

Therefore, this thesis explores the impact of natural disasters at the international level, the Indian context and how the frequent and sudden flood disasters impacted the gender in the Indian state of

Kerala. Also, this thesis focuses on the determinants of coping mechanisms women adopt in Kerala.

This introductory chapter outlines the research motivation, theoretical foundation, literature review, research gaps, study objectives, and thesis flow.

1.1. Research Motivation

Destructive floods are widespread climate events in India and South Asian countries (Kundzewicz et al., 2008; A., 2012). In India, the states susceptible to flood the most are Gujarat, Bihar, Uttarakhand, Maharashtra, West Bengal, Odisha, Andhra Pradesh, and Kerala (Bhattacharjee & Behera, 2017). The presence of sub-tropical monsoons and vast riverine plains favours flood events in various parts of India (Pal et al., 2022). Varying rainfall pattern results from the rapidly growing temperature of the earth's atmosphere, which ultimately results in frequent floods, as disclosed by the Inter-governmental Panel on Climate Change (IPCC). Besides, climate change also has led to changes in land use patterns which in turn led to increased and frequent floods (Roy et al., 2020). At the present time, flood is causing severe complications owing to human interference with the natural system and land. In India, floods are the result of non-stop monsoon rainfall, river bank erosion and siltation of channel beds, reduced river channel carrying capacity for high flows, poor natural drainage in flood-prone areas, cloudbursts and various other meteorological factors (Bhattachaiyya & Bora, 1997; Dhar & Nandargi, 2003; Kaushik & Sharma, 2012).

As per the report of Global Climate Risk Index 2021, India ranked 7 out of 10 in 2019 among the most affected countries (Eckstein et al., 2021). India has recorded the highest mortality and damages due to hydrological disasters ever since the 1990s (Patankar, 2019). The majority of Indian population are affected by floods and landslides during the monsoon season (Nanditha & Mishra, 2021; George et al., 2021). This flooding leads to disproportionate direct and indirect impacts on vulnerable sections of society (Adelekan, 2010; Chatterjee, 2010; Jongman, 2018; Patankar, 2019; Winsemius et al., 2016).

The level of human development determines the effects of natural disasters in a country, i.e., the number of deaths, people affected and total damages due to the natural disaster. Unemployment,

education, population density, and investment determine the effects caused by natural disasters in a country. This thesis adds to the existing literature by focusing on SAARC countries and Indian states, which remains an understudied area. Hence, study focusing on this region and India is essential to disaster-related literature.

During 2018 and 2019 devastating floods were witnessed by Kerala, the southern state of India. Based on scientific studies this is the result of global warming and can be a recurring event. (Vijaykumar et al., 2021).

The impact of natural disaster on gender relation became an important field of research among scholars recently, which revealed the fact that disaster does not affect everyone in the same way (Llorente-Marrón et al., 2020; Alston, 2014; Anderson, 1994; Bradshaw, 2015; Enarson, 1998). During flood caused by climate change, vulnerability and gender turn out to be a significant concern that needs to be addressed. Vulnerability, as defined by UNISDR, is "the characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard" (UNISDR, 2009). Vulnerability often affects people's ability to cope with and recover from natural disasters (Blaikie et al., 1994; Fordham, 1999; Enarson, 2004; Singh et al., 2017). The adaptive capacity of men and women is determined by access to different capital assets and livelihood practices (Cutter, 1993; Denton, 2001; Enarson, 2004; Naz, 2019). This shows the need to include gender in studies related to vulnerability and adaptive capacity during disasters (Dankelman, 2002; Dankelman & Jansen, 2010).

Shortage of resources, assets, and money makes the life of the poor difficult during disasters compared with the wealthy (Zorn, 2018). The risk or impact associated with a disaster can be described as a function of hazard, exposure, and vulnerability (IPCC, 2013). In times of catastrophe, even people with skills and abilities can't do anything to overcome the vulnerable situation they are in if they don't get access to resources like human and natural resources which will help them to adapt (Kabeer & Subrahmanian 1996; Wisner et al. 2014) and cope with these diverse situations. People with more access to such resources have more livelihood options available compared to others, and that makes them less vulnerable (Žurovec & Vedeld, 2019).

Against this background, the focus of the thesis is to contribute to the literature on gender vulnerability in the face of extreme weather-related events, which remains an understudied area

and more so in the Indian context. Using primary data collected based on a structured questionnaire for gender and focusing on the rural area of Wayanad and Alappuzha districts of Kerala, which faced floods recently, this study tries to understand gender vulnerability to the extreme weather event of floods and identify its associates. The literature on gender vulnerability in the face of extreme weather-related events remains an understudied area, especially in the Indian context. This calls for a study to understand the determinants of vulnerability in the selected region.

As per Blaikie et al., 1994, a "Coping mechanism is a manner in which people act within the existing resources and ranges of expectations of a situation to achieve various ends". Thus, in times of flood, people try to adapt using available resources. Some of the factors which influence adaptive capacity are infrastructure, skills and knowledge and income diversification (Yusuf et al., 2021). Factors such as age, level of education, marital status and resource ownership determine the coping capacities of rural women (Dodge et al., 2014). Adaptation to climate change can be seen as the procedure in which people adjust to the negative impacts of climate change as one look for better coping opportunities with varying circumstances, risks, and hazards

Less adaptive capacity during extreme climate change increases the vulnerability of people residing in developing countries (Blaikie et al., 1994; IPCC, 2007). Many disaster research has shown that the major victims of climate change can be women due to their social status and ability to cope with disaster (Ahmed, 2010).

At present, studies based on coping with flooding and the factors which influence the choice of coping in the selected areas, especially among women is an unexplored area. Hence, there is a need to explore and understand the coping strategy and its determinants among women. So, I wanted to explore this aspect. This led to the question of whether empowered women can cope better with disaster than unempowered women and the socio-economic determinants for choosing an adaptive strategy for women affected by climate disaster in the study area from Kerala.

The United Nations (UN) in 1992 recognized the importance to empower women and include them in the decision-making processes to realize sustainable development (UN, 1992). Gender equality and women empowerment was the emphasis in the Goal 5 of the Sustainable Development Goals (SDG) 23 years later in 2015. Though a lot of interventions have been done in the last few decades, the above-mentioned goals along with fair representation are far from becoming a reality. This is

because the discussions at both national and international social and economic conventions have been dominated by the capitalistic doctrine that supports patriarchy. It is observed that though women are adversely impacted by the consequences of climate change, this fact is evidently absent from the positions where climate mitigation strategies are developed. This leads to further injustice, exploitation, and pollution. The eco-feminist theory claims, among other things, that women have different experiences with the environment due to their position in the household, social forces, cultural traditions, or historic structures (Lv & Deng, 2019).

Gender-specific issues in climate change only came out in discussions and conventions only when women's organizations entered the international platforms and gave these concerns a voice. For instance, it was not until COP13 in Bali that an action plan was presented to include gender and social issues in the agenda for future negotiations (European Institute for Gender Equality and Burkevica, 2013). The patriarchal system is reinforced by the dominance of cis man in environmental questions. It is crucial to straighten out the structures which are entangled with colonialism and capitalism and controlled by gender norms of masculinity and femininity (MacGregor, 2006).

1.2. Theoretical foundation

This section develops a theoretical framework to examine gender vulnerability during extreme weather-related disasters and adaptive capacity.

The impact of natural disasters can be analyzed through vulnerability. During disasters, vulnerability and adaptive capacity will differ from person to person, which can be seen from both the natural disaster risk theory by Blaikie et al. (1994) and feminist political ecology by Rocheleau et al. (1996). From these theories, it is evident that the level and type of vulnerability will be different for men and women and also among women (Nonoguchi, 2012).

The capacity to cope with disaster is an important aspect which influences the vulnerability of individuals and communities during a disaster. The three factors of vulnerability include exposure, resilience, and resistance. These factors are formed by political and socio-economic arrangements and the ability of individuals and societies to adapt to disaster risks (Pelling, 1999; Few, 2003). This is explained through hazard coping theory.

1.2.1 Natural Disaster Risk Theory

Blaikie et al. (1994), in their Pressure and Release (PAR) model, try to emphasize how vulnerability is shaped by social, political, and economic factors for individuals and households. They emphasize vulnerability is the result of unequal distribution of power and resources among different groups of people. To supplement the PAR model, Blaikie et al. (1994) developed the Access model, which reveals how individuals can be released from risk over time as vulnerability changes. The Access model scrutinizes the circumstances in which vulnerability is created or lessened in the allocation of assets, income, and other resources in society through the social, economic, and political processes (Blaikie et al., 1994; Wisner et al., 2004). The intrahousehold gender politics results in the discriminatory allocation of power and resources, escalating the suffering of women and girls (Agarwal, 1989; Agarwal, 1990; Sen, 1990). Less access to resources by women (Blaikie et al., 1994) makes them vulnerable to disasters (Denton, 2000; Denton, 2002; Cannon, 2002; MacGregor, 2010; Nelson et al., 2002).

1.2.2. Disaster Vulnerability Theory

Vulnerability as a concept is significant across disciplines and professions (Gillespie, 2008; Gillespie, 2010). The evolving theory of disaster vulnerability merges itself with other areas like environmental sustainability, terrorism, and social development along with the traditional methods of disaster mitigation, preparedness, mitigation, and response (Cutter, 2006). There exists income inequality and differences in household wealth where unequal costs are borne by poorest households during floods. As per vulnerability theory, among nations and regions of the world, community vulnerability to disasters is not even (Zakour & Gillespie, 2013). Low-income people, less developed communities, very young and very old, women, and persons with disabilities and health problems comprise the vulnerable population. They will be more vulnerable in times of disaster (Zakour & Gillespie, 2013).

A more complete theory of vulnerability, the vulnerability plus theory results from integrating vulnerability theory and resilience theory. Resilience theory is combined with Access and PAR model to integrate vulnerability and resiliency theory (Zakour & Swager, 2018). Resiliency theorists highlight population and individual outcomes, whereas vulnerability theorists highlight economic and structural variables (Norris et al., 2008). Resilience models concentrate on wellness

supplement vulnerability theory (Zakour & Gillespie, 2013). Vulnerability plus theories can help in reducing the level of vulnerability and also encourages resilient recoveries (Zakour & Swager, 2018).

1.2.3. Feminist Political Ecology

Rocheleau et al. (1996), through the feminist political ecology, move towards analyzing environmental crisis via gender differences in the ways human beings relate to the environment. Global economic, political, and environmental changes influenced men and women differently in resource use and allocation and environmental management (Rocheleau et al., 1996). This results from the fact that men and women relate differently to nature and the environment and not solely because of unequal political and economic structures. Gender differences are classified with regard to the experience of, responsibilities for, and interests in nature and environment in accordance with feminist political ecology (Rocheleau et al.,1996). Pertinent feminist theories like ecofeminism and environmental feminism led to such classification. As per Shiva (1988), there is a natural connection between nature and women, which provides women with an understanding of the ecosystem and environmental protection (Nightingale, 2006). This view was questioned by Agarwal (2003), who focused on material practices, comprising gender and class-based classification of labour and division of property and power, which influence the interaction of people with nature and their interests in certain resources and ecological processes (Agarwal, 1992; Nightingale, 2006; Rocheleau, 1996). Gender, along with class, race and culture, influences resource access (Agarwal, 1992; Rocheleau et al., 1996). Usually, women have customary resource use rights while men have legal ownership of resources (Agarwal, 2003; Rocheleau et al., 1996). Women were denied their customary access and control over land due to the patriarchal land reforms, which eventually marginalized them (Rocheleau et al., 1996; Nightingale, 2006). The green revolution greatly influenced and made changes in the gender division of labour as women remained in subsistence farming and men engaged in cash-crop farming (Boline et al., 1998; Mies & Shiva, 1993; Shiva, 1998).

Feminist political ecology highlights the need to understand the complicated local settings where social, economic, and political processes at the global or national level render the existing unequal

distribution of power and resources to increase the vulnerability of marginalized peoples during environmental disasters (Nonoguchi, 2012).

1.2.4. Hazard Coping Theory- The Burton, Kates, and White adaptation model

The Hazard coping theory is mainly about human adjustments to floods, and other natural disasters. As per the hazard coping theory of Burton, Kates and White (1978), the people who suffer from disaster respond to disasters in a rational and ordered way based on hazards and their social and economic resources.

According to the adaptation model by Burton et al. (1990), there are three types of adaptation adjustments. They are biological adaptation, cultural adaptation and adjustments which are of two kinds- incidental and purposive. The purposive adjustment is believed to be more proper during floods. Biological adaptation is adjustments which are believed to be resulted from a natural selection process. Cultural adaptation refers to behaviours in a social system that reacts to environment changes which may not be to improve in the direction of the impact instantly. Whereas adjustments are direct and rapid reaction to disasters which includes changes in daily activities.

1.3. Literature Review

1.3.1. Natural disaster- a general overview

A natural disaster is often related to loss of life and property and social and environmental disruption. The United Nations Strategy for Disaster Risk Reduction (UNSDR) defines a disaster as "a serious disruption of the functioning of a community or society involving widespread human, material, or environmental losses and impacts which exceeds the ability of the affected community to cope using its resources" (UNDSR, 2019). A significant impact of natural disasters can be seen on the public health and welfare of people and inhabitants of the place affected by the disaster. It also results in a substantial economic burden. Around $891 billion in damage was caused worldwide from 2000 to 2009 due to natural disasters (Kellet & Sparks, 2012). Critical and expensive infrastructures are destroyed during a disaster. When it comes to low-income countries, the negative impact of a disaster on health and the economy is severe, and especially the burden

can be seen in poor sections of the society. Policies aiming towards sustainable development can help developing countries to adapt and cope with disasters and also will help them to be less vulnerable to future disasters (Ludwig et al., 2007). In low-income countries, disaster leads to a higher financial burden, whereas higher-income countries are faced with large industrial damage (McDermott, Frank & Tol, 2014). Development policies which include disaster management strategies like investments in reducing disaster risk can reduce disaster risk (De Haen & Hemrich, 2007). Rapid urbanization results in the overflowing of rivers and floods (Du, Shi, Rompaey & Wen, 2015). Sustainable urban development should be promoted to recover from climate change (Leichenko, 2011).

India is becoming more vulnerable to disaster every year because of its high population and increasing urbanization (UNDRR & CRED, 2019). Floods, landslides, cyclone, earthquakes, and droughts repeatedly occur across India every year (Bahadur, Lovell & Pichon, 2016). The unplanned and low-standard infrastructure can lead to higher human, physical and economic losses during and after a disaster. India falls within the group of countries which faces high risk from natural hazards, and for long it lacked the ability to manage and adapt to these hazards leading to significant steps taken by India's national and state governments to deal with disaster risk. To efficiently deal with natural disasters, The Disaster Management Act provided a framework that helped improve disaster risk management (Bahadur, Lovell & Pichon, 2016). India gradually understood the need to incorporate disaster management in the development plans. As this realization was made into practice, now in India's policy framework, Disaster Management has an important place (Patil, 2012).

Floods frequently occur in India (EM-DAT, 2019). Heavy monsoon rain often leads to flooding and landslides. India gets 1150 mm average rainfall, with a significant difference across the country (Ministry of Home Affairs, 2011). From 1900 to 2018, flood-prone regions in India are Andhra Pradesh, Assam, Bihar, Gujarat, Orissa, Tamil Nadu, Uttar Pradesh, and West Bengal (EM-DAT, 2019).

A study conducted in 5 major cities of India shows that investment in infrastructure suited for climate risk specific to these cities will help to recover from the natural disaster, and low infrastructure gaps will reduce the disaster risk (Govidarajulu, 2020). Owing to the climate change, natural disaster impacts lots of people around the world, and the burden is borne by the people in

developing countries more than in developed countries. Through a study done in Odisha, India, one can see that educating people regarding the risk of disaster and giving warnings can help to reduce disaster risk (Ray-Bennett, 2018). Rapid urbanization causes flooding, which should be corrected through effective urban planning and flood management (Suriya & Mudgal, 2012). Over the years, one can see that there has been a huge increase in the urban population of India, which went up from 17.97 per cent in 1961 to almost 31.16 per cent in 2011 (Tripathi, 2013), which led to rapid urbanization and vulnerability of the local population. Sustainable and inclusive development can be planned to reduce disaster risk (Parikh, Sandal & Jindal, 2014).

1.3.2. Natural disaster, Gender, and Vulnerability

During disasters, vulnerability and adaptive capacity will differ from person to person, as seen from both the natural disaster risk theory (Blaikie et al., 1994) and feminist political ecology by Rocheleau et al. (1996). From these theories, it is evident that the level and type of vulnerability will be different for men and women and also among women (Nonoguchi, 2012).

During flood caused by climate change, vulnerability and gender turn out to be a significant concern that needs to be addressed. Vulnerability, as defined by UNISDR, is "the characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard" (UNISDR, 2009). Vulnerability often affects people's ability to cope with and recover from natural disasters (Blaikie et al.,1994; Fordham, 1999; Enarson, 2004; Singh et al., 2017). The adaptive capacity of men and women is determined by access to different capital assets and livelihood practices (Cutter, 1993; Denton, 2001; Enarson, 2004; Naz, 2019). This adds in gender as a component to vulnerability and adaptive capacity (Dankelman, 2002; Dankelman & Jansen, 2010).

The ability to adapt to climate change events like floods differs for men and women. Women with lesser access to resources than men are repeatedly forced by gender norms, leading to limited mobility or decision-making ability even though disaster impacts both men and women (CCC, 2009). This can have an impact on women's livelihood plans, food security and right to access food (CCC, 2009), particularly while considering the fact that women are more likely to be engaged in agricultural-related activities compared to men (Odame et al., 2002). Flooding, which directly worsens the socio-economic status in the local communities, is one of the main causes of

social crises. Women are the most vulnerable groups in disaster-prone areas (Hines, 2007; Dasgupta et al., 2010). Women are often victimized during a disaster in the particular aspect of vulnerability compared to men owing to the conventional practices and work-related practices. Due to their inferior position in society, women often exhibit less power to face natural disasters (Duddy, 2002; Gaag, 2013).

Changes in adaptation to disaster and access to resources are always defined by class, religion, and gender (Enarson, 2004; Denton, 2001). For instance, gender-specific social norms and women's predetermined roles in society often affect women's capacity to adapt and make decisions during adverse climate change situations or disasters (Dankelman, 2002). Based on various studies, it is evident that household's plans to adapt to flood and other climate-related disasters are guided by institutional and socio-economic factors, i.e., age (Dadzie & Acquah, 2012; Saqib et al., 2016), education (Deressa et al., 2010; Rehima et al., 2013), land access (Naz et al., 2018), size of the household (Ullah et al., 2015) and credit obtained (Saqib et al., 2016; Ullah et al., 2015). If individuals have access to resources, this reduces their vulnerability (Davison, 1988; Corbett, 1989).

1.3.3. Disaster and coping mechanism

The capacity to cope with disaster is an important aspect which influences the vulnerability of individuals and communities during a disaster. The three factors of vulnerability include exposure, resilience, and resistance. These factors are formed by political and socio-economic arrangements and the ability of individuals and societies to adapt to disaster risks (Pelling, 1999; Few, 2003).

Coping and adaptation, both terms are used to define the plans adopted in reaction to extreme events. These terms are used interchangeably in literature (Jabeen et al., 2010; Yasmin & Ahmed, 2013). Then these terms were distinguished in which coping is an immediate and short-term measure implemented, whereas adaptation must include 'livelihood progression beyond reactive responses' (Shafie & Rahman, 2014). Sale of assets, borrowing from neighbours, and family members, land mortgaging, temporary migration in search of jobs, and looking for alternative employment are some of the coping methods adopted (Islam et al., 2012; Yasmin & Ahmed, 2013; Morsheed, 2007; Nyakundi et al., 2010).

According to IPCC, "resilience is the ability of social, economic and environmental systems to cope with hazardous events, trends or disturbances, responding or reorganizing in ways that maintain their essential functions, identity, and structure, while also maintaining the capacity for adaptation, learning and transformation" (Pachauri et al., 2014). Adaptation to climate change is also differentiated into two. One is the adaptation strategy which is a long-term strategy (Thomas et al., 2007), and the other one is the coping strategy which comprises short-term household strategies aimed at lessening the impacts of floods (Thomas et al., 2007; DFID, 2008). Adaptive strategies can be proactive and reactive (Bruin, 2011). In proactive adaptation strategy, there is the involvement of anticipation of climate change, whereas reactive adaptation strategies focus on the impacts of climate change after facing it (Shongwe et al., 2014). Reactive adaptation strategies are being used commonly by societies in response to climate change (Bierbaum et al., 2013).

The gendered differences in access, use and control of natural resources, control over economic assets, physical mobility and decision-making power all have different impacts on men and women when it comes to their exposure to disasters and coping capacity to extreme weather events (FAO, 2011; ESCAP, 2017; UN Women & UNDP-UNEP PEI, 2018; Halle & Kellogg, 2020; CIFOR Climate Gender briefs, www.CIFOR.org/gender-climate; Adzawla et al., 2019; Ampaire et al., 2020; Jerneck, 2018a; Jerneck, 2018b; Ncube et al., 2018). Thus, it can be stated that the more empowered women are they will have the more adaptive capacity (UNDP, 2016a; UNDP, 2016b).

1.4. Research Gap

Based on the extensive literature review on natural disasters, gender and disaster coping, the research gaps noted are:

- In the case of SAARC countries, particularly India the study of the factors associated with disaster induced damages is important for policy formulations and disaster management.
- Gender vulnerability in the face of extreme weather-related events remains an overlooked area, especially in the Indian context. An evaluation of vulnerability helps to distinguish the affected people's requirements and limitations.

- Factors influencing the choice of coping especially among women is an area which needs to be explored. This study investigates whether empowerment of women has any influence on their selection of coping strategy.

The above-mentioned research gaps urge the need to carry out an analysis based in India, which looks into vulnerability. This also calls for a study which includes the determinants of coping methods adopted by women during sudden disaster floods and how empowerment influences the coping strategy adopted by women.

1.5. Objectives of the study

The main objectives of the study are:

- To examine the determinants of the impact of natural disasters in India and SAARC countries
- To assess the gendered effect of natural disasters in Kerala
- To measure women's empowerment in disaster-hit regions and to see the association between women empowerment and coping mechanism.
- To measure and compare women empowerment in Alappuzha and Wayanad, districts of Kerala and Indian states using NFHS data.

1.6. Overview of the thesis

This thesis comprises seven chapters that are briefly summarised here:

Chapter I. Introduction

This chapter puts forth the research background, related theoretical foundation for the study and the objectives. Then marks out the thesis design.

Chapter II. Determinants Of Impact of Natural Disaster in SAARC Countries with Special Reference to India

The chapter investigates the determinants of the impact of natural disasters by considering the SAARC countries and India. The study period ranges from 1960 to 2018 for the 8 SAARC

countries and 28 Indian states using panel data analysis. The study indicates that variables like population density, urban population and education affect natural disaster fatalities.

Chapter III. The physical and social field

This chapter describes the field and experiences during the field study, and some observations are also included.

Chapter IV. Gender Vulnerability in the Face of Climate Change: A Study of Wayanad and Alappuzha Districts of Kerala, India

This chapter reviews gender vulnerability during the recent floods in the rural areas of the Indian state of Kerala using primary data. With a focus on identifying the socio-economic factors associated with gender vulnerability, this chapter also incorporates policy suggestions to reduce gender vulnerability in the face of floods in Kerala, where it is becoming a recurrent phenomenon.

Chapter V. Coping strategies adopted by women and its determinants during floods: Evidence from Alappuzha and Wayanad districts of Kerala, India

This chapter examines the different coping strategies adopted by women during the recent floods in the rural areas of the Indian state of Kerala using primary data. It also tries to determine the determinants of women's coping strategies.

Chapter VI. To Measure and Compare Women Empowerment in Alappuzha and Wayanad, Districts of Kerala and Indian States Using NFHS Data.

This chapter analyses and compares the level of women empowerment in districts of Alappuzha and Wayanad with women empowerment in Kerala (comprising all districts), as measured by NFHS data and then deduces where Kerala stands in terms of women empowerment vis-à-vis India (all states NFHS data) considering the fact that Kerala is advanced in terms of other developmental outcomes.

Chapter VII. Conclusion

This chapter wraps up the conclusions drawn from the research work, including the concise contribution to the research field, the limitations of the study, and the prospects of future research.

Chapter 2

Determinants of impact of natural disaster in SAARC countries with special reference to India[1]

2.1. Introduction

The present chapter tried to examine what are the factors which determines the impact of natural disaster and how these variables intensify or lessen disaster impacts if they are significant enough to influence the disaster impacts in any way. This is an international view which will be focused on India.

Natural disaster is often related with loss of life and property along with social and environmental disruption. The United Nations Strategy for Disaster Risk Reduction (UNSDR) defines a disaster as "a serious disruption of the functioning of a community or society involving widespread human, material, or environmental losses and impacts which exceeds the ability of the affected community to cope using its resources" (UNSDR, 2019). A large impact of natural disaster can be seen on the public health and welfare of people and inhabitants of the place affected by the disaster, and it also results in huge economic burden. Around $891 billion damage was caused worldwide during 2000 to 2009 due to natural disaster (Kellet & Sparks, 2012). The critical and expensive infrastructures are destroyed during disaster. When it comes to low-income countries the negative impact of disaster on health and economy is severe and especially the burden can be seen on poor sections of the society. Policies aiming towards sustainable development can help developing countries to adapt and to cope with disaster and also will help them to be less vulnerable to future disasters (Ludwig et al., 2007). In low-income countries, disaster leads to higher financial burden whereas higher income countries are faced with large industrial damage (McDermott, Frank & Tol, 2014). Generally, additional disaster reduces GDP growth by 24 per cent in the short-term (Heger, Julca & Paddison, 2008) while (Skidmore & Toya, 2002) taking into account the disaster effects, growth has a positive relation with climatic disasters but negative relation with ecological disasters in the

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long term. Each year in the last decade, the natural disaster claimed and affected millions of lives along with huge damages due to increasing climate change and vulnerable population across the world. Development policies which include disaster management strategies like investments in reducing disaster risk can reduce disaster risk (Haen & Hemrich, 2007). Rapid urbanisation results in overflowing of rivers and floods (Du, Shi, Rompaey & Wen, 2015). Sustainable urban development should be promoted to recover from climate change (Leichenko, 2011). SAARC countries which are almost similar in terms of GDP growth, with almost similar export basket are highly responsive to external and natural shocks (Jain & Singh, 2009).

India is becoming more vulnerable to disaster every year because of its high population and increasing urbanisation (UNDRR & CRED, 2019). Floods, landslides, cyclone, earthquakes, and droughts repeatedly occur across India every year (Bahadur, Lovell & Pichon, 2016). The unplanned and low standard infrastructure can lead to higher human, physical and economic losses during and after a disaster. India falls within the group of countries which faces high risk from natural hazards, and for long it lacked the ability to manage and adapt to these hazards leading to significant steps taken by India's national and state governments to deal with disaster risk. To efficiently deal with natural disaster, The Disaster Management Act provided a framework, which helped to improve disaster risk management (Bahadur, Lovell & Pichon, 2016). India gradually understood the need to incorporate disaster management in the development plans. As this realization was made into practice, now in India's policy framework Disaster Management has an important place (Patil, 2012).

Floods occur frequently in India (EM-DAT, 2019). Heavy monsoon rain often leads to flooding and landslides. India gets 1150 mm average rainfall with a significant difference across the country (Ministry of Home Affairs, 2011). From 1900 to 2018, flood-prone regions in India are Andhra Pradesh, Assam, Bihar, Gujarat, Orissa, Tamil Nadu, Uttar Pradesh, and West Bengal (EM-DAT, 2019).

This chapter tries to discover the determinants of the impact of natural disaster in SAARC countries and India using disaster data from EM-DAT database between 1969 to 2018 using panel data analysis. This study tries to uncover how the variable like GDP, population density, urban population, education, and gross capital formation influences disaster impacts in these countries using the EM-DAT.

The next section, section 2 analyses some available literature related to disaster studies. Section 3 discusses the objective. Section 4 provides the data and methodology used for the study. Section 5 reports the results and section 6 involves discussions. Section 7 conclusion with the implications of the study.

2.2. Literature Review

Natural disasters often cause negative effect on economic growth, particularly for developing countries (Klomp & Valckx, 2014; Strobl, 2012). The impact of natural disaster on the development and growth of different regions, countries differs and its impact on people and gender is different based on their vulnerability and ability to cope up with such disasters. It can be seen that growth in developing countries is often sensitive to disaster (Loaysa et al. 2012). Financial aid during the recovery period of natural disaster helps to reduce the decline in GDP in countries with strong institutions (Barone & Mocetti, 2014). There exists a temporary slowdown in GDP per capita as the result of natural disaster, and less developed countries will be suffering from more significant loss (Felbermayr & Groschl, 2014). Based on a study conducted in Vietnam, it shows that more destructive natural disaster tends to decrease the output growth and destruction of capital and property improves the economy in short term (Noy & Vu, 2010).

Investment in education can reduce natural disaster risk (Cuaresma, 2009). Higher-income countries will be able to overcome disaster risk due to the increase in per capita income (Kellenberg & Mobarak, 2008). In Nigeria, GDP per capita and urban population determines the impact of disaster (Okon, 2018). Population, economic development, education-these variables can have an influence on the impact of disaster (Padli, Habibullah & Baharom, 2007). Better institution can reduce the harmful impact of disaster (Noy, 2009; Skidmore & Toya, 2007; Skidmore & Toya, 2007; Raschky, 2008; Kahn, 2005). Also, education can be helpful in reducing disaster risk (Yamauchi, Yohannes & Quisumbing, 2009).

A study conducted in 5 major cities of India shows that investment in infrastructure suited for climate risk specific to these cities will help to recover from the natural disaster, and low infrastructure gaps will reduce the disaster risk (Govindarajulu, 2020). Owing to the climate change, natural disaster impacts lots of people around the world and the burden is borne by the people in developing countries than in developed countries. Through a study done in Odisha, India,

one can see that educating people regarding the risk of disaster and giving warnings can help to reduce disaster risk (Ray-Bennett, 2018). Rapid urbanisation causes flooding, which should be corrected through effective urban planning and flood management (Suriya & Mudgal, 2012). Over the years, one can see that there has been a huge increase urban population of India which went up from 17.97 per cent in 1961 to almost 31.16 per cent in 2011 (Tripathi, 2013), which led to rapid urbanisation and vulnerability of the local population. Sustainable and inclusive development can be planned to reduce disaster risk (Parikh, Sandal & Jindal, 2014).

As a country moves towards development, it will be capable in lowering human and economic losses due to natural disaster (Toya & Skidmore, 2007). Disaster impact and development of a country has a negative relation. i.e., as a country develops it can reduce the number of fatalities and damages due to disaster (Albala-Bertrand, 1993). During natural disasters, less developed countries are faced with huge number of fatalities, while developed countries suffer from more significant economic losses. More people are affected in counties with greater income inequality whereas better social welfare measures help in reducing adverse disaster impacts on people. Moreover, the disaster impact on people can delay or even reduce the economic growth of developing countries (Tselios & Tompkins, 2019). Exposure to disaster hazard determines the relation between wealth and disaster in a country. As an economy develops, the countries that face the low hazard of disaster initially face high losses, and then less.

Similarly, countries facing high hazard of disaster initially faces low losses and then high (Schumacher & Strobl, 2011). In high-income countries, the losses due to natural disaster are low in terms of affected people and high in terms of damages. Education tends to decrease the loss of natural disaster, and high urban population has a positive relation with disaster loss. Also, larger area reduces disaster impact as land area has negative relation with disaster impact (Songwathana, 2018). Disaster impacts seems to reduce with long-run economic growth (Kim, 2010). Income, geography, and institution of a country determine the death due to natural disaster in a country. Developed countries experience lower death compared to developing countries when faced with disaster with the same intensity. Deaths from natural disaster are lesser in countries closer to the equator, which implies that geography also plays an important part in determining disaster death. Countries with strong institutions and less income inequality often experiences a smaller number of deaths during (Kahn, 2005). Level of human development determines the effects of natural

disaster in a country, i.e., the number of deaths, people affected and total damages due to the natural disaster. Unemployment, education, population density, investment determine the effects caused by natural disaster in a country. It has been observed from (Padlia, Habibullahb & Baharomc, 2018) that education, government consumption, openness and investment have negative, and population density have a positive relationship with the effect of natural disasters. This study adds into the existing literature by focusing on SAARC countries and Indian states, which to the best of my knowledge remains an understudied area. As the SAARC countries and India house large human population and are developing economically, the study of the factors associated with disasters induced damages is important for policy formulations for disaster management. Hence, focus on this region and India is an important contribution to disaster related literature.

2.3. Objective

This chapter tried to examine what are the factors which determines the impact of natural disaster and how these variables intensify or lessen disaster impacts if they are significant enough to influence the disaster impacts in any way.

For this, the study selected SAARC Countries giving detailed attention to India. India and SAARC countries are almost similar as they are the fastest-growing economies in terms of GDP growth, also with growing savings and doubling gross capital formation over the years. These countries have HDI values ranging from 0.4 to 0.7. So, it will be interesting to analyse how variables like GDP, Gross capital formation, urban population, education, and population density affect impact of natural disaster in these countries. First, this chapter considered the SAARC countries, and then Indian states.

2.4. Data &Methodology

Data on impact of natural disaster, i.e., deaths, affected people and economic losses happened due to natural disaster, is taken from EM-DAT data source. Though EM-DAT provides information on type of disaster, this thesis does not separate disaster into different types. Because in case of SAARC countries and India there is a huge difference in geography and climate which results in different types of disaster. Also, this study excluded epidemics from the analysis. This analysis excluded nations and states in the EM-DAT data if there were many missing values for disaster

death, affected and damages counts. Since in EM-DAT, the estimated damage value is provided in Dollars (US $). So, in the analysis the monetary damages have been converted to real terms using deflator indexes using 2015 as the reference year.

This study covers the analysis of SAARC countries from 1969 to2018 and Indian states from 1990 to 2018 separately. SAARC (The South Asian Association for Regional Cooperation) includes eight countries (Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka). From these this study dropped the Maldives due to data constraint. For the analysis of SAARC countries, the development indicators (real per capita GDP, Population density, Urban population, Gross capital formation) are taken from World Development Indicators database (WDI, 2019), Barro-Lee educational attainment database has been used to obtain average years of total schooling (Barro-Lee, 2016; Barro-Lee, 2018).

Indian union comprises of 28 states (Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chhattisgarh, Goa, Gujarat, Haryana, Himachal Pradesh, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Mizoram, Nagaland, Odisha, Punjab, Rajasthan, Sikkim, Tamil Nadu, Telangana, Tripura, Uttar Pradesh, Uttarakhand, and West Bengal) and 8 Union Territories (Andaman and Nicobar Islands, Chandigarh, Daman & Diu, Delhi, Jammu & Kashmir, Ladakh, Lakshadweep and Puducherry). This study does not include every state and UTs into consideration due to data constraint. The sample excludes some states; they are, Arunachal Pradesh, Mizoram, Sikkim, and Telangana. For Union Territories, only Jammu & Kashmir is included. For the Indian states, data on population density and urban population are taken from the census of India (India Census, 2011) and Gross capital formation is taken from Annual survey of industries (Annual Survey of Industries, 2016-17) and GSDP and gross enrolment ratio are taken from Indiastat database, (Indiastat, 2018).

Based on the literature, this study proposes the equation 1.

$$\log(\text{Natural Disaster})_{it} = \alpha_{it} + \beta_1 \log(\text{GDP per capita})_{it} + \beta_2 \text{Education}_{it} + \beta_3 \text{Gross capital formation}_{it} + \beta_4 \log(\text{Population Density})_{it} + \beta_5 \text{Urban Population}_{it} + e_{it} \quad (1)$$

in the above equation, i stands for country 1, 2, 3, … n and e_{it} is the error term. Natural Disaster represents the total number of deaths (D), total affected (A) and total economic losses (EL) due to disaster

Due to missing values, this chapter analyzed four models in the study based on the equation.[2] For SAARC countries, two models are used, and for Indian states also two models are used.

Model I: SAARC countries from 1969 to 2018. Here the analysis takes only 5 SAARC countries as data for Afghanistan, Bhutan, and Maldives from 1969 are not available.

Model II: SAARC countries from 2000 to 2018. Here the study is based on 7 SAARC countries as data for the Maldives is not available.

Model III: Indian states from 1990 to 2018. Here the analysis focused on Indian states except for Arunachal Pradesh, Chhattisgarh, Jharkhand, Mizoram, Sikkim, Telangana, and Uttarakhand as data for these states are not available.

Model IV: Indian states from 2000 to 2018. Here the Indian states except for Arunachal Pradesh, Mizoram, Sikkim, and Telangana are included as data for these states are not available.

For the model I and II, average years of total schooling has been taken as the proxy for education and for model III and IV, gross enrolment ratio has been taken as a proxy for education.

For each model, the study run the panel regression, and after comparing the fixed and random effects model using Hausman test, the random effect model is selected. This thesis also uses the Breusch-Pagan Lagrange multiplier (BP-LM) test to check for the evidence of significant differences across countries. I have also checked for multicollinearity, autocorrelation and Heteroskedasticity and made necessary changes in the model wherever necessary. Before applying the panel data models, unit root tests were used to check for the stationarity of the series.

[2] As we don't have data for some countries and states, the list of countries and states included in each model can be found in appendix.

2.5. Results

Descriptive statistics of all the variables used in the analysis is included in the appendix. Panel data discussion has been divided into two parts. In the first part, the chapter discuss the results for SAARC countries followed by the discussion for the states of India. For all the models, Hausman test have been used to select between fixed or random effect models. Unit root test has also been conducted to check for stationarity and wherever necessary, non-stationary series has been converted to stationary series through first difference.

2.5.1. Determinants of the impact of natural disaster in SAARC countries

Table 2. 1: Determinants of impact of natural disaster in SAARC countries

Variables	Model I			Model II		
	Log Total death	Log Total affected	Log Total damages	Log Total death	Log Total affected	Log Total damages
Log GDP percapita	-5.70	-3.32	-9.89	-2.28	-6.21	26.54
	(10.34)	(10.00)	(18.06)	(6.11)	(6.89)	(33.60)
Log (Population density)	0.52*	1.55*	0.91*	0.34	1.69***	-1.35*
	(.16)	(.61)	(.42)	(.38)	(.44)	(.65)
Urban population	0.03	0.07	0.13	-0.72	-2.20	4.81**
	(.05)	(.06)	(.06)	(2.23)	(1.64)	(1.61)
Average years of schooling	0.40	0.37	0.25	1.85*	1.58**	-0.61
	(.33)	(.41)	(1.07)	(.78)	(.56)	(2.09)
Gross capital formation	0.05	0.09	0.13	-0.06	0.05	0.14
	(.08)	(.08)	(.14)	(.04)	(.06)	(.12)
Constant	2.44	3.21	-0.52	4.09*	4.68*	5.18**
	(1.57)	(3.37)	(2.41)	(1.47)	(2.24)	(1.97)
No. of observations	221	218	138	109	108	48

Robust standard error is given in parentheses: *** p<0.01, ** p<0.05, * p<0.1

From Table 2.1, one can observe that for the model I population density is significant and have a positive relation with disaster death, total affected people, and damages. Here one can see that gross capital formation is not significant, however it is having a negative relation with damages. Model II shows that population density, urban population and education are significant. Population density and affected people have a positive relation while population density and damages have negative relation, while urban population has positive relation with damages. Education shows positive relation with total affected people and damages. GDP shows the expected sign as per the literature even though the variable is not significant in both models.

2.5.2. Determinants of the impact of natural disaster in Indian states.

Table 2. 2: Determinants of impact of natural disaster in Indian states

Variables	Model III			Model IV		
	Log Total death	Log Total affected	Log Total damages	Log Total death	Log Total affected	Log Total damages
Log (GSDP)	2.97	-1.83	2.38	3.37	-0.22	-2.03
	(2.89)	(2.92)	(4.98)	(4.35)	(6.17)	(7.58)
Log (population density)	0.12	0.60	-0.54	-0.19	-0.78	-0.69
	(.60)	(.45)	(.35)	(.75)	(.45)	(.71)
Log (Urban population)	-0.16	0.70***	0.67	-0.02	-0.09***	-0.03
	(.34)	(.22)	(.43)	(.02)	(.03)	(.02)
Gross Enrolment Ratio(I-V)	0.01	0.05*	0.04	-0.01	0.01	-0.01
	(.01)	(.03)	(.03)	(.01)	(.02)	(.02)
Log (Gross capital formation)	0.01	0.00	-0.00	0.01	0.01	-0.00
	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)
Constant	-2.44	9.92***	2.73	1.22	12.19***	6.43
	(3.61)	(2.52)	(1.97)	(5.67)	(3.89)	(6.15)
No. of observations	314	277	193	236	200	141

Robust standard error is given in parentheses: *** p<0.01, ** p<0.05, * p<0.1

From Table 2.2, for model III, urban population and education are significant. Urban population and education are positively related to affected people. For model IV, there is a negative relation between affected people and urban population. GDP shows the expected sign i.e., high GDP lessens the disaster impact as per the literature, even though the variable is not significant in both models.

Overall, from the four models, it is observed that urban population and population density have greater influence on disaster impacts.

2.6. Discussion

Natural disaster leads to human fatalities, damages to property and environment. Although the frequency of natural disaster across the world is increasing, the number of people died, the number of affected people, and economic losses differ across countries and regions. In some places, the impact is higher, and in some other places, it is lesser. Here this analysis becomes essential, i.e., what are the factors which determine the impact of natural disaster in different countries and regions. From the analysis, it can be seen that population density and disaster impacts are positively related, i.e., if population density increases, disaster impact will also increase. This mostly happens in urban areas where people live close. Also, the study shows a positive relationship between urban population and disaster damages. Over the year the disaster death and damages are increasing, owing to the growing population and expansion of cities.

These similar kinds of relation of variables like urban population, population density and education on the impact of natural disaster in the study conducted by (Cuaresma, 2009; Songwathana, 2018; Kellenberg & Mobarak, 2008; Kim, 2010; Okon, 2018; Padlia, Habibullahb & Baharomc, 2018).

2.7. Conclusion

This paper intends to consider the determinants of the impact of natural disaster in SAARC region especially in India and how these variables affect the disaster impact in this region. Some economic variables which can affect disaster fatalities are education, urban population and population density based on this study. As indicated by the study increased urban population where people live nearby, during disaster due to high population density, the disaster impacts will also be higher.

Chapter 3

The Physical and Social Field

"It matters what matters we use to think other matters with; it matters what stories we tell to tell other stories with; it matters what knots knot knots, what thoughts think thoughts, what descriptions describe descriptions, what ties tie ties. It matters what stories make worlds, what worlds make stories."

— Donna J. Haraway, Staying with the Trouble: Making Kin in the Chthulucene

The Intergovernmental Panel on Climate Change (IPCC) sixth report identifies India as one of the most vulnerable countries severely impacted by extreme climate events such as deadly heatwaves, rising sea levels, frequent floods, and droughts (Nayak & Luke, 2022). Kerala, the southern state of India, witnessed devastating floods during the monsoon seasons of 2018 and 2019 (Vijaykumar et al., 2021). This 2019 flood is an example of how global warming has affected this region leading to intense rainfall, causing a greater threat to the vulnerable western ghats area. The scientific studies confirmed that this 2019 flood was an event of mesoscale cloudburst (MsCB) never reported before in Kerala, which usually occurs in northern parts of India. Such events due to global warming can be a recurring event in this southern state of India (Vijaykumar et al., 2021).

The study was carried out in the Pozhuthana village of Wayanad district and Kainakary village in Kuttanad of Alappuzha district of Kerala, India. Almost 49 villages in Wayanad and 55 villages in Alappuzha districts were severely affected during the 2019 floods (GoK, 2019), which was the worst hit compared to other state districts (IANS, 2019). I selected Pozhuthana village in Wayanad district and Kainakary village of Kuttanad in Alappuzha purposively as almost every household in Pozhuthana and Kainakary village was affected in one way or another during the 2019 floods (GoK-Wayanad, 2019). In Pozhuthana village, the number of households is 1571. Following a 95% confidence interval and accepting around a 10% margin of error, the number of households needs to be 91. In Kainakary village, the number of households is 3932. Following a 95% confidence interval and accepting around a 10% margin of error, the number of households needs to be 94. To be exact, I selected 124 households in Wayanad and 145 households in Alappuzha districts based on a random walk model (United Nations, 2005; Kumar & Pathak, 2022) due to time and resource constraints.

I shall begin with a sketch of my study area to provide an idea about the landscapes and a glimpse of life in the places where I did fieldwork.

3.1. Field description

3.1.1. Pozhuthana- Wayanad

Wayanad- the hilly tropical district of Kerala is in the margin of the Western Ghats, one of the world's eight most important biodiversity hotspots and a UNESCO world heritage site (Wayanad, 2022). Wayanad is a region of significant ecological importance (Münster, 2012; District of Wayanad, 2016). Wayanad's forests are fragmented, dispersed into scattered islands of forest bordering densely populated agricultural land (Voorhees, 2010; Munster, 2012).

Wayanad is primarily an agricultural region, though the name Wayanad comes from *vayal nadu*, which is the land of rice paddy fields (Wayanad District, 2016; Münster, 2012). The people here mainly depend on agriculture as farmers, planters, or labourers (Mathai, 2018), primarily paddy, plantations, and spices (Jose & Padmanabhan, 2015). In Wayanad, 74 per cent of the workforce is dependent upon agriculturally based activities, and 40 per cent of the labour force is agricultural day labourers (Indian Census, 2011). In Wayanad, around fifty per cent of the population is Hindu, one quarter is of Christian faith, and the remaining quarter is Muslim, apart from a small Jain community (Wayanad District, 2016). Wayanad is home to twenty *Adivasi* (tribal) groups population (Betz et al., 2014; Wayanad District, 2016).

Pozhuthana is a small village in Vythiri Taluk of Wayanad district. This area is drained by the Pozhuthana river, which passes through the middle of the village area and finally combines with the Kabani River. My fieldwork in Pozhuthana was done from January 2022 to September 2022. On the first day, I took strolls in the study area to understand the schedule of the local people so that I could go and meet them to collect the data without interrupting or disturbing their daily life. I got down in the main village road, and from there, I used to walk to the hoses of participants. On the way, I noticed the agricultural lands, the people working there, and voices from each household and I also joined their resting time meetings.

I collected information from people belonging to different religions, castes, communities, political parties, occupations, gender, and age groups of Pozhuthana village. Most of the people were ready to take the survey, but Few avoided taking the survey.

As it was during covid wave time, I was wearing masks which were uncomfortable to wear for a long time, and I was not able to drink water at times as I had to remove the mask otherwise. I used to travel daily to the field from my home, covering 138 km. Most people were not wearing masks during the interview, which scared me like anything, so I gave them masks and sanitizer.

Figure 3. 1: Paddy field in Wayanad

Figure 3. 2: Areca nut cultivation on large acres of land along the roadsides

Figure 3. 3: farmers along with the bullocks in fields

Figure 3. 4: Tapioca cultivation in between Areca nut

The above pictures show the green paddy fields, Areca nut fields, tea and coffee plantations, and tapioca cultivation. On both sides of roads, you can see either agricultural filed, tea/coffee plantations or areca nut/tapioca/banana cultivation. In every household, you can see they are also

doing homestead cultivation. Every household has coffee plants, and the smell of coffee flowers fills your nostrils. This is the scenery which will please your eyes.

3.1.1.1. Varied impacts of climate change on local people

The climate crisis hits marginalized communities the most. The continuous floods and landslides owing to the ever-increasing climate crisis have disrupted the lives of the people residing in the fragile Western Ghats regions. The continuous flood results in the loss of agricultural produce which otherwise could have been harvested. The houses are destroyed, and they are still looking for monetary support to reconstruct them.

3.1.1.2. The ruined houses in the deluge

Figure 3. 5: House with cracks which is not yet rebuilt

Figure 3. 6: The aftermath of floods

The above picture shows the houses still waiting to be repaired, which were destroyed during the floods. The first picture is of the house where the base was destroyed and the house silted to the left. Staying inside is very dangerous, but the family stays in the house as they don't have the means to construct a new house or do the necessary repair work. Here such houses are a common scenario. Many got assistance from the government, but the money was insufficient as they could only build the base of the house with that money. Reconstruction of many houses is left unfinished because of monetary reasons.

3.1.1.3. Over-indebtedness

To continue the cultivation, the farmers took up multiple loans, increasing their debt burden twofold. Unpredicted weather and climate change-induced disasters are not helping these farmers, as their crops are lost entirely. This leaves them with a considerable debt burden.

3.1.1.4. Devastation during the cataclysm

Figure 3. 7: The picture showing the severity of floods

Figure 3. 8: The tea plantations destroyed during floods

The entire area was covered in flood water during the flood, as seen in the above pictures. The whole house was flooded, damaging household utensils and electronic appliances. Still, people are not able to come out of this damage. One family staying near the Pozhuthana river raised concerns that they got lots of blankets and dresses during the flood. But what they wanted was kitchen

utensils. Also, some participants pointed out the unequal distribution of relief materials. Those who lost everything were left with nothing, and the others got all the benefits during distribution.

3.1.2. Kainakary- Kuttanad, Alappuzha

Kuttanad is famous for its enormous paddy fields with unique geographical characteristics. Here farming is done beneath 1.2 to 3.0 meters (4 to 10 ft) of sea level and is the crucial rice producer in the state with the lowest altitude in India. The primary occupations in Kuttanad are farming and fishing though income from backwater tourism is also on the rise. It is fascinating to note that the farmers of the Kuttanad area, also well known as "The Rice Bowl of Kerala" (Kuttanad, 2022), are famous for Bio Saline Farming (BSF). BSF refers to agriculture carried out within varying salinity levels in groundwater, soils or a combination of both (Masters et al., 2007). Having understood the complexity and importance of the Kuttanad farming system, the Food and Agriculture Organization (FAO) has declared it a Globally Important Agricultural Heritage System (GIAHS).

Kainakary, a small village in Kuttanad, is surrounded by water bodies. Here the primary mode of transportation is by boat, which the Kerala State Water Transport Department runs. Vast paddy fields mainly cover the area. Coming to the social composition, the Kainakary region has a significant population of Hindu religion followed by Christians and Muslims.

My fieldwork in Kuttanad was done from October 2021 to March 2022. Before coming to the field, I interacted with local contacts to gain access to the communities and also to know the schedules of the participants to conduct the survey and interviews simultaneously. I was travelling in boats to reach each *padasekharam* (paddy folder) where they farm and live.

I collected information from people belonging to different religions, castes, communities, political parties, occupations, gender, and age groups of Kainakary village. At first, they were reluctant to respond or to start a conversation with me. So, to warm up and start the discussion, I told them about my work and what I was planning to do, then asked about what they were doing, and then they gradually started to respond. Participant observation was adopted during my fieldwork apart from the survey questionnaire. I observed their activities during the conversations and asked them their thoughts and views about various problems they were facing, which were linked to climate change, their occupation, drinking water shortage and what solution they were expecting for these

problems. The interviews were conducted mainly while the respondents were occupied in their daily activities in a way that would not interrupt their everyday life.

With its delicate and closed ecosystem, Kuttanad is facing devastating effects on its ecosystem due to climate change. Climate-induced Sea level rise, and flooding of rivers, unceasingly play havoc in its nature. The flip side is that the region has been getting flooded severely in the last four years. Due to continuous flooding in the area, people turning to agriculture reduced tremendously and started leaving it in search of jobs and better living conditions in cities and urban areas. But people who have depended on agriculture for generations continue their primary source of income even though they are under a huge debt burden under climate diversities because they don't know what to do apart from this. Women are working in the large paddy fields on daily wages, which largely affects their income source. The farmers here take up enormous loans for agriculture but are unable to repay the loan because of unexpected climate diversities.

Figure 3. 9: The vast paddy fields of Kainakary, Kuttanad

Figure 3. 10: Flocks of ducks in the fields Figure

The above pictures show the green paddy fields of Kainakary. On both sides of roads, you can see the paddy field either ready to be harvested or fields where flocks of ducks swimming. This is a majestic and eye-catching scenario where you can find a large area covered in green.

Group farming is very famous here. The farmers here get an agricultural loan through the Kisan Credit Card system (KCC), which is 25000 Indian rupees per acre at 4 % interest. But this is available only for those who own the land. The tenant farmers won't get this loan facility. Hence, one can see that land ownership determines access to government credit schemes, leaving the farmers who work on leased lands vulnerable economically and making it difficult to build resilience against disasters.

3.1.2.1. Varied impacts of climate change on local people

The climate crisis hits marginalized communities the most. The following is an exemplary story which concludes the same. This highlights socio-economic injustice and intersectional inequalities existing in the area. The continuous floods and human intervention have resulted in massive disruption of everyday life and livelihoods of people residing here and pose a threat to the years-old agricultural system, paddy fields, wetlands, canals, bunds, islets, inland waterways, and lagoons. Saltwater intrusion and silting rivers, estuaries and spillways endangered the delicate bio-saline ecosystem.

3.1.2.2. The Watery woes

Figure 3. 11: Picture of a house surrounded by floodwater

From the above picture, one can see the house surrounded by flood water which came inside, breaching the bunds. The image reveals how houses are surrounded by this flood water mixed with water from paddy fields ridden with pesticides, sewerage water discharged from houseboats and water from toilet pipes. With no other way out, people are forced to walk through these murky and contaminated waters, which confirm the presence of coliform bacteria. Participants lamented that walking through these waters is unavoidable, leading to multiple dermatological issues in people. Exposure to contaminated environments results in dermatological diseases after a flood (Brown & Murray, 2013; Kaffenberger et al., 2016; Huang et al., 2016; Dayrit et al., 2018).

3.1.2.3. The ghost villages


Figure 3. 12 and Figure 3. 13: Abandoned houses in Kainakary, Kuttanad

The pictures above are of abandoned houses, among many in the area. These abandoned houses, which were occupied once, tell the story of people who were forced to move out because they were not able to stay any longer there, and they moved because they had the means to do so compared to the other residents who are still staying inside the flooded houses. The local people also reported that in no time, this land of paddy fields would turn into a ghost village if this situation continued. Their homes are submerged in water almost all around the year. People cannot sell their land as the area is flooded continuously. No one will buy land here from them, and the price of land also dropped in this area as it is not suitable to live here and can't carry out agricultural activities. Hence people migrate to cities leaving everything behind. Those who don't have any means to migrate to cities or other areas are left behind. They are forced to continue living in the worst conditions during floods. The continuous disruption of water bodies in the name of development, which is not based on scientific and sustainable technology, is a kind of oppression of nature. Instead of showing control and power, only cooperation and mutual understanding can change the current situation here.

3.1.2.4. The agony

Figure 3. 14: An old couple staying in a temporary shelter

Figure 3. 15: Temporary shelter built on large pillars

An old couple residing there for generations, as one can see from the above picture, were very much concerned about the increased climate-related disaster in the region. They cannot move out of this place because they have no means. They are staying in the temporary shelter built by the

government, as shown in the right-side picture. At night snakes and poisonous insects come inside these temporary shelters, and they are afraid to sleep. They showed me how difficult it is to live in these unsafe conditions. Their house was completely damaged during the floods, and they cannot reconstruct it as they don't have enough money. They complained about not getting any compensation as their house was destroyed and raised the point that those with partially damaged houses were given aid for reconstruction and damage compensation. They were asking what the logic behind this action was. They were looking at me with many expectations, and while writing these, I still remember those eyes telling me the agony and frustration they were going through. They are people without any power or money. They don't know what to do or how to change their plight. This emphasizes how aspects of a person's social and political identities combine to generate different modes of discrimination and privilege.

3.2. Double burden of Women

The frequent and amplified natural disaster has increased the burden of marginalized sections in India, including women (Raman, 2020). Especially among women, the severity of climate change impacts differs based on their socio-economic position. Underprivileged women experience a disproportionate ferocity of climate-related disasters than privileged women (Rao & Raju, 2020). In the study area through, the structured questionnaire, which focuses on the male and female members from each household, showed that within the household, the roles of males and females are different. The workload of women will escalate in the coming days with frequent disasters. The climate-induced soil salinization intensifies the burden on women as they are expected to obtain drinking water for the household (Nayak & Luke, 2022). They carry water from public taps in boats for household needs and store it for one week. Women are held responsible for fetching water for household and drinking purposes based on customary gender roles.

Here, I ask: Who gets access to safe water? Who gets to live healthy lives? Who gets to have a future? Who matters? Who is safe from climate-related disasters? I claim that shortage of drinking water due to salinity, floods, and other developmental activities embodies one’s social norms and values, political systems, or ideology that are not generally considered in dealing with environmental issues (Di Baldassarre et al., 2019).

Women suffer more from skin-related diseases due to using contaminated water from surrounding water bodies for washing and cleaning, owing to their burden of household chores. During floods, the hours spent by women on cleaning debris and organizing household belongings is more compared to their male counterparts. Women do the cleaning work and take care of children, which is unpaid care work within the household. This signifies the societal identification of women as caretakers in a patriarchal society. Also, women are doing work outside on a daily wage basis to support their families financially. Very few women have ownership of the land where they are doing agriculture. The loan women obtain is not used for productive purposes, which will enable them to be financially stable. One of the respondents asked what the use of a loan is when this only increases their debt burden but not their financial stability. So, in this case, who decides to take up loans becomes crucial and for what purpose it is being used.

Figure 3. 16: Picture showing a woman resting on the large pillars created to prevent flooding from entering the houses and the roads covered in flood water

In the above picture, one can see a woman taking a rest between daily wage jobs. She was having food with her fellow members while discussing their problems. Some were from marginalized communities with less income, and some were from higher-income families compared with the rest. Women in the same area face different issues based on their socio-economic status, family relations, employment, education, and cultural differences. So basically, different women faces or experience environmental changes disproportionately. We should support these women, but then it is often not spelt out clearly what these requirements are, what capacity building really needs, what is implied by creating awareness, what brings about inclusion, and what even empowerment really requires. So, we have to cross-examine all of these.

3.3. Intersectional research on climate change-way forward

Move towards feminist theorizing - feminist theorizing helps us with resources about ethical and epistemological issues that are right at the centre of this interconnection of justice and global environmental crises. To address such environmental crises, we must also consider not just gender but other relevant factors, such as class, race, age, disability, and indigeneity. Intersectionality helps to understand how power emerges and interacts. “Intersectionality includes interaction between gender, race and other categories of difference in individual lives social practices, institutional arrangements, and cultural ideologies and outcomes of these interactions in terms of power” (Davis, 2008, p. 68).

The responsibility, vulnerability, and decision-making power of individuals about climate change can be assigned to social structures based on gender, socio-economic status, nationality, ethnicity, health, sexual orientation, age, and place. Also, adaptation strategies to climate change may emphasize or encounter these categorizations.

Tuana (2008, p.189), through the explanatory case of hurricane Katrina, shows how climate change is interrelated with power relations. As pointed out by Tuana, in the case of Kuttanad also, we can see that marginalized people are less likely to move out to live in another place. In Kuttanad, the people who are in lower economic and social strata are the ones who suffer most as they don't have the means to adapt to the continuous flood disaster. So, we should focus on their betterment of them while making policies. Including intersectionality in climate-related studies and research will also help social and political conditions for climate governance.

We must understand the emotions of people residing over there, their attachments, and their environment to realize their needs and what we can do collectively not to destroy further their ways of living in the name of development. The unscientific construction of roads and bridges, agricultural methods, tourism plans etc., we must look into all of these differently using a different and sustainable approach. For this, we need interdisciplinary methods.

3.4. Solution - The way out (based on participant observation and response from locals)

First and foremost, to solve any problem, the immediate thing to do is to work closely with the affected community, analyzing their needs and concerns.

We can only solve these environmental problems by working with different feminist groups, grassroots groups, activist groups, grassroots organizations, and local government bodies rather than controlling an implementation from above. So, it is important to have separate implementation bodies at the regional and local levels to address the specific needs of people, especially women and other disadvantaged sections of society based on their socio-economic backgrounds- the process should be inclusive. While forming policies, it is to be noted that it doesn't come from people for whom we are recommending. So, we should help them to increase their political awareness and encourage them to be part of decision making which will benefit them in turn. We should ensure there are enough members representing every section of society and women from all backgrounds in policy making. Hence the solution to environmental problems should come from collective decisions and mutual understanding, not from control and power.

In policy making, accountability is important. Only bringing accountability to the entire process of policy making, successful implementation, and evaluation of policy over time will lead to good results and some changes in society in a positive way. Only policy is not important. How we implement it, who benefits, and how efficient it is will make real changes in society, in the lives of women and in the lives of vulnerable people in times of irregular climate catastrophes. Always keeping in mind that we have limited time, but we have to act fast. As reminded by Haraway, we should keep in our mind that everything is a mess, and we have a little bit of time. For this, we must work together, coming out from the comfort of one’s discipline to solve the issue at hand.

Pozhuthana- Those depending on agriculture should be given loans with less interest or no interest based on their financial situation. The relief materials should be given to those who need them the most based on a priority basis.

Kuttanad- The flooding in the area can be prevented if illegal reclamation of the lake is prevented. Conserving Vembanad lake and, distilling leading water channels, deepening the catchment area of dams would prevent recurrent flooding in the region. The Kuttanad package, proposed by well-known agricultural scientist M. S. Swaminathan should be carried out efficiently to solve problems of flood and bund breaches.

Chapter 4

Gender Vulnerability in the Face of Climate Change: A Study of Wayanad and Alappuzha Districts of Kerala, India[3]

4.1. Introduction

This chapter explores gender vulnerability during the flood disaster in the selected field. In contrast, the previous chapter described the field area, the people living there and the issues they faced due to recurrent flooding.

Climate change has become a major concern in recent years across the globe. The frequency of weather-related extreme events like record high temperature variation and abnormal rainfall, among others is increasing rapidly. The fluctuations in rainfall uncertainty sometimes cause recurrent floods in the regions where such events were uncommon in the recent past. The research argues that climate change has enhanced the occurrence and strength of severe rainfall (Ali & Mishra, 2018; Goswami et al., 2006; Mukherjee et al., 2018; Papalexiou & Montanari, 2019; Wasko & Sharma, 2017) and flooding (Alfieri et al., 2017; Ali et al., 2019; Hirabayashi et al., 2013; Mirza, 2011). With unprecedented changes occurring in the global environment, extreme weather and climate events may occur with higher intensity and frequency in the near future. Such events will eventually lead to increased vulnerability of individuals, communities, and regions around the world. Especially in less developed regions and countries, the recovery period from these extreme climate events will be longer compared to the developed countries, which makes them less resilient to such events (Ebi & Bowen, 2016). Based on a climate model, by 2050 around 920 to 3400 million people worldwide will be exposed to an increased number of natural hazards owing to the greenhouse gas emission scenarios (Arnell & Lloyd-Hughes, 2014). It is also estimated that around 100 to 580 million people will be exposed to the highest rank of river flood risk by 2050 (GFDRR, 2014).

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Climate change-induced disasters over time have resulted in increased gender inequality, especially worsening the condition of women when they are not able to maintain their livelihood practices due to inadequate capital assets (Rahman, 2013). Although men and women are affected by climate change, there is a difference, and the impact will not be the same (Aguilar, 2010). The reactions to climate change can be different for both men and women due to their different roles in society (UNDP, 2011). Studies focusing on gender during climate change help to realize the impact of climate change on societies or communities (Villamor et al., 2013). This makes the studies related to gender analysis during disasters relevant, focusing on the issues faced by both men and women (Bhattarai et al., 2015). During disasters caused by climate change, the key focus should be given to gender and vulnerability (Naz & Saqib, 2021).

Based on the Global Climate Risk Index 2021, developed by the organization Germanwatch, India ranks 7 out of 10 in terms of the most affected countries in 2019 (Eckstein et al., 2021). India, one of the most disaster-prone countries in the world, has recorded the highest mortality and damages due to hydrological disasters ever since the 1990s (Patankar, 2019). As per the Central Water Commission (CWC) of India, during the period 1952 to 2018, floods in India resulted in the loss of over a hundred thousand lives and economic damage worth 4.69 trillion INR (Mahapatra, 2020). Around 14 per cent of the total land area of India falls under the category of flood-prone region (Gupta et al., 2003; Singh & Kumar, 2013). A large proportion of people in India are affected by floods and landslides during the monsoon season (Nanditha & Mishra, 2021; George et al., 2021). The vulnerable sections of society will be affected disproportionately by the direct and indirect impacts of flooding (Adelekan, 2010; Chatterjee, 2010; Jongman, 2018; Patankar, 2019; Winsemius et al., 2016). Analysis of vulnerability is needed to achieve successful disaster risk reduction (Proag, 2014).

Kerala, the southern state of India, witnessed devastating floods during the monsoon seasons of 2018 and 2019 (Vijaykumar et al., 2021). This 2019 flood is an example of how global warming has affected this region leading to intense rainfall, causing a greater threat to the vulnerable western ghats area. The scientific studies confirmed that this 2019 flood was an event of mesoscale cloudburst (MsCB) never reported before in Kerala, which usually occurs in northern parts of India. Such events due to global warming can recur in this southern state of India (Vijaykumar et al., 2021).

Against this background, this chapter's focus is to contribute to the literature on gender vulnerability in the face of extreme weather-related events, which remains an understudied area and more so in the Indian context. Using primary data collected based on a structured questionnaire for men and women focusing on the rural area of Wayanad and Alappuzha districts of Kerala, which faced floods recently, the study tried to understand gender vulnerability to the extreme weather event of floods and identify its associates.

4.2. Literature Review

During disasters, vulnerability and adaptive capacity will differ from person to person. This can be seen from the natural disaster risk theory by Blaikie et al. (1994) and feminist political ecology by Rocheleau et al. (1996). From these theories, it is evident that the level and type of vulnerability will be different for men and women and also among women (Nonoguchi, 2012).

Blaikie et al. (1994), in their Pressure and Release (PAR) model, emphasize how vulnerability is shaped by social, political, and economic factors for individuals and households. They emphasize vulnerability is the result of unequal distribution of power and resources among different groups of people. To supplement the PAR model, Blaikie et al. (1994) developed the Access model, which reveals how individuals can be released from risk over time as vulnerability changes. The Access model scrutinizes the circumstances in which vulnerability is created or lessened in the allocation of assets, income, and other resources in society through the social, economic, and political processes (Blaikie et al., 1994; Wisner et al., 2004). The intrahousehold gender politics results in discriminatory allocation of power and resources which escalates the sufferings of women and girls (Agarwal, 1989; Agarwal, 1990; Sen, 1990). Less access to resources by women (Blaikie et al., 1994) makes them vulnerable to disasters (Denton, 2000; Denton, 2002; Cannon, 2002; MacGregor, 2010; Nelson et al., 2002).

Rocheleau et al. (1996), through feminist political ecology, move towards analyzing environmental crises via gender differences in the ways human beings relate to the environment. Global economic, political, and environmental changes influenced men and women differently in resource use and allocation and in environment management (Rocheleau et al., 1996). This results from the fact that men and women relate differently to nature and the environment and not solely because of unequal political and economic structures. Gender, along with class, race and culture,

influences resource access (Agarwal, 1992; Rocheleau et al., 1996). Usually, women have customary resource use rights while men have legal ownership of resources (Agarwal, 2003; Rocheleau et al., 1996). Women were denied their customary access and control over land due to the patriarchal land reforms, which eventually marginalized them (Rocheleau et al., 1996; Nightingale, 2006). The green revolution greatly influenced and changed the gender division of labour as women remained in subsistence farming and men engaged in cash-crop farming (Boline et al., 1998; Mies & Shiva, 1993; Shiva, 1998).

Vulnerability as a concept is significant across disciplines and professions (Gillespie, 2008; Gillespie, 2010). The evolving theory of disaster vulnerability merges itself with other areas like environmental sustainability, terrorism, and social development along with the traditional methods of disaster mitigation, preparedness, mitigation, and response (Cutter, 2006). As per vulnerability theory, among nations and regions of the world, community vulnerability to disasters is not even (Zakour & Gillespie, 2013). Low-income people, less developed communities, very young and very old, women, and persons with disabilities and health problems comprise the vulnerable population, and they will be more vulnerable in times of disasters (Zakour & Gillespie, 2013).

A complete theory of vulnerability, the vulnerability plus theory results from the integration of vulnerability theory and resilience theory. Resilience theory is combined with Access and PAR model to integrate vulnerability and resiliency theory (Zakour & Swager, 2018). Resiliency theorists highlight population and individual outcomes, whereas vulnerability theorists highlight economic and structural variables (Norris et al., 2008). Resilience models concentrate on wellness supplements vulnerability theory (Zakour & Gillespie, 2013). Vulnerability plus theories can help in reducing the level of vulnerability and also encourages resilient recoveries (Zakour & Swager, 2018).

Disruptive and devastating disasters also have a gendered dimension to them. We can often see that during a disaster, women are more vulnerable, and this vulnerability comes from the disaster itself and also from the position of women in society (Gaag, 2013). Furthermore, disasters highlight the gender disparities existing in society (UNISDR, 2009). There is a difference between vulnerability and disaster risk, which has been pointed out by social scientists. The differential access to resources caused by economic, social, geographic, demographic, cultural, institutional,

governance and environmental factors causes vulnerability (Birkmann, 2006). Alternatively, disaster risk is formed by vulnerability and its relation with environmental factors called hazards (Cardona et al., 2012). In times of disaster, everyone in that particular region bears the negative consequences though all are not affected in the same way. Some groups will be more vulnerable to disasters due to social and economic inequalities existing in the particular region (Aptekar & Boore, 1990; Barnes et al., 2005; Andrew, 1997; Llorente-Marron et al., 2020). Due to the lack of gender-specific data related to the impact of natural disasters on gender was not so common earlier. Since the '90s, various studies have shown that disasters do not affect the entire population involved in the same way, and women are the most affected among the vulnerable section (Alston, 2014; Anderson, 2007; Bradshaw, 2014; Enarson, 1998). In accordance with a study conducted by World Bank, women become extremely vulnerable to disasters if they have inferior socio-economic status compared to men (WHO, 2002). Usually, women earn less than men and work in small, home-based businesses or informal sectors. In such situations, the loss of livelihood aggravates their situation (Eckstein & Kreft, 2014).

During flood caused by climate change, vulnerability and gender turn out to be an important issue that needs to be addressed. Vulnerability, as defined by UNISDR, is "the characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard" (UNISDR, 2009). Vulnerability often affects people's ability to cope with and recover from natural disasters (Blaikie et al.,1994; Fordham, 1999; Enarson, 2004; Singh et al., 2017). The adaptive capacity of men and women is determined by access to different capital assets and livelihood practices (Cutter, 1993; Denton, 2001; Enarson, 2004; Naz, 2019). This adds in gender as a component of vulnerability and adaptive capacity (Dankelman, 2002; Dankelman & Jansen, 2010).

The ability to adapt to climate change events like floods differs for men and women. Women with lesser access to resources than men are repeatedly forced by gender norms, leading to limited mobility or decision-making ability even though disaster impacts both men and women (CCC, 2009). This can have an impact on women's livelihood plans, food security and right to access food (CCC, 2009), particularly while considering the fact that women are more likely to be engaged in agricultural-related activities compared to men (Odame et al., 2002). Flooding, which directly worsens the socio-economic status in the local communities, is one of the main causes of

social crises. Women comes within the most vulnerable groups in disaster-prone areas (Hines, 2007; Dasgupta et al., 2010). Women are often victimized during a disaster in the particular aspect of vulnerability compared to men owing to conventional and work-related practices. Due to their inferior position in society, women often exhibit less power to face natural disasters (Duddy, 2002; Plan International, 2013).

Changes in adaptation to disaster and access to resources are always defined by class, religion, and gender (Enarson, 2004; Denton, 2001). For instance, gender-specific social norms and women's predetermined roles in society often affect women's capacity to adapt and make decisions during adverse climate change situations or disasters (Dankelman, 2002). Based on various studies, it is evident that household's plans to adapt to flood and other climate-related disasters are guided by institutional and socio-economic factors, i.e., age (Dadzie & Acquah, 2012; Saqib et al., 2016), education (Deressa et al., 2010; Rehima et al., 2010), land access (Naz et al., 2018), size of the household (Ullah et al., 2015) and credit obtained (Saqib et al., 2016; Ullah et al., 2015). If individuals have access to resources, this reduces their vulnerability (Davison, 1988; Corbett, 1989). An evaluation of vulnerability helps to distinguish the affected people's requirements and limitations. This makes the vulnerability analysis for gender crucial during floods caused by climate change.

4.3. Data and Methodology

The current study attempts to determine the vulnerability and its associates among gender affected by flood during 2019. The study was carried out in the Pozhuthana village of Wayanad district and Kainakary village in Kuttanad of Alappuzha district of Kerala, India. Wayanad- the hilly tropical district of Kerala is located in the margin of the Western Ghats, one of the world's eight most important biodiversity hotspots and a UNESCO world heritage site (Wayanad, 2022). The people here mainly depend on agriculture as farmers, planters, or labourers (Mathai, 2018), primarily paddy, plantations, and spices (Jose & Padmanabhan, 2015). From the field experience, I learned that the flood severely affected those who depend on agriculture and allied activities, especially women who work in homestead cultivation.

Kainakary village is in Kuttanad, which is famous for its enormous paddy fields with unique geographical characteristics. Here farming is done beneath 1.2 to 3.0 meters (4 to 10 ft) of sea

level and is the crucial rice producer in the state with the lowest altitude in India. The primary occupations in Kuttanad are farming and fishing though income from backwater tourism is also on the rise. It is fascinating to note that the farmers of the Kuttanad area, also well known as "The Rice Bowl of Kerala" (Kuttanad, 2022), are famous for Bio Saline Farming (BSF). BSF refers to agriculture carried out within varying salinity levels in groundwater, soils or a combination of both (Masters et al., 2007). Having understood the complexity and importance of the Kuttanad farming system, the Food and Agriculture Organization (FAO) has declared it a Globally Important Agricultural Heritage System (GIAHS).

Almost 49 villages in Wayanad and 55 villages in Alappuzha districts were severely affected during the 2019 floods (GoK, 2019), which was the worst hit as compared with other districts of the state (IANS, 2019). I selected Pozhuthana village in Wayanad district and Kainakary village of Kuttanad in Alappuzha purposively as almost every household in Pozhuthana and Kainakary village was affected in one way or another during the 2019 floods (GoK-Wayanad, 2019). In Pozhuthana village, the number of households is 1571. Following a 95% confidence interval and accepting around a 10% margin of error, the number of households needs to be 91. In Kainakary village, the number of households is 3932. Following a 95% confidence interval and accepting around a 10% margin of error, the number of households needs to be 94. To be exact, I have selected 124 households in Wayanad and 145 households in Alappuzha districts (242 males and 269 females) based on a random walk model (United Nations, 2005; Kumar & Pathak, 2022) due to time and resource constraints.

Many studies on disaster and vulnerability analysis have interviewed the head of the household to analyze the effects and adaptation related to disasters caused by climate change (Yila & Resurreccion, 2013; Yila & Resurreccion, 2014; Ullah et al., 2015; Saqib et al., 2016). This study makes a difference by interviewing husbands and wives separately, and such studies are very few. The socio-economic profile of the respondents can be seen in Table 4.1.

Table 4. 1: Socio-Economic Profile of the Respondents (% of the respondent)

S. No.	Indicator	Total
1	Education	
1. a	Illiterate	2.54
1. b	Class V pass	14.29
1. c	Class X pass	41.49

1. d	Class XII pass	24.66
1. e	Graduate and above	17.03
	Total	100.0
2	**Income (in rupees)**	
2. a	No income	1.74
2. b	Below 5000	16.13
2. c	5000 –10000	29.53
2. d	10000 – 25000	36.72
2. e	25000 – 50000	15.88
	Total	100.0
3	**Age (years)**	
3. a	18 – 30	8.02
3. b	31 – 40	35.23
3. c	41 – 50	25.05
3. d	51 – 60	19.18
3. e	Above 60	12.52
	Total	100.0
4	**Marital status**	
4. a	Single	5.09
4. b	Married	89.82
4. c	Widowed	5.09
	Total	100.0
5	**Gender**	
5. a	Male	47.36
5. b	Female	52.64
	Total	100.0

Source: Authors' computations using the field survey data

The resources available at household level influences livelihood practices adopted by individuals. In a society household is the basic unit where men and women contest and work together for resources (Agarwal, 1997; Doss et al., 2014). Household also plays a major role as it is within household gender is encountered, and it is the household which replicates power relations, values, gender relations, societal norms, and privilege in social, political, and economic framework (Ariyabandu, 2009; Naz, 2019). Various advantages and opportunities men and women obtain from household assets and social support are influenced by sociocultural norms and gender relations, and during natural disaster it is important how they bargain and control their use (Watson, 1994; Yila, 2013). Gender determined vulnerabilities are created by gender disparities which ultimately results from differences in access to household assets and sociocultural resources by men and women (Gaillard et al., 2017). This is evident in power disproportion, which exists in economic, political, social, and cultural spheres of the society (Wisner et al., 2014; Gaillard et al., 2017).

In times of disasters, even people with skills and abilities can't do anything to overcome the vulnerable situation they are in if they don't get access to resources like human and natural resources which will help them to adapt (Kabeer & Subrahmanian 1996; Wisner et al., 2014) and cope with these diverse situations. People with more access to such resources have more livelihood options available compared to others, and that makes them less vulnerable (Zurovec & Vedeld, 2019). I created the vulnerability index for respondents based on the modified household vulnerability index (HVI) framework of Tendayi (2011) used by Naz & Zaqib (2021). The vulnerability index consists of five dimensions: human capital, natural capital, physical capital, social capital, and financial capital, as shown in Table 4.2. The vulnerability index was created at the individual level by using the household level factor.

Based on the literature, I gave equal weights to the variables of the index (Naz & Saqib, 2021; Tendayi, 2011). The vulnerability index aggregates the scores of five dimensions of capital assets under study, and an aggregated score is assigned for each respondent. The indicators used for each dimension of capital assets are:

Human capital: Education is a significant human capital indicator which has a greater influence on the selection of livelihood practices (Xu et al., 2015). Skill can also be used to measure human capital indirectly (Paul, 2010; Naz & Saqib, 2021).

Natural Capital: Land, which is a natural resource, helps farmers to cope better during disasters. So, men and women with access to agriculture or homestead land have a better adaptive capacity (Xu et al., 2015).

Physical Capital: This dimension of capital assets includes basic infrastructure which can maintain the livelihood of people (DFID, 2000). This study used whether the respondents availed shelter, Entry of flood water and Land affected by the flood.

Financial Capital: This dimension includes productive assets like cash and savings, which gives financial independence (Paul, 2010; Naz & Saqib, 2021). Here I included land ownership, Possession of livestock, savings accounts, and ownership of vehicles.

Social Capital: This is a multi-level aspect and can calculate this depending on the purpose of one’s research (Paldam & Svendsen, 2000). This severe and frequent flood was not a recurrent

phenomenon in this particular area of the Wayanad and Alappuzha districts. Hence it is important to know whether they received the warning ahead of or relief materials during and after the flood, which could have significantly contributed to their vulnerability.

For the vulnerability index, I checked the internal consistency reliability using Cronbach's alpha, which is 0.67.

Table 4. 2: Five dimensions of capital assets used for creating vulnerability index

Human capital
1. Education
2. knows swimming
Physical capital
1. Availed shelter
2. Entry of flood water
3. Land affected by flood
Social capital
1. Relief material received
2. Warning received
Natural capital
1. Access to agricultural/homestead land
Financial capital
1. Land ownership
2. Possession of livestock
3. Have savings
4. Owns vehicle

Source: Household survey, 2021

The variables used in each dimension are based on Naz & Zaqib (2021), and some changes are made based on the data which can be seen in the appendix. The questions related to each dimension were assigned codes and added all the dimensions to create an index. The vulnerability index varies from 3 to 21. As the score in the vulnerability index increases, they become less vulnerable. The data were analyzed using Stata 13.

Table 4. 3: Variables used in creating vulnerability index (% of the respondent)

S. No.	Variables	Total
1	**Education**	
1. a	Illiterate	2.54
1. b	Class V pass	14.29
1. c	Class X pass	41.49
1. d	Class XII pass	24.66
1. e	Graduate and above	17.03
	Total	100.0
2	**Knows swimming**	
2. a	No	42.27
2. b	Yes	57.73
	Total	100.0
3	**Availed shelter**	
3. a	No	0.39
3. b	Yes	99.61
	Total	100.0
4	**Entry of flood water**	
4. a	Damage to house	23.58
4. b	Damage to house and agricultural/homestead land	76.42
	Total	100.0
5	**Land affected by flood**	
5. a	No land affected by flood	36.29
5. b	Less than 50%	6.71
5. c	80%	9.47
5. d	100%	47.53
	Total	100.0
6	**Relief material received**	
6. a	Nothing	12.13
6. b	Cash	85.13
6. c	Cash and relief materials	1.96
6. d	Cash, Relief materials and Temporary shelter	0.39
6. e	Cash, Relief materials and Permanent shelter	0.39
	Total	100.0
7	**Warning received**	
7. a	No	56.21
7. b	Yes	43.79
	Total	100.0
8	**Access to agricultural/homestead land**	
8. a	No	68.10
8. b	Yes	31.90
	Total	100.0
9	**Land ownership**	
9. a	No	82.58
9. b	Yes	17.42
	Total	100.00
10	**Possession of livestock**	
10. a	No	66.54
10. b	Yes	33.46

	Total	100.0
11	**Have savings**	
11. a	No	60.27
11. b	Yes	39.73
	Total	100.0
12	**Owns vehicle**	
12. a	No vehicle	37.38
12. b	Household has bicycle	11.55
12. c	Household has two-wheeler	39.53
12. d	Household has bicycle, boat and two-wheeler	1.37
12. e	HH has four-wheeler	0.78
12. f	Household has four-wheeler and two-wheeler	9.39
	Total	100.0

Source: Authors' computations using the field survey data

To find out the association between vulnerability with selected socio-economic indicators, three statistical tests have been used. To start with, used the chi-square test in order to establish a linear relationship. Here the study tests the null hypothesis (H_0); no association against the alternative (H_1) there exists an association. Secondly, to measure the level of association between variables are measured using Cramer's V, which varies between 0 to 1 and 1 indicates a strong association. Thirdly, Fisher's exact test is used when the number of cases in each cell is very few.

The study tried to find the determinants of respondents' vulnerability using multiple regression model. The set of explanatory variables are selected from flood and climate change vulnerability literature (Paul, 2010; Yila & Resurreccion, 2013; Naz, 2019; Naz & Saqib, 2021). The individual level explanatory variables are age, credit obtained, marital status, access to TV/internet, monthly income, and household level explanatory variables used are sex of the household head, type of family, received government assistance during a flood, religion, and caste. The study estimates the following equation:

$$
\begin{aligned}
&Vulnerability\ index \\
&\quad = \alpha + \beta_1 Age + \beta_2 Cedit\ obtained + \beta_3 Marital\ status \\
&\quad + \beta_4 Access\ to\ inetrnet + \beta_5 Sex\ of\ the\ household\ head \\
&\quad + \beta_6 Type\ of\ family + \beta_7 Recieved\ government\ assistance \\
&\quad + \beta_8 \ln(Monthly\ income) + \beta_9 Religion + \beta_{10} Gender + u
\end{aligned}
$$

Here the dependent variable is an index, the vulnerability index which is different for each respondent based on their access to capital assets. Multicollinearity and Heteroskedasticity are checked for this model.

4.4. Results

In the first part, the study discusses the result of the three statistical tests used to find the association between the vulnerability index and some chosen socio-economic factors. In the second part, the results of multiple regression model are given.

4.4.1. Association between vulnerability index and selected socio-economic indicators

Here in the first section, the vulnerability index aggregates the scores of five dimensions of capital assets under study and an aggregated score is assigned for each individual and the index is categorized into three groups. The vulnerability index varies from 3 to 21. Higher the score in the vulnerability index means they are less vulnerable. Each respondent is categorized then to either of the three groups, less vulnerable with aggregate score of 15 and above, medium vulnerable with aggregate score of 9 and 14 and highly vulnerable with aggregate score between 3 and 8.

To find out the association between the vulnerability index with selected socio-economic indicators, this study employed three statistical tests. Firstly, tried to find out the association between the age of the respondents and vulnerability. Here got significant results from the statistical tests, and from the Table 4.4, one can see that most of the respondents who are above the age 50 fall into a highly vulnerable group compared to others.

4.4.1.1. Association of vulnerability index with related factors (Individual characteristics)

Table 4. 4: Age of the respondents - Association with Related Factors

Vulnerability Index	**Age**			
Values	18-30	31-50	Above 50	Total
Low vulnerability	4.72%	66.04%	29.25%	106
Medium vulnerability	10.37%	67.04%	22.59%	270

High vulnerability	5.93%	42.22%	51.85%	135
Pearson chi2(2)	38.5285			
Pr	0.000			
Cramér's *V*	0.1942			
Pr (Fisher's exact)	0.000			
Source: Authors' calculations				

Next, assessed the association between credit obtained by respondents and their vulnerability. While employing the statistical test, found out that there is a significant association between vulnerability and availing credit, as shown in Table 4.5. This result signifies the importance of credit availability for individuals. When they have access to credit, they can cope with disaster as this helps them to create new income opportunities and subsequently reduces their vulnerability during the disaster. This is evident from the table, which shows that 81 per cent of the respondents who have not received any credit are highly vulnerable to disaster, while those who have access to credit are less vulnerable.

Table 4. 5: Credit - Association with Related Factors

Vulnerability Index	**Credit obtained**		
Values	No	Yes	Total
Low vulnerability	34.91%	65.09%	106
Medium vulnerability	57.78%	42.22%	270
High vulnerability	81.48%	18.52%	135
Pearson chi2(2)	53.9142		
Pr	0.000		
Cramér's *V*	0.3248		
Pr (Fisher's exact)	0.000		
Source: Authors' calculations			

Next, tried to find out the association between gender and vulnerability, which turned out to be insignificant, as shown in Table 4.6. Even though insignificant, the result shows that more female respondents belong to the highly vulnerable category than male respondents.

Table 4. 6: Gender - Association with Related Factors

Vulnerability Index	**Gender**		
Values	Male	Female	Total
Low vulnerability	52.83%	47.17%	106
Medium vulnerability	48.89%	51.11%	270
High vulnerability	40.00%	60.00%	135
Pearson chi2(2)	4.4588		
Pr	0.108		
Cramér's *V*	0.0934		
Pr (Fisher's exact)	0.107		
Source: Authors' calculations			

4.4.1.2. Association of vulnerability index with related factors (Household characteristics)

Here in the household level characteristics first tried to find out the association between vulnerability and the sex of the household head, which turned out to be significant. From Table 4.7, one can see that those in male-headed households are more vulnerable to disaster than those belonging to female-headed households.

Table 4. 7: Household head - Association with Related Factors

Vulnerability Index	**Household head**		
Values	Male	Female	Total
Low vulnerability	82.08%	17.92%	106
Medium vulnerability	80.74%	19.26%	270
High vulnerability	67.41%	32.59%	135

Pearson chi2(2)	10.7831
Pr	0.005
Cramér's *V*	0.1453
Pr (Fisher's exact)	0.006
Source: Authors' calculations	

Again, employing the statistical tests, checked the association between religion and vulnerability, showing significant results, as shown in Table 4.8. Here one can infer that individuals from the Hindu community are more vulnerable to disaster than those in Muslim and Christian community.

Table 4. 8: Religion - Association with Related Factors

Vulnerability Index	**Religion**			
Values	Hindu	Muslim	Christian	Total
Low vulnerability	42.45%	1.89%	55.66%	106
Medium vulnerability	52.96%	22.96%	24.07%	270
High vulnerability	76.30%	18.52%	5.19%	135
Pearson chi2(2)	92.6346			
Pr	0.000			
Cramér's *V*	0.3011			
Pr (Fisher's exact)	0.000			
Source: Authors' calculations				

Then tried to find out whether there is any association between vulnerability and government assistance they got during the flood, which turned out to be insignificant, as seen in Table 4.9. Here one can see that most individuals who are highly vulnerable to the disaster have received assistance from the government in terms of cash at the time of disaster after the damages have been assessed. In contrast, some are being left out without any assistance.

Table 4. 9: Received Govt. assistance - Association with Related Factors

Vulnerability Index	**Received government assistance**

Values	No	Yes	Total
Low vulnerability	11.32%	88.68%	106
Medium vulnerability	12.22%	87.78%	270
High vulnerability	11.11%	88.89%	135
Pearson chi2(2)	0.1301		
Pr	0.937		
Cramér's *V*	0.0160		
Pr (Fisher's exact)	0.949		
Source: Authors' calculations			

Next, tried to find out the association between place of residence and vulnerability, which turned out to be insignificant, as shown in Table 4.10. Even though insignificant, the result shows that respondents from Alappuzha belong to the highly vulnerable category compared to respondents in Wayanad.

Table 4. 10: Place of residence - Association with Related Factors

Vulnerability Index	**Place of residence**		
Values	Wayanad	Alappuzha	Total
Low vulnerability	49.06%	50.94%	106
Medium vulnerability	48.52%	51.48%	270
High vulnerability	38.52%	61.48%	135
Pearson chi2(2)	4.1303		
Pr	0.127		
Cramér's *V*	0.0899		
Pr (Fisher's exact)	0.125		
Source: Authors' calculations			

4.4.2. Socio-economic associates of vulnerability during flood

Table 4. 11: OLS Model Results

Variables		Regression Coefficients	p>|z|	95% CI
Age of the respondent		-.0256*	0.047	-.0508- -.0003
		(0. 012)		
Credit obtained	No[R]			
	Yes	1.7163***	0.000	1.095- 2.337
		(0. 316)		
Marital status	Single[R]			
	Married	.1539	0. 838	-1.321- 1.628
		(0. 750)		
	Widowed	.3405	0.691	-1.342-2.023
		(0. 856)		
Access to internet	No[R]			
	Yes	3.0342***	0.000	2.454- 3.615
		(0. 295)		
Sex of household head	Male[R]			
	Female	-.7229	0.152	-1.713- .2675
		(0. 504)		
Type of family	Nuclear[R]			
	Joint	.5680		
		(0. 403)	0.160	-.2243- 1.360
Religion	Hindu[R]			
	Muslim	-.9188*	0.015	-1.655- -.1828
		(0. 375)		

	Christian	1.8901***	0.000	1.198- 2.583
		(0. 352)		
Received government assistance	No[R]			
	Yes	1.3806***	0.001	.5759- 2.1854
		(0. 410)		
Income		.0833*	0.048	.0006- .1659
		(0. 042)		
Gender	Male[R]			
	Female	-.2007	0.564	-.8842-.4828
		(0. 348)		
District	Wayanad[R]			
	Alappuzha	-.3325	0.242	-.8899- .2248
		(0. 284)		
Constant		8.5798***	0.000	5.739-11.421
		(1.446)		
Observations		403		
R-squared		0.471		
Note: R-Reference Category; Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1				
Source: Authors' computations using the field survey data				

From Table 4.11, one can observe that the variables credit obtained, age of the respondent, access to the internet, religion, income, and government assistance are significant.

Credit obtained turned out to be an important factor which men and women's vulnerabilities as access to credit enables them to look for alternate income choices when their income source has been destroyed. In this aspect, the findings are in accordance with the many other studies related to vulnerability which indicates that as there are restrictions in taking up several income-generating

activities due to the unavailability of credit in developing countries, increasing vulnerability to natural calamities increases (Dankelman & Jansen, 2010; Naz & Saqib, 2021).

In the same way, those who have access to the internet also becomes less vulnerable, indicating their preparedness for disaster. When individuals have access to these information tools, they will get some prior information or warnings in times of disasters which will help them to be prepared.

We can see from the above results that as the age of the respondents increases, their vulnerability also increases. Also, those belonging to the Christian community seem to be less vulnerable. Individuals who got government assistance are also less vulnerable to flood disasters.

Also, with an increase in income, people become less vulnerable, given all other variables in the model are held constant. When individuals have income, they have the capacity or ability to cope with disaster. As indicated in studies, access to resources, especially income and credit, will help individuals to cope with climate change disasters (Davison, 1988; Corbett, 1989; Saqib et al., 2016; Ullah et al., 2015).

Then when it comes to gender, though the gender variable is insignificant, we can see that female respondents are more vulnerable to flood disasters than male respondents in the study area.

4.5. Conclusion and policy implications

In light of ongoing research on climate change and its gendered approach, this study brings into focus the important issue of gender vulnerability to extreme weather events. The chapter has attempted to identify the socio-economic associates of the vulnerability of men and women during the flood, which can also guide policy making in this area. This study tried to determine men's and women's vulnerability based on the index, which includes five capital asset dimensions. The chapter reveals that access to financial assets, government assistance and information tools helps people to be prepared to cope when a sudden disaster strikes. The lack of resources and inadequate access to information tools makes individuals vulnerable during a disaster. This highlights that efforts should be made to make people more aware of the financial products available and encourage their use by these individuals. Further, exclusive information campaigns targeting these

disaster-prone areas can reduce people's vulnerability to these events. The efforts to improve people's incomes in disaster-hit regions can also contribute.

Most respondents reported their income is from livestock and paid labour, and during floods, their income source has been severely affected due to the loss of livestock. Therefore, while analyzing vulnerability, we should also focus our attention on access to capital assets and resources available to enable them to cope with disaster.

The frequent climate-related disasters have increased the vulnerability of the people in the region. This necessitates the shift of focus from relief centric approach to an active and inclusive policy and action which covers prevention, mitigation, preparedness to response and recovery (GoK, 2019). The study shows that the availability of credit, income and proper access to disaster information can significantly impact mitigating vulnerability. Credit availability makes individuals less vulnerable during disasters (Dankelman & Jansen, 2010; Naz & Saqib, 2021) by creating new income opportunities. So, it is recommended that the local and state governments make a disaster risk reduction programme which includes both easy availability of credit and self-employment opportunities. The local governments should adequately monitor and assess such initiatives for effective implementation. There exists an inadequate information system and weak coordination between various institutions (GoK, 2019). Hence, in coordination with district and state-level authorities, the local government should strengthen disaster preparedness that includes weather forecasts, early warning, and information about relief camps to reduce disaster vulnerability.

Chapter 5

Coping strategies adopted by women and its determinants during a flood: Evidence from Alappuzha and Wayanad districts of Kerala, India

5.1. Introduction

The previous chapter delves into gender vulnerability and its associates, while this chapter focuses on women. Here the study measured women's empowerment and attempted to figure out the various coping strategies adopted by women based on their socio-economic determinants. Also, the study attempts to identify whether empowerment influences the coping strategy adopted by women.

Environmental challenges caused by climate change top the concerns of policy makers across the world. The major long-term progression of weather conditions causes climate change. Experts on climate change evolution forecasted various geological and meteorological events which will eventually lead to disastrous events like land movements, droughts, rising sea levels, erosion, heavy rain, and flooding (IPCC, 2014; Idier et al., 2013; Poumadere, 2014). Around the world, countries, governments, communities, and individuals are concerned and searching for remedies to deal with threatening results of climate change and disaster risks (Barros et al., 2014; Kuwornu, 2019; UNEP & UNDP, 2012; Tabe-Ojong et al., 2020).

The frequent natural disasters due to climate change and global warming affect the people living in the developing world. In today's world, the main concern is the environmental disasters related to varying meteorological conditions caused by global warming (CRED, 2017). Climate change vulnerabilities are extreme in South Asian countries (wester et al., 2019). In the region, climate change-induced rainfall and floods will frequently occur in the coming years (Nepal & Neupane, 2022). Globally, heavy destruction and economic damages are caused by floods which is one of the dominant and devastating natural disaster (Roy et al., 2021; Saha et al., 2021). The presence of several riverine terrenes, along with the geographic position and climate conditions, makes Asian countries more vulnerable to floods than the rest of the world (Thanh et al., 2020).

Flood magnitude and frequencies are rapidly increasing across the world, and India is no exception when it comes to frequent floods (Chowdhuri et al., 2020; Mallik et al., 2020). After Bangladesh, India tops the flood-hit countries in the world (Das et al., 2019). Most of the Indian population is affected by floods and landslides (Nanditha & Mishra, 2021; George et al., 2021). During the monsoon season of 2018 and 2019, the southern state of India Kerala experienced destructive floods, and the 2019 flood was proved scientifically to be the result of global warming. Also, this region is said to experience such climate changed induced floods frequently hereafter (Vijayakumar et al., 2021).

Though disasters affect everyone, the vulnerable and poor in underprivileged settings will be more affected as they will be depending mostly on agriculture and related activities for livelihood. The frequent climate change and extreme weather events drive people to poverty (Birkmann et al., 2013; Hallegatte et al., 2018; World Bank, 2013). Adaptive and active coping approaches are practical actions to recover livelihoods and reduce the negative impact of extreme weather events such as floods (Tabe-Ojong et al., 2020).

There is no research done so far to explore the coping strategy women use in these areas in response to floods and what factors determine these coping strategies. This will help policy makers to come up with real solutions focusing on the needs of the local women. Hence, this research is important as it provides information about how we can help the local women in the flood-affected area through support in proper coping mechanisms, thereby reducing their vulnerability caused by unforeseen climate emergencies like floods.

5.2. Literature Review

As per the hazard coping theory of Burton, Kates and White (1978), the people who suffer from disaster respond to disasters in a rational and ordered way based on hazards and their social and economic resources. Disaster response may differ for each society based on their stage of development which can act as a factor based on which the members of society respond to disasters (Laska, 1990). The coping actions adopted can be influenced by various levels of wealth, technological development, and social organizations (Burton et al., 1978).

The capacity to cope with disaster is an important aspect that influences individuals and communities' vulnerability during a disaster. The three factors of vulnerability include exposure, resilience, and resistance. These factors are formed by political and socio-economic arrangements and the ability of individuals and societies to adapt to disaster risks (Pelling, 1999; Few, 2003).

Coping and adaptation are used to define the plans adopted in reaction to extreme events. These terms are used interchangeably in literature (Jabeen et al., 2010; Yasmin & Ahmed, 2013). Then these terms were distinguished in which coping is an immediate and short-term measure implemented, whereas adaptation must include 'livelihood progression beyond reactive responses' (Shafie & Rahman, 2014). Sale of assets, borrowing from neighbours and family members, land mortgaging, temporary migration in search of jobs, and looking for alternative employment are some of the coping methods adopted (Islam et al., 2012; Yasmin & Ahmed, 2014; Morsheed, 2007; Nyakundi et al., 2010).

According to IPCC, "resilience is the capacity of social, economic and environmental systems to cope with hazardous events, trends or disturbances, responding or reorganizing in ways that maintain their essential functions, identity, and structure, while also maintaining the capacity for adaptation, learning and transformation" (Pachauri et al., 2014). Adaptation to climate change is also differentiated into two. One is the adaptation strategy which is a long-term strategy (Thomas et al., 2007), and the other is the coping strategy which comprises short-term household strategies aimed at lessening the impacts of floods (Thomas et al., 2007; DFID, 2008). Adaptive strategies can be proactive and reactive (De Bruin, 2011). In proactive adaptation strategy, there is the involvement of anticipation of climate change, whereas reactive adaptation strategies focus on the impacts of climate change after facing it (Shongwe et al., 2014). Reactive adaptation strategies are commonly used by societies in response to climate change (Bierbaum et al., 2013).

As per Blaikie et al. (1994), "Coping mechanism is a manner in which people act within the existing resources and ranges of expectations of a situation to achieve various ends". Thus, in times of flood, people try to adapt using available resources. Some of the factors which influence adaptive capacity are infrastructure, skills and knowledge and income diversification (Yusuf et al., 2021). Factors such as age, level of education, marital status and resource ownership determine the coping capacities of rural women (Dodge et al., 2014). Adaptation to climate change can be seen as the procedure through which individuals adjust to the negative impacts of climate change as one looks for better coping opportunities with varying circumstances, risks, and hazards.

Less adaptive capacity during extreme climate change events increases the vulnerability of people residing in developing countries (IPCC, 2007). Many disaster research has shown that the major victims of climate change can be women due to their status in society and ability to cope with disaster (Ahmed, 2010). Women have different skills to adapt to climate change as their employment is mainly in the agriculture sector, where we can see gender gap vulnerabilities and differences in access to resources and productivity (Huyer, 2016). Such disparities eventually increase the burden and negative effects on women affected by climate change (Jonsson, 2011; Adzawla et al., 2019). The gendered differences in access, use and control of natural resources, control over economic assets, physical mobility and decision-making power all have different impacts on men and women when it comes to their exposure to disasters and coping capacity to extreme weather events (FAO, 2011; ESCAP, 2017; Jerneck, 2018a; Jerneck, 2018b; UN Women & UNDP-UNEP PEI, 2018; Adzawla et al., 2019; Ampaire et al., 2020; Halle & Kellogg, 2020; CIFOR Climate Gender briefs, www.CIFOR.org/gender-climate). Thus, we can say that the more empowered women are they will have the more adaptive capacity (UNDP, 2016a; UNDP, 2016b). Hence it is important to analyze their coping and their socio-economic determinants in times of sudden and frequent flood disasters.

At present less research has been carried out on coping with flooding and the factors which influence the choice of coping in the selected areas, especially among women. For that reason, there is a need to explore and understand the coping strategy and its determinants among women. This study tries to determine whether women can cope better with flood disasters based on their level of empowerment.

5.3. Data and Methodology

The current study attempts to analyze how women cope with natural disasters based on their empowerment in the 2019 flood. I have selected 124 households in Wayanad and 145 households in Alappuzha districts as explained in chapter 4. The respondents' socio-economic profile can be seen in Table 5.1.

Table 5. 1: Socio-Economic Profile of the Respondents (% of the respondent)

S. No.	Indicator	Total
1	Education	
1.a	Illiterate	3.35
1.b	Class V pass	14.87
1.c	Class X pass	43.12
1.d	Class XII pass	24.91
1.e	Graduate and above	13.75
	Total	100.0
2	**Income (in rupees)**	
2.a	No income	38.29
2.b	Below 5000	19.33
2.c	5000 –10000	27.51
2.d	10000 – 25000	11.52
2.e	25000 – 50000	3.35
	Total	100.0
3	**Age (years)**	
3.a	18 – 30	10.04
3.b	31 – 40	34.94
3.c	41 – 50	23.79
3.d	51 – 60	19.33
3.e	Above 60	11.90
	Total	100.0
4	**Marital status**	
4.a	Single	5.20
4.b	Married	85.50
4.c	Widowed	9.29
	Total	100.0

Source: Authors' computations using the field survey data

There are many literatures available related to disaster vulnerability and adaptation triggered by climate change (Yila & Resurrction, 2013; Yila & Resurrection, 2014; Ullah et al., 2015; Saqib et al., 2016). This study considered three coping strategies used by women, which are obtained credit, government assistance and reduced food consumption (Yusuf et al., 2021). This study differs as the focus is on the women respondents in the flood-affected area by trying to find out what

determines the coping strategy used by these women and what the role of empowerment is in the coping method used by these women, whether empowered women cope better with disaster. For this, I constructed a composite women empowerment index that aggregates the scores of three indices: the decision-making index, mobility index and economic security index. The women empowerment index varies from 12 to 40. Lower the score in the women empowerment index means they are less empowered. The variables used in each sub-index are:

The Decision-making index includes who decides on Major Household purchases, Health related to the child, Health related to self, who makes decisions regarding selling or buying items for the family like jewellery, car, land, house, etc., Family planning, education of children, on choosing the clothes you wear. Then assigned number codes to the questions and added up all the questions to create an index ranging from 3 to 7.

Mobility index includes whether women are allowed to go to Friends'/relatives' houses, allowed to go to market, allowed to go to healthcare Centre/hospitals, allowed to go to NGO clinics/training centres, allowed to go to Cinema/fair, allowed to go to religious place-mosque/temple /church. Then assigned number codes to the questions and added up all the questions to create an index ranging from 0 to 12.

The economic security index includes whether women Owns Agricultural land, Livestock, House/shop, or Jewelleries. Then assigned number codes to the questions and added up all the questions to create an index ranging from 0 to 12.

To find out the association between different coping strategies with empowerment and selected socio-economic indicators, three statistical tests were employed: the chi-square test, Cramer's V and Fisher's exact test.

Then estimated logistic regression as the three outcome variables, obtained credit, Government assistance and reduced food consumption, are binary variables. Here the study tries to find out the association between the coping strategies adopted by women during floods and women's empowerment while controlling for other relevant socio-economic factors. The logistic model is represented as:

$$O_i = ln\frac{p_i}{1-p_i} = \beta_0 + \beta_1 Z_i$$

Where O represents log of odds ratio, p is the probability of occurrence of an event and Z_i represents the explanatory variables. The ratio $\frac{p_i}{1-p_i}$ represents the odds of a coping strategy selected. The explanatory variables used are age, religion, caste, political and general awareness, income of the respondent, sex of the household head, phone usage of the respondent, place of residence. The set of explanatory variables are selected from various flood, climate change and coping literature (Yusuf et al., 2021; Mekonnen, 2022; Mabuku et al., 2019; Brito et al., 2017; Castells-Quintana et al., 2018; Ncube et al., 2018; Chukwuone & Amaechina, 2021; Tabe-Ojong et al., 2020).

5.4. Results

The first section discusses the results of three statistical tests used to find the association between women's three coping strategies and some selected socio-economic indicators. In the first part of the analysis the women empowerment index is divided into low, medium, and highly empowered categories. Each woman is categorized then to either of the three groups based on the score of women empowerment index, less empowered women with aggregate score of 12 and 20, medium empowered women with aggregate score of 21 and 29 and women with high empowerment are those with aggregate score between 30 and 40. The second section discusses the results of logistic regression.

5.4.1. Association between coping strategy: credit obtained and selected socio-economic indicators

To determine the association between coping strategy credit obtained with selected socio-economic indicators, this study applied three statistical tests. To begin with, tried to find out the

Coping strategy: obtained credit	**Women empowerment**			
Values	Low	Medium	High	Total
No	15.86	68.97	15.17	145
Yes	0.81	43.55	55.65	124
Pearson chi2(2)	56.8890			
Pr	0.000			
Cramér's *V*	0.4599			
Pr (Fisher's exact)	0.000			
Source: Authors' calculations				

association between the empowerment of women respondents and access to credit. Here got significant results from the statistical tests and can infer from the Table 5.2 that women are likely to take up credit to cope with disaster impacts as empowerment increases. Credit availability enables these women to make purchases and to be involved in the decision making and also give them the access to productive assets. They eventually get the bargaining power within the household and in the society which plays an important role in reducing their vulnerability and coping strategies in times of disasters. Hence more empowered women seem to be taking up loans to reduce the negative impacts of floods.

Coping strategy: obtained credit	**Age**					
Values	18 -30	31-40	41-50	51-60	Above 60	Total
No	15.17	30.34	17.24 %	20.00 %	17.24 %	145
Yes	4.03 %	40.32%	31.45 %	18.55%	5.65 %	124
Pearson chi2(2)	23.4701					
Pr	0.000					
Cramér's *V*	0.2954					
Pr (Fisher's exact)	0.000					
Source: Authors' calculations						

Table 5. 2: Women empowerment - Association with Related Factors

Next, checked the association between credit availability and the age of the respondent. Here also, one can see a significant association between availing credit and the age of the respondent. Also, from the Table 5.3, one can see that women in the age group between 31-40 are taking loans compared to the other age groups. Most of the respondents were reporting their credit money is being used for productive uses as they bought livestock and started group farming with a small group.

Table 5. 3: Age of the respondents - Association with Related Factors

Again, employing the statistical tests, checked the association between religion and credit availing, which showed significant results, as shown in Table5.4. Here one can infer that women from the Hindu community are taking up loans, followed by Christian and Muslim women.

Table 5. 4: Religion - Association with Related Factors

Coping strategy: obtained credit	Religion			
Values	Hindu	Muslim	Christian	Total
No	56.55 %	23.45%	20.00 %	145
Yes	58.06 %	11.29 %	30.65%	124
Pearson chi2(2)	8.6047			
Pr	0.014			
Cramér's *V*	0.1789			
Pr (Fisher's exact)	0.014			
Source: Authors' calculations				

Next, employing the statistical tests, checked the association between caste and credit availing, which showed significant results, as shown in Table 5.5. Here one can see that more women from OBC and the general category take up credit compared to women from SC/ST category.

Table 5. 5: Caste - Association with Related Factors

Coping strategy: obtained credit	Caste			
Values	General	OBC	SC/ST	Total
No	28.97%	53.10%	17.93%	145
Yes	42.74%	48.39%	8.87%	124
Pearson chi2(2)	7.8728			
Pr	0.020			
Cramér's *V*	0.1711			
Pr (Fisher's exact)	0.020			
Source: Authors' calculations				

Then, tried to find out the association between credit availability and the sex of the household head, which turned out to be insignificant. Even if the result turned out to be insignificant, from the Table 5.6, one could see that women belonging to male-headed households are taking loans compared to female-headed households.

Table 5. 6: HH head - Association with Related Factors

Coping strategy: obtained credit	HH head		
Values	Male	Female	Total
No	72.41%	27.59 %	145

Yes	75.81%	24.19 %	124
Pearson chi2(2)	0.3996		
Pr	0.527		
Cramér's *V*	-0.0385		
Pr (Fisher's exact)	0.578		
Source: Authors' calculations			

Finally, tried to find out the association between credit availability and place of residence of the respondent, which turned out to be significant. Here it is evident that more women in Wayanad, compared to Alappuzha, take up loans to cope with disasters from Table 5.7. This can be linked with the empowerment level of women in both these districts. Compared to Alappuzha women in Wayand district were more empowered. This is important because empowerment level actually influences the credit taking behaviour of women and their intrahousehold decision making and bargaining power.

Table 5. 7: Place of residence - Association with Related Factors

Coping strategy: obtained credit	**Place of residence**		
Values	Wayanad	Alappuzha	Total
No	35.86%	64.14%	145
Yes	58.06%	41.94 %	124
Pearson chi2(2)	13.2603		
Pr	0.000		
Cramér's *V*	-0.2220		
Pr (Fisher's exact)	0.000		
Source: Authors' calculations			

5.4.2. Association between coping strategy: government assistance and selected socio-economic indicators

To determine the association between coping strategy government assistance with selected socio-economic indicators, this study applied three statistical tests. To begin, tried to find out the association between the empowerment of women respondents and government assistance. Here got significant results from the statistical tests. The Table 5.8 shows that women's empowerment plays an important role in getting government assistance during the flood. As women become

empowered, they will have the bargaining power and during diverse situations like disasters they will be able to react to these adversities and can negotiate for better opportunities.

Table 5. 8: Women empowerment - Association with Related Factors

Coping strategy: Government assistance	**Women empowerment**			
Values	Low	Medium	High	Total
No	9.38%	56.25%	34.38%	32
Yes	8.86%	57.38%	33.76%	237
Pearson chi2(2)	0.0179			
Pr	0.991			
Cramér's *V*	0.0082			
Pr (Fisher's exact)	1.000			
Source: Authors' calculations				

Next, checked the association between government assistance and the age of the respondent. Here one can see that the association is insignificant. But one can infer from the Table 5.9 that those who used government assistance as a coping strategy are women aged 31-40.

Table 5. 9: Age of the respondents - Association with Related Factors

Coping strategy: Government assistance	**Age**					
Values	18 -30	31-40	41-50	51-60	Above 60	Total
No	12.50%	37.50%	28.13%	12.50%	9.38%	32
Yes	9.70%	34.60%	23.21%	20.25%	12.24%	237
Pearson chi2(2)	1.6448					
Pr	0.801					
Cramér's *V*	0.0782					
Pr (Fisher's exact)	0.805					
Source: Authors' calculations						

Again, employing the statistical tests, checked the association between religion and credit availing, which showed significant results, as shown in Table 5.10. Here one can infer that woman from the Hindu community got government assistance, followed by Christian and Muslim women.

Table 5. 10: Religion - Association with Related Factors

Coping strategy: Government assistance	Religion			
Values	Hindu	Muslim	Christian	Total
No	43.75 %	15.63 %	40.63 %	32
Yes	59.07 %	18.14 %	22.78 %	237
Pearson chi2(2)	4.8590			
Pr	0.088			
Cramér's *V*	0.1344			
Pr (Fisher's exact)	0.095			
Source: Authors' calculations				

Next, employing the statistical tests, checked the association between caste and credit availing, which showed significant results, as shown in Table 5.11. The table shows that more women from OBC and the general category got government assistance compared to women from SC/ST category.

Table 5. 11: Caste - Association with Related Factors

Coping strategy: Government assistance	Caste			
Values	General	OBC	SC/ST	Total
No	50.00%	31.25%	18.75 %	32
Yes	33.33 %	53.59 %	13.08 %	237
Pearson chi2(2)	5.6384			
Pr	0.060			
Cramér's *V*	0.1448			
Pr (Fisher's exact)	0.053			
Source: Authors' calculations				

Then, tried to find out the association between credit availability and the sex of the household head, which turned out to be significant. Even if the result turned out to be significant, from the Table 5.12, one could see that women belonging to male-headed households got more government assistance compared to female-headed households.

Table 5. 12: HH head - Association with Related Factors

Coping strategy: Government assistance	HH head

Values	Male	Female	Total
No	75.00 %	25.00%	32
Yes	73.84 %	26.16 %	237
Pearson chi2(2)	0.0197		
Pr	0.888		
Cramér's *V*	0.0086		
Pr (Fisher's exact)	1.000		
Source: Authors' calculations			

Finally, tried to find out the association between government assistance and place of residence of the respondent, which turned out to be significant. It is evident that more women in Alappuzha, compared to Wayanad, got government assistance from the Table 5.13.

Table 5. 13: Place of residence - Association with Related Factors

Coping strategy: Government assistance	**Place of residence**		
Values	Wayanad	Alappuzha	Total
No	65.63%	34.38%	32
Yes	43.46%	56.54%	237
Pearson chi2(2)	5.5744		
Pr	0.018		
Cramér's *V*	0.1440		
Pr (Fisher's exact)	0.023		
Source: Authors' calculations			

5.4.3. Association between coping strategy: Reduced food consumption and selected socio-economic indicators

To determine the association between coping strategy reduced food consumption with selected socio-economic indicators, this study applied three statistical tests. To begin with, tried to find out the association between the empowerment of women respondents and a reduction in food consumption. Here got significant results from the statistical tests. Women with medium

empowerment seem to adopt reduced food consumption as a coping mechanism compared to others as shown in Table 5.14.

Table 5. 14: Women empowerment - Association with Related Factors

Coping strategy: Reduced food consumption	**Women empowerment**			
Values	Low	Medium	High	Total
No	7.81%	45.31%	46.88%	128
Yes	9.93%	68.09%	21.99%	141
Pearson chi2(2)	18.7005			
Pr	0.000			
Cramér's *V*	0.2637			
Pr (Fisher's exact)	0.000			
Source: Authors' calculations				

Next, checked the association between the reduction in food consumption and the age of the respondent. Here one can see that the association is insignificant. But from Table 5.15, it shows that as the age of women increases, they do not prefer reducing food consumption as a coping mechanism.

Table 5. 15: Age of the respondents - Association with Related Factors

Coping strategy: Reduced food consumption	**Age**					
Values	18 -30	31-40	41-50	51-60	Above 60	Total
No	10.16%	37.50%	26.56%	20.31%	5.47%	128
Yes	9.93%	32.62%	21.28%	18.44%	17.73%	141
Pearson chi2(2)	9.8493					
Pr	0.043					
Cramér's *V*	0.1913					
Pr (Fisher's exact)	0.038					
Source: Authors' calculations						

Again, employing the statistical tests, checked the association between religion and reduced food consumption, which showed significant results, as indicated in Table 5.16.

Table 5. 16: Religion - Association with Related Factors

Coping strategy: Reduced food consumption	**Religion**

Values	Hindu	Muslim	Christian	Total
No	44.53%	27.34%	28.13%	128
Yes	68.79%	9.22%	21.99%	141
Pearson chi2(2)	20.2652			
Pr	0.000			
Cramér's *V*	0.2745			
Pr (Fisher's exact)	0.000			
Source: Authors' calculations				

Next, employing the statistical tests, checked the association between caste and reduced food consumption, which showed insignificant results, as shown in Table 5.17.

Table 5. 17: Caste - Association with Related Factors

Coping strategy: Reduced food consumption	**Caste**			
Values	General	OBC	SC/ST	Total
No	34.38%	53.91%	11.72%	128
Yes	36.17%	48.23%	15.60%	141
Pearson chi2(2)	1.2220			
Pr	0.543			
Cramér's *V*	0.0674			
Pr (Fisher's exact)	0.541			
Source: Authors' computations using the field survey data				

Then, tried to find out the association between reduced food consumption and the sex of the household head, which turned out to be insignificant. Even if the result turned out to be significant, from the Table 5.18, one can see that women who were in male-headed households reduced their food consumption compared to female-headed households.

Table 5. 18: HH head - Association with Related Factors

Coping strategy: Reduced food consumption	**HH head**		
Values	Male	Female	Total
No	77.34%	22.66%	128
Yes	70.92%	29.08%	141
Pearson chi2(2)	1.4373		
Pr	0.231		

Cramér's *V*	0.0731
Pr (Fisher's exact)	0.266
Source: Authors' calculations	

Finally, tried to find out the association between reduced food consumption and place of residence of the respondent, which turned out to be significant. Here it is evident from Table 5.19, that more women in Alappuzha, compared to Wayanad, reduced their food consumption to cope with disaster.

Table 5. 19: Place of residence - Association with Related Factors

Coping strategy: Reduced food consumption	**Place of residence**		
Values	Wayanad	Alappuzha	Total
No	89.84%	10.16%	128
Yes	6.38%	93.62%	141
Pearson chi2(2)	188.0860		
Pr	0.000		
Cramér's *V*	0.8362		
Pr (Fisher's exact)	0.000		
Source: Authors' calculations			

5.4.4. Determinants of coping strategy adopted by women during flood

Table 5. 20: Logistic Model Results

Variables		Obtained credit			Government assistance			Reduced food consumption		
		Odds Ratio	p>|z|	95% CI	Odds Ratio	p>|z|	95% CI	Odds Ratio	p>|z|	95% CI
Women empowerment index		1.3683*** (0.093)	0.000	1.198- 1.563	1.0542 (0.080)	0.488	0.908- 1.224	.9950 (0.099)	0.960	0.818- 1.210
Age of the respondent		.9790 (0.015)	0.159	0.951- 1.008	1.0021 (0.020)	0.913	0.964- 1.042	1.0101 (0.024)	0.673	0.964- 1.059
Religion	Hindu[R]									
	Muslim	1.0031 (0. 564)	0.996	0.333- 3.021	1.3732 (1.128)	0.699	0.275- 6.866	.4049 (0.373)	0.326	0.067- 2.463
	Christian	.4819 (0. 214)	0.101	0.202- 1.152	.3670* (0.199)	0.065	0.126- 1.065	.4237 (0.301)	0.226	0.105- 1.704
Caste	General[R]									
	OBC	.9119 (0.410)	0.838	0.377- 2.203	2.1152 (1.333)	0.234	0.615- 7.273	1.2613 (0.941)	0.756	0.292- 5.445
	SC/ST	.4115 (0.263)	0.164	0.118- 1.437	.7586 (0.590)	0.722	0.165- 3.482	4.6921 (4.736)	0.126	0.649- 33.928
Sex of household head	Male[R]									
	Female	.8311 (0.318)	0.629	0.392- 1.760	.6827 (0.345)	0.450	0.253- 1.839	.8996 (0.511)	0.852	0.295- 2.739
Exposure to political/general awareness	Never or less often[R]									
	Everyday	1.8036 (0.729)	0.145	0.817- 3.983	1.8545 (1.045)	0.273	0.615- 5.595	1.7674 (1.188)	0.397	0.473- 6.598
Phone usage	Calling & texting[R]									

	Calling, texting, and browsing	.2865*** (0.133)	0.007	0.116-0. 710	.3554* (0. 192)	0.056	0.123- 1.027	.6342 (0.470)	0.539	0.148- 2.713
Income		1.1800*** (0.050)	0.000	1.087- 1.281	1.0707 (0. 063)	0.242	0.955- 1.201	.8778* (0.061)	0.062	0.766- 1.006
Place of residence	Wayanad[R]									
	Alappuzha	.5643 (0.205)	0.115	0.277- 1.149	4.0432*** (1.951)	0.004	1.570- 10.412	290.3399*** (201.306)	0.000	74.598- 1130.016
Constant		.0033*** (0.006)	0.002	0.000-0.120	1.9983 (4.364)	0.751	0.028-144.386	.0587 (0.164)	0.310	0.000- 13.995
Observations		262			262			262		
Pseudo R-squared		0.3290			0.1219			0.6553		

Note: R-Reference Category; Values are given in Odds ratio and Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Source: Authors' computations using the field survey data

Table 5.20 shows the odds ratio from the logistic regression. Women with high empowerment score had higher odds of obtaining credit as coping strategy compared to women with less empowerment score. Most respondents got credit through the self-help group bank linkage programme. Within the group priority is given to the most needed members while the risk is borne by everyone in that group. Also, women with internet access had less odds of obtaining credit as coping strategy compared to those who don't have access to internet. As women's income increases, they have higher odds of obtaining credit as a coping strategy.

Though insignificant, women with high empowerment score have high odds of getting government assistance which they use as coping strategy compared to women with less empowerment scores. Women belonging to Christian community has less odds of choosing government assistance as a coping strategy compared to women belonging to Hindu and Muslim community. Also, women with internet access had less odds of choosing government assistance as a coping strategy compared to those who don't have access to internet. Women in Alappuzha district has higher odds of choosing government assistance as a coping strategy compared to women in Wayanad district.

Though insignificant, women with higher empowerment score have less odds of adopting reduced food consumption a coping strategy compared to women with less empowerment scores. Also, women with higher income have less odds of adopting reduced food consumption a coping strategy compared to women with less income. Women in Alappuzha district has higher odds of adopting reduced food consumption a coping strategy compared to women in Wayanad district.

From the Table 5.20, it is evident that the main variable of interest, the women empowerment index and the other control variables, religion, phone usage, income, and village residing, are significant and influence how women cope with disaster by obtaining credit. There is a positive relationship between women's empowerment and obtaining credit which will help them to face the negative impacts of flood disasters. Even though not significant, one can see that women don't take loans to mitigate or cope with disaster impacts as they age.

In the same way, religion, phone usage and place of residence are significant and influence the coping strategy adopted by women when it comes to government assistance. Although insignificant, the women empowerment index score and getting government assistance are positively related.

Then we can see that income and place of residence are significant, influencing the adoption of coping strategy reduced food consumption. Hence it matters where women live when it comes to their coping strategy. Here though insignificant, we can see as the empowerment score increases, they don't prefer reduced food consumption as a coping strategy.

5.5. Conclusion and policy implications

This paper tried to examine the factors that determine women's choice of flood coping strategies to reduce the negative impacts of floods in the Wayanad and Alappuzha districts of Kerala, India. The three coping strategies, access to credit, government assistance and reduced food consumption, were influenced by several factors such as the level of empowerment, occupation, political and general awareness, religion, income, phone usage and place of residence. A binary association exists between the three coping strategies used and some selected independent variables. But they are insignificant in some cases after controlling, even if the direction is the same.

Women in the same area face different problems based on their socio-economic status, family relations, employment, education, and cultural differences. So basically, different women faces or experience environmental changes disproportionately. So, it is important to have separate implementation bodies at the regional and local levels to address the specific needs of women residing in this area. We can achieve this while working together with different feminist groups, grassroot groups, activist groups, grassroot organizations and individuals apart from merely consulting with women. We should support these women, but then it is often not spelt out clearly what all of these requires, what capacity building really needs, what is implied by creating awareness, what brings about inclusion, and what even empowerment really requires. So, we must cross-examine all of these while formulating policies for these women to address their vulnerability during the disaster to help them adapt to extreme climate events.

From various climate-related research, it is evident that credit availability will reduce vulnerability associated with disaster risk (Saqib et al., 2016; Ullah et al., 2015; George et al., 2022). Here in this analysis, we can see that as empowerment increases, women take up credit as a coping strategy. Thus, making empowered women less vulnerable to disaster impacts. More political and

general awareness, providing job opportunities, and increased income can be helpful in choosing different coping strategies by women in the flood-hit region.

Chapter 6

To Measure and Compare Women Empowerment in Alappuzha and Wayanad, Districts of Kerala and Indian States Using NFHS Data.

6.1. Introduction

In the previous chapter women's empowerment was measured based on the data from the field. This chapter will be comparing women empowerment in the selected two districts of Kerala and also the states of India.

Women empowerment is gaining importance in policy making and is given focus among countries recently to move towards gender equality. The inclusion of women empowerment in the World Development Report (WDR) of 2001 and the Millennium Development Goals (MDG), and the Sustainable Development Goals (SDG) itself shows the increasing importance of this topic in the policy making and development discussions. Women empowerment indicates that women are given equal opportunities in life, which will eventually help them be independent and free to express their opinions and have the capacity to make decisions regarding themselves. Empowerment can be defined as a process which converts power relations between individuals (Batliwala, 2007). Empowerment as a process helps women to attain knowledge and skill (Cornwall, 2016). It can also be noted that empowerment is both a process and an outcome.

Women empowerment implies women have equal earning opportunities, political participation and access to education and health (Duflo, 2012). Empowerment leads to stronger decision-making power for women (Batliwala, 2007; Kabeer, 2005) and also helps women to make decisions freely, which allows them to lead a better life by removing gender constraints (Agarwal, 2015; Gasper & van Staveren, 2003; Kabeer, 1999; Kabeer, 2016). Access to productive resources is a crucial determinant of empowerment which ultimately helps to improve the bargaining status of women in the household (Meier zu Selhausen, 2016) (Sell & Minot, 2018). As per the definition of United Nations, women empowerment has three concepts, and they are involvement in decision-making, access to productive resources and extended choices of individual women (UNFPA, 2005; Malhotra & Schuler, 2005; Basu & Koolwal, 2005).

Empowerment is obtaining the power to understand one's rights and also to carry out his/her responsibilities efficiently. Power cannot be transacted rather, it has to be obtained, make use of, sustained and maintained (Varghese, 2014). Empowerment is "the process of increasing the capacity of groups to make choices and to transform those choices into desired actions and outcomes" (Swain & Fan, 2009). There are various aspects of women's empowerment, like Domestic decision-making, Access to and control over resources, Freedom of movement, and Couple interaction (Malhotra, Schuler & Boender, 2002). Female autonomy within the household is indicated by the decision-making power of women compared to their husbands (Banerjee & Roy, 2015). Less gender biases in mortality and natality rates, access to education and professional training, employment opportunities, property ownership, and household decision-making improves women's empowerment. Providing access to education and employment improved women's empowerment significantly over time (Dreze & Sen, 1995).

6.2. Literature Review

The term women empowerment has been a research topic since the late 1980s. From several studies on women empowerment, one can see that age, gender, marital status, nationality, social role, economic activity, intra-household distribution, and health are some important factors which can affect empowerment (Sen, 1992; Sen, 2009; Kabeer, 1994; Trommlerová et al., 2015). Access to and control over resources can also be an important determinant of empowerment when they are able to utilize these resources for their own needs (Malhotra et al., 2002; Khan & Awan, 2011).

There have been numerous studies in various countries which deal with the determinants of women's empowerment. Mason (1998), in a study of five Asian countries, including India, found that social conditions have significant effects on women's empowerment. Ackerly (1995), in her study of Bangladesh and Acharya and Bennett (1983), in their study of Nepal, find that bringing women to the market influences domestic decision-making and empowers women. According to Banerjee & Roy (2015) autonomy of females is mainly related to social factors and income status. Beegle, Frankenberg & Thomas (2001) show that status influences decision-making power in Indonesia.

Similarly, if microcredit is available, domestic violence would be less common in Bangladesh (Hashemi, Schuler & Riley,1996). Malhotra & Mather (1997) find that work for pay and education

increases women's decision-making power in their study of Sri Lanka. According to Dyson & Moore (1983), kinship patterns have a significant impact on female autonomy. As per Allendorf (2007), "women who own land are significantly more likely to have the final say in household decisions".

Women's empowerment plays a crucial part in the development of a country. In every society, without considering the fulfilment of the needs of women, development cannot be achieved as women constitute half of the population. Development involves improving living conditions; this also implicates improved status for women in society. Providing them access to education is one initial step which can be taken in the direction of this path. Women's access to education has paved the way for their empowerment (Dominic & Jothi, 2012). Self-help groups (SHGs) shows an important role in the empowerment of women in Kerala (Kumar & Rakhin, 2016; Minimol & Makesh, 2012). Together with high educational attainment, social and cultural framework which make certain equality of women in all domains of life is also needed (Mitra & Singh, 2007).

Age, education, access to formal credit, household landholding, the participation in the SHG determines women's empowerment. Women empowerment leads to a reduction in domestic violence and better child education (Dutta, 2014). Women's economic contribution, their ability to make purchases, and their ownership of productive assets are determined by their access to credit. Women empowerment refers to freedom from domination by family, which includes the decision-making power regarding the use of their money, decisions regarding visiting their native home when they wish and freedom to put forward their opinion regarding the selling of jewellery and to opt outside work (Ginige et al., 2016). Access to education and training in skills which helps women to actively participate in economic activities gives them financial independence, eventually leading to their empowerment (Bushra & Wajiha, 2015). Educated and employed women have a greater influence on the financial decisions taken in the household, and also, they take part in decisions concerning societal issues (Malhotra & Mather, 1997). Women's empowerment is positively related to women's education, employment, asset ownership, household wealth, and usage of electronic media and husband education does not affect women's empowerment (Akram, 2017).

Women's control of loans from the Grameen Bank in Bangladesh influenced their empowerment and general household well-being. In cases where women had given their husbands complete

control of the loan, they remained dependent on their husbands' willingness to utilize their money for regular debt repayment. As a result, women were often forced to either substitute funds from their homestead activities or take out another loan from informal sources to pay their debts. At the household level, women who lost control over their money also lost control of the consumption/nutritional standards in their homes, with far-reaching implications for the children (Goetz & Sen Gupta, 1996).

The heart of empowerment is decision-making, whether at the micro or macro levels (Blumberg, 1995). To make decisions in the home about how to use resources, about the planting of crops, or how much to borrow or market produce is to exercise influence and independence; to decide to run for political office, how to exercise one's vote, or to join a political movement is also to exercise power and autonomy, and in fact, these processes are interconnected.

Decision-making may act as a proxy for bargaining power; other proxies include employment, income earning, and asset control. Women's bargaining power is positively associated with spending on food and health, among other categories (Doss, 2013). Studies from countries such as Brazil, 16 Guatemala, and Cote d'Ivoire have noted a positive association between mothers' income share and child nutrition (Engle, 1993; Haddad & Hoddinott, 1994; Thomas, 1990). The same applies to non-cash assets, as studies in several countries have observed that increasing women's assets increases the household budget allocation for food (Malapit et al., 2013). Similarly, in Nepal, control over both income and agricultural decisions is positively correlated with higher height-for-age z-score (HAZ) for children (Malapit et al., 2013). Women's decision-making is especially important in settings with limited resources: across Sub-Saharan Africa, Asia, and Latin America, women's decision-making is more strongly associated with child nutrition in poor households than wealthy households (Richards et al., 2013). However, even within the same country, women in some areas may have more liberty to move freely and carry out daily tasks than others (Sethuraman, Lansdown & Sullivan K, 2006). Freedom of movement can also facilitate social connections and group membership, and it has been theorized that maternal social support may influence childcare practices and, in turn, child nutrition (Engle, 1993). In addition, freedom of movement may be closely linked to women's bargaining and decision-making power, as it may provide women with greater exit options, changing their fallback position in the bargaining model (Gammage, Kabeer & Rodgers, 2016; Katz, 1997). Women with greater freedom of movement

may have a greater ability to acquire skills, for example, through participating in NGO programs and greater income-earning potential, which would improve their bargaining position (Agarwal, 1997).

Over the years, India has improved in a few gender-related indicators as an improvement in the ratio of female literacy and involvement of women in grass roots democracy. Still, we are yet to reach the level accomplished by developed and many developing countries. Given the opportunity and access to strategic resources, Indian women have proved they can do extremely well in all potential area. However, among Indian women, not everyone can enjoy the benefits of development. This improvement or higher empowerment is sometimes restricted to certain groups, sections, and regions while majority of women are excluded from this process (Interim Report of the Working Group on Empowerment of Women, May 2001). India is one of the world's largest populated countries in the World with diversified religions, ethnicity, languages, and cultures. This shows a need for different approach to achieve women empowerment which considers local realities and understandings (Ministry of Women and Child Development, 2001).

As a highly patriarchal society in India, women cannot take part in the decision-making process with men, where the subordinate status of women indicates a lack of empowerment (Osmani, 1998). Especially this can be seen in the case of rural women who don't have autonomy as they are not being paid while working in family farms, hence no financial independence, even though they have education (Sathar & Kazi, 2000). Rural women in India suffer from being both economically and socially invisible. Women should know that they also have the rights to equality, dignity, and justice as their male counterparts (Sahai, 1998). Being oppressed in all spheres of life, women need to be empowered (Sports and Women & Child Development, 1988). This can be made possible by creating groups for women and enhancing their collective strength. This will contribute to the long-term goals of gender equity and the empowerment of women (Levitt, 1990).

The principal objective of the chapter is to measure and compare women empowerment among women aged 15-49 years women in Alappuzha and Wayanad, districts of Kerala and India, using NFHS-4 data.

6.3. Data and Methodology

6.3.1. Source of Data

The cross-sectional data from National Family Health survey (NFHS-4) conducted during 2015-2016 is used for this analysis.

6.3.2. Construction of indices

6.3.2.1. Decision-making index (DMI)

The Decision-making index includes whether the person who decides how to spend respondents' earnings, on respondent's health care, on large HH purchases, what to do with the husband's earnings, on visits to family/relatives, decision maker for using contraception. Answers to each were coded as 2 if the woman alone or together with her husband decision and 1 if somebody other than the women respondent is the decision maker. This can be the husband or anyone from the family. For each women respondent, the scores were then added to get an aggregated score which ranged from 0 to 12.

6.3.2.2. Mobility index (MI)

The mobility index includes whether women are allowed to go to the market, allowed to go to the health facility, and allowed to go to places outside the village. The answers to the first three questions were coded from 0 to 2, where 0 indicates that the respondent can't go out on her own. Whereas 1 indicates that the respondent can go out if someone will accompany her and 2 indicates she can go out on her own. For each respondent, the scores were then added to get an aggregated score which ranged from 0 to 6.

6.3.2.3. Economic security index (ESI)

The economic security index includes whether women own a house alone or jointly, own land alone or jointly, and earn more than their husbands. Regarding asset ownership of land/house four options were given: respondent has no ownership, respondent owns jointly with husband, respondent owns property alone and together with husband, and finally respondents own house/land alone. The last two options were merged. Answers to all question were coded as 0 if they do not own anything, 1 if they own only jointly or own alone or alone and jointly. For the question related to earning more than the husband, it was coded 0 if the husband doesn't have

income, 1 if earns less, 2 if earns the same and 3 if earns more than the husband. For each respondent, the scores were then added to get an aggregated score which ranged from 0 to 10.

6.3.2.4. Women Empowerment Index (WEI)

We get the WEI by adding together the three indices- DMI, MI and ESI. For each respondent, the scores were then added to get an aggregated score which ranged from 3 to 9. Lower the score in the women empowerment index means they are less empowered. Each woman is categorized then to either of the three groups, less empowered women with aggregate score of 3 and 4, medium empowered women with aggregate score of 5 and 6 and women with high empowerment are those with aggregate score between 7 and 9.

6.4. Results

6.4.1. Evidence of women empowerment

Table 6. 1: Evidence of women empowerment in India

State	WEI			DMI			MI			ESSI		
	low	medium	high	low	medium	high	Low	medium	high	low	medium	high
Andhra Pradesh	85.20	5.81	8.99	87.49	3.48	9.03	85.93	3.86	10.21	89.26	7.46	3.28
Arunachal	84.39	6.21	9.40	88.15	2.91	8.94	83.25	4.73	12.02	89.78	8.58	1.65
Assam	85.81	7.18	7.01	88.43	2.77	8.80	84.64	6.05	9.30	94.01	5.35	0.64
Bihar	86.59	7.44	5.98	87.60	5.51	6.89	85.94	6.02	8.04	94.22	5.20	0.57
Chattisgarh	86.10	6.08	7.82	89.00	2.19	8.81	84.77	6.46	8.77	91.57	6.92	1.51
Goa	66.83	13.65	19.52	75.38	3.63	20.99	65.34	5.82	28.84	84.29	13.43	2.28
Gujarat	76.12	11.77	12.12	80.33	6.21	13.47	74.53	8.71	16.76	89.26	9.35	1.39
Haryana	86.85	7.05	6.11	88.58	3.87	7.55	85.70	6.00	8.30	95.10	4.36	0.54
Himachal Pradesh	72.37	10.65	16.98	78.20	4.88	16.92	71.20	3.16	25.63	91.11	7.94	0.95
Jharkhand	85.76	6.61	7.63	88.08	2.74	9.18	85.10	5.42	9.48	92.98	6.04	0.98
Karnataka	85.22	7.33	7.45	87.88	3.89	8.23	84.07	6.96	8.98	91.44	6.71	1.85
Kerala	81.86	9.27	8.87	84.13	3.68	12.19	78.99	13.33	7.68	90.64	7.27	2.08
Madhya Pradesh	86.39	7.05	6.55	88.41	3.27	8.31	85.52	6.69	7.79	93.50	5.64	0.86
Maharashtra	84.40	6.99	8.61	87.80	2.77	9.43	83.68	3.86	12.46	93.25	5.82	0.92
Manipur	87.22	5.71	7.07	90.45	1.58	7.97	85.15	5.89	8.96	92.91	5.65	1.44
Meghalaya	86.37	5.45	8.18	90.51	1.93	7.56	84.53	4.30	11.17	90.96	6.50	2.54
Mizoram	84.56	7.98	7.45	91.54	1.01	7.45	84.29	0.52	15.18	94.53	4.96	0.51
Nagaland	86.91	6.72	6.37	90.60	1.27	8.14	84.93	5.59	9.48	95.25	4.04	0.70
Odisha	85.70	7.74	6.57	88.71	3.27	8.01	84.46	9.05	6.48	91.01	7.54	1.45

Punjab	86.14	6.57	7.29	89.06	2.01	8.93	84.96	5.01	10.03	94.77	4.77	0.46
Rajasthan	86.24	7.34	6.42	88.36	3.50	8.14	84.84	6.57	8.59	94.93	4.60	0.48
Sikkim	83.02	6.74	10.24	88.81	1.14	10.05	82.76	0.67	16.57	93.53	5.30	1.16
Tamil Nadu	81.52	6.89	11.59	84.49	3.99	11.52	81.15	4.85	14.00	88.32	8.87	2.81
Tripura	81.59	6.64	11.77	85.09	2.40	12.51	80.60	6.07	13.33	88.38	8.72	2.91
Uttar Pradesh	87.34	7.21	5.44	89.49	3.50	7.01	85.86	6.46	7.68	94.92	4.61	0.48
Uttarakhand	85.90	6.24	7.86	89.47	2.21	8.31	85.18	2.72	12.11	94.59	4.83	0.58
West Bengal	85.20	5.86	8.94	87.58	2.53	9.89	84.81	3.15	12.04	93.95	5.14	0.91
Telangana	85.16	6.02	8.81	87.74	3.54	8.72	85.49	4.19	10.32	89.51	6.76	3.73
India	**84.94**	**7.22**	**7.84**	**87.48**	**3.56**	**8.96**	**84.01**	**5.86**	**10.13**	**92.69**	**6.07**	**1.24**

Source: Computed by author from NFHS 4 data

The NFHS-4 survey has collected information from all 28 states. There is a disparity across the regions of India in the proportions of women with high decision-making power, mobility, and economic security, which can be seen from the Table 6.1. The proportion of women with high decision-making at the national level is 8.96%. It ranges from 6.89% in Bihar to 20.99% in Goa. The high freedom of women's movement outside the home at the national level is 10.13%, ranging from 6.48% in Odisha to 28.84% in Goa. When it comes to economic security, numbers are very less. At the national level, it is only 1.24%. All states exhibit less economic security for women, and from the table, we can see high women empowerment ranges from 0.46% in Punjab to 3.73% in Telangana.

Table 6. 2: Evidence of women empowerment in Kerala

District	**WEI**			**DMI**			**MI**			**ESSI**		
	Low	medium	high	low	medium	high	Low	medium	high	low	medium	high
Kasargodu	81.81	11.10	7.09	83.99	5.98	10.03	77.55	13.75	8.70	92.32	6.45	1.22
Kannur	80.07	10.88	9.05	82.44	3.21	14.34	77.15	14.51	8.35	92.17	6.73	1.11
Wayanad	77.52	11.15	11.33	82.30	4.56	13.14	75.36	12.94	11.70	87.07	10.09	2.84
Kozhikode	83.84	9.37	6.79	85.90	2.55	11.55	80.46	13.13	6.42	94.08	4.81	1.11
Malappuram	83.15	11.88	4.97	83.69	6.60	9.71	80.33	14.86	4.81	95.25	4.25	0.51
Palakkad	78.86	12.43	8.71	81.68	4.67	13.65	75.44	17.54	7.02	89.34	8.08	2.58
Thrissur	83.49	8.02	8.49	85.01	3.13	11.85	79.95	12.85	7.20	92.01	6.22	1.77
Ernakulam	85.87	6.08	8.05	87.92	2.48	9.60	82.64	10.32	7.04	91.77	5.41	2.82
Idukki	84.28	8.32	7.41	85.73	2.94	11.33	81.21	12.76	6.02	92.08	6.35	1.57
Kottayam	80.34	7.72	11.94	82.95	3.04	14.02	77.53	12.53	9.95	87.43	9.56	3.01
Alappuzha	80.31	9.36	10.33	83.61	2.45	13.94	77.37	13.75	8.88	89.36	8.34	2.30
Pathanamthitta	82.01	7.08	10.91	84.90	2.75	12.35	80.03	10.17	9.80	87.36	8.90	3.74
Kollam	79.67	7.87	12.45	82.40	2.52	15.07	77.84	12.17	9.99	87.18	9.89	2.93
Thiruvanathapuram	81.15	7.60	11.24	84.38	3.44	12.18	79.45	12.31	8.24	85.80	11.01	3.19
Kerala	**81.86**	**9.27**	**8.87**	**84.13**	**3.68**	**12.19**	**78.99**	**13.33**	**7.68**	**90.64**	**7.27**	**2.08**

Source: Computed by author from NFHS 4 data

Table 6.2 shows that the high women empowerment proportion in Kerala ranges from 4.97% in Malappuram to 12.45% in Kollam. Wayanad shows high empowerment of women compared to women in Alappuzha. Even though Wayanad shows high mobility for women compared to Alappuzha, in terms of high decision-making power and economic security, there is not much difference.

6.5. Conclusion

This chapter tries to measure and compare women empowerment in Alappuzha and Wayanad, districts of Kerala and Indian states, using NFHS data. From the women empowerment index created and all other indices, one can see that the south shows better results than the rest of India. While comparing the two districts of interest in Kerala, one can see that even though the same Wayanad shows better performance than Alappuzha.

This result from NFHS 4 regarding Wayanad and Alappuzha districts of Kerala have an implication to the result got from chapter 5. In chapter 5, shows women in Wayanad district is more empowered compared to the women in Alappuzha district. Those women who used credit as a coping strategy are women with high empowerment scores. Also, one can see that women in Wayanad district adopted availing credit as a coping strategy than those in Alappuzha district. Based on flood related literature it has been observed that taking up loans can be a major coping mechanism adopted during floods (Yusuf et al., 2021). This signifies the importance of empowerment of women especially during frequent climate change induced disasters. This calls for policy actions focusing on the needs of women in this area which can improve their level of empowerment, ultimately reducing their vulnerability and aiding coping mechanisms adopted by them.

Women Empowerment is not merely a slogan but a prerequisite for an optimal capacity for the overall development of a family, society, nation, and a sustainable world.

Chapter 7

Conclusion

What might it mean to "know well"?

"Knowing well is a matter both of moral-political and of epistemic concern." (Code 1991, 72)

We must also account for not knowing, for our lack of knowledge about phenomena

Climate change poses a great threat in recent times. The climate change-induced disaster risks (CCIDR) are faced by nations across the world (Chan, 2018; Dodson et al., 2020), which leads to unequal impacts on ecosystems, humankind, societies, nations and economies (Pörtner, 2021; Whyte, 2021). Unstable weather conditions like heavy rainfall, floods, cyclones, droughts, and sea level rise lead to chaos (Perkins-Kirkpatrick et al., 2022; Stott, 2016). During floods caused by climate change, vulnerability and gender turn out to be important issues that need to be addressed. Vulnerability often affects people's ability to cope with and recover from natural disasters (Blaikie et al.,1994; Fordham, 1999; Enarson, 2004; Singh et al., 2017). The adaptive capacity of men and women is determined by access to different capital assets and livelihood practices (Cuter, 1993; Denton, 2001; Enarson, 2004; Naz, 2019). This adds in gender as a component of vulnerability and adaptive capacity (Dankelman, 2002; Dankelman & Jansen, 2010). The gendered differences in access, use and control of natural resources, control over economic assets, physical mobility and decision-making power all have different impacts on men and women when it comes to their exposure to disasters and coping capacity to extreme weather events (FAO, 2011; ESCAP, 2017; Jerneck, 2018a; Jerneck, 2018b; UN Women & UNDP-UNEP PEI, 2018; Adzawla et al., 2019; Ampaire et al., 2020; Halle & Kellogg, 2020).

7.1. Summary and main conclusions

Through this thesis, I first tried to understand the determinants of natural disaster in an international context, including India. Then moved towards the Kerala flood in 2019, where the focus was on gender vulnerability during the floods. Then tried to find out the determinants of coping mechanisms adopted by women in the study area.

The first chapter gives a glimpse of what this thesis is all about. Here the importance and motivation of the thesis are explained, which introduces the readers to the basic idea regarding the difference between hazard and disaster, why climate change is an important concern in today's world, who gets affected most by these frequent climate-related disasters and why this study is important, especially in the Indian context.

The second chapter explores the determinants of the impact of natural disasters in India and SAARC countries. India is becoming more vulnerable to disaster every year because of its high population and increasing urbanization (UNDRR & CRED, 2019). So, using panel data analysis, it is important to discover the determinants of the impact of natural disasters in SAARC countries and India using disaster data from the EM-DAT database between 1969 to 2018. This study tries to uncover how variable like GDP, population density, urban population, education, and gross capital formation influences disaster impacts in these countries using the EM-DAT.

From the analysis, it shows that population density and disaster impacts are positively related, i.e., if population density increases, disaster impact will also increase. This mostly happens in urban areas where people live close by. Also, there is a positive relationship between urban population and disaster damage. Over the year, disaster death and damages are increasing owing to the growing population and expansion of cities. We can see these similar kinds of relations of variables like urban population, population density and education on the impact of natural disasters in the study conducted by (Cuaresma, 2009; Songwathana, 2018; Kellenberg & Mobarak, 2008; Kim, 2010; Okon, 2018; Padlia, Habibullahb & Baharomc, 2018). According to this study, some economic variables that can affect disaster fatalities are education, urban population, and population density. As indicated by the study increased urban population where people live nearby during a disaster due to high population density, the disaster impacts will also be higher.

The third chapter is about the physical and social field, where I described the field focusing on participant observation. This gives a clear picture of the need for climate-related research in the field area and explains the field experiences.

The fourth chapter assesses the gendered effect of natural disasters in Kerala based on vulnerability. Climate change has become a major concern in recent years across the globe. The frequency of weather-related extreme events like record high-temperature variation and abnormal rainfall, among others, is increasing rapidly. The fluctuations in rainfall uncertainty sometimes

cause recurrent floods in the regions where such events were uncommon in the recent past. Climate change-induced disasters over time have resulted in increased gender inequality, especially worsening the condition of women when they are not able to maintain their livelihood practices due to inadequate capital assets (Rahman, 2013). Disruptive and devastating disasters also have a gendered dimension to them. In times of disaster, everyone in that particular region bears the negative consequences though all are not affected in the same way. Some groups will be more vulnerable to disasters due to social and economic inequalities in the particular region (Aptekar & Boore, 1990; Barnes et al., 2005; Andrew, 1997; Llorente-Marron et al., 2020).

This chapter tried to determine men's and women's vulnerability based on the index, which includes five capital asset dimensions. Access to financial assets, government assistance and information tools help people to be prepared to cope when a sudden disaster strikes. The lack of resources and inadequate access to information tools makes individuals vulnerable during a disaster. This highlights that efforts should be made to make people more aware of the financial products available and encourage their use by these individuals. Further, exclusive information campaigns targeting these disaster-prone areas can reduce people's vulnerability to these events. The efforts to improve people's incomes in disaster-hit regions can also contribute.

The frequent climate-related disasters have increased the vulnerability of the people in the region. This necessitates the shift of focus from relief centric approach to an active and inclusive policy and action which covers prevention, mitigation, preparedness to response and recovery (GoK, 2019). It is evident that the availability of credit, income and proper access to disaster information can significantly impact mitigating vulnerability. Credit availability makes individuals less vulnerable during disasters (Dankelman & Jansen, 2010; Naz & Saqib, 2021) by creating new income opportunities. So, it is recommended that the local and state governments make a disaster risk reduction programme which includes both easy availabilities of credit and self-employment opportunities. The local governments should properly monitor and assess such initiatives for their effective implementation. There exists an inadequate information system and weak coordination between various institutions (GoK, 2019). Hence the local government, in coordination with district and state-level authorities, should take action to strengthen disaster preparedness that includes weather forecasts, early warning and information about relief camps to reduce disaster vulnerability.

The fifth chapter measures women's empowerment in selected Wayanad and Alappuzha districts of Kerala and sees whether empowered women cope better with disaster. The capacity to cope with disaster is an important aspect which influences the vulnerability of individuals and communities during a disaster. The three factors of vulnerability include exposure, resilience, and resistance. These factors are formed by political and socio-economic arrangements and the ability of individuals and societies to adapt to disaster risks (Pelling, 1999; Few, 2003).

Less adaptive capacity during extreme climate change events increases the vulnerability of people residing in developing countries (IPCC, 2007). Many disaster research has shown that the major victims of climate change can be women due to their status in society and ability to cope with disaster (Ahmed, 2010). Women have different skills to adapt to climate change as their employment is primarily in the agriculture sector, where gender gap vulnerabilities and differences in access to resources and productivity are evident (Huyer, 2016). Such disparities eventually increase the burden and negative effects on women affected by climate change (Jonsson, 2011; Adzawla et al., 2019).

This is particularly true if we see the trouble the environment is currently facing - to borrow an expression dear to the visionary philosopher Donna Haraway (Haraway, 2016) - having huge consequences on present generations of humans, especially women. Despite women's full engagement in both the productive and care economies, women may find themselves in time hunger and poverty. They are most of the time, unpaid caregivers, lacking access to decision-making processes, social protection services, and essential resources to pursue decent living standards, including food, land, credit, information, and technological inputs (De Schutter, 2017).

The primary purpose is to examine which factors determine women's choice of flood coping strategies to reduce the negative impacts of floods in the Wayanad and Alappuzha districts of Kerala, India. The three coping strategies, access to credit, government assistance and reduced food consumption, were influenced by several factors such as the level of empowerment, occupation, political and general awareness, religion, income, phone usage and place of residence. A binary association exists between the three coping strategies used and some selected independent variables. But after controlling, even if the direction is the same, they are not significant in some cases. Women in the same area face different problems based on their socio-economic status, family relations, employment, education, and cultural differences. So basically, different women

face or experience environmental changes disproportionately. So, it is important to have separate implementation bodies at the regional and local levels to address the specific needs of women residing in this area. We can achieve this while working together with different feminist groups, grassroot groups, activist groups, grassroot organizations and individuals apart from merely consulting with women. From various climate-related research, it is evident that credit availability will reduce vulnerability associated with disaster risk (Saqib et al., 2016; Ullah et al., 2015; George et al., 2022). Here in this analysis, one can see that as empowerment increases, women take up credit as a coping strategy. Thus, making empowered women less vulnerable to disaster impacts. More political and general awareness, providing job opportunities, and Increased income can help choose different coping strategy by women in flood-hit regions.

The sixth chapter compares the level of women empowerment in Alappuzha and Wayanad, districts of Kerala and Indian states, using NFHS data. The chapter's main objective is to measure and compare women empowerment among women aged 15-49 years in the Alappuzha and Wayanad districts of Kerala and India using NFHS-4 data. Over the years, India has improved in a few gender-related indicators as an improvement in the ratio of female literacy and involvement of women in grass roots democracy. Still, we are yet to reach the level accomplished by developed and many developing countries. Given the opportunity and access to strategic resources, Indian women have proved they can do extremely well in all potential area. However, among Indian women, not everyone can enjoy the benefits of development. This improvement or higher empowerment is sometimes restricted to certain groups, sections, and regions while majority of women are excluded from this process (Interim Report of the Working Group on Empowerment of Women, May 2001). India is one of the world’s largest populated countries in the World with diversified religions, ethnicity, languages, and cultures. This shows a need for different approach to achieve women empowerment which considers local realities and understandings (Ministry of Women and Child Development, 2001).

From the women empowerment index created and all other indices, one can see that the south shows better results than the rest of India. When we compare the two districts of interest in Kerala, we can see that even though the same Wayanad shows better performance than Alappuzha.

7.2. Contributions

This thesis aims to add to the existing literature on climate change, vulnerability and coping strategies adopted by women during flood disasters in the Indian context. Through the study, many policy implications can be drawn, which will be helpful when climate-related disaster becomes a recurring event.

The first objective examined the factors which determine the impact of natural disasters and how these variables intensify or lessen disaster impacts if they are significant enough to influence the disaster impacts in any way. As the SAARC countries and India house large human populations and are developing economically, the study of the factors associated with disaster-induced damages is essential for policy formulation for disaster management. India and SAARC countries are almost similar as they are the fastest-growing economies in terms of GDP growth, with growing savings and doubling gross capital formation over the years. These countries have HDI values ranging from 0.4 to 0.7. This thesis analyzed how variables like GDP, Gross capital formation, urban population, education, and population density affect the impact of natural disasters in these countries. Hence, focusing on this region and India is important to disaster-related literature. This thesis contributes to the existing literature as there have not been many studies done in this regard with respect to India.

The second objective is to contribute to the existing literature on gender vulnerability in the face of extreme weather-related events, which remains an understudied area and more so in the Indian context. Using primary data collected based on a structured questionnaire for men and women focusing on the rural area of Wayanad and Alappuzha districts of Kerala, which faced floods recently, this study tried to understand gender vulnerability to the extreme weather event of floods and identify its associates.

In light of ongoing research on climate change and its gendered approach, this study brings into focus the important issue of gender vulnerability to extreme weather events. The thesis tried to identify the socio-economic associates of the vulnerability of men and women during the flood, which can also guide policy making in this area. The differential access to resources caused by economic, social, geographic, demographic, cultural, institutional, governance and environmental factors causes vulnerability (Birkmann, 2006). Alternatively, disaster risk is formed by

vulnerability and its relation with environmental factors called hazards (Cardona et al., 2012). In times of disaster, everyone in that particular region bears the negative consequences though all are not affected in the same way. Some groups will be more vulnerable to disasters due to social and economic inequalities in the particular region (Aptekar & Boore, 1990; Barnes et al., 2005; Andrew, 1997; Llorente-Marron et al., 2020). So, this thesis brings out the vulnerability faced based on access to resources available to the individuals, which will help in policy making and also, this is an important contribution to literature on vulnerability associated with the flood disaster in the Indian context where such studies are gaining importance due to the recurring climate-related disasters in the region.

Through the third objective, the thesis looks into coping strategies adopted by women in the face of flood disasters and their determinants. The main determinant is empowerment. Here the thesis is trying to examine whether empowerment has anything to do with their coping during disaster events. At present less research has been carried out on coping with flooding and the factors which influence the choice of coping in India, especially in Kerala, among women. Therefore, this thesis exploring this aspect contributes to the existing research as there is a need to explore and understand the coping strategy and its determinants among women. This study tries to find out whether women can cope better with flood disasters based on their level of empowerment. Less adaptive capacity during extreme climate change events increases the vulnerability of people residing in developing countries (IPCC, 2007). Various disaster research has shown that the major victims of climate change can be women due to their status in society and ability to cope with disaster (Ahmed, 2010). Women have different skills to adapt to climate change as their employment is primarily in the agriculture sector, where gender gap vulnerabilities and differences in access to resources and productivity is evident (Huyer, 2016). Such disparities eventually increase the burden and negative effects on women affected by climate change (Jonsson, 2011; Adzawla et al., 2019).

This will help policy makers to come up with real solutions focusing on the needs of the local women. Therefore, this research is significant as it provides information about how we can help the local women in the flood-affected area through support in proper coping mechanisms, thereby reducing their vulnerability caused by unforeseen climate emergencies like floods.

7.3. Research Limitations

The thesis has a limitation which is grounded on the data source. While analyzing the SAARC countries and Indian states, the study did not include every SAARC country or Indian state as some data were unavailable. EM-DAT is the data source used for the analysis, which has limitations. The information on the EM-DAT database is based on different resources, including non-governmental organizations, insurance companies, press releases, UN agencies and research institutes. The indirect cost of disasters is not included. Also, the poor from developing countries will not have any insurance or access to formal markets, thus making it difficult to obtain their information during natural disasters (Tol & Leek, 1999).

The primary survey-based analysis also had its limitations. There are some limitations in the study due to the presence of recall errors, and in some cases, the respondents were unwilling to reveal information. Another limitation is that one can't generalize this study's findings as this study is limited to a particular area and different societies have different social settings that influence vulnerability and coping strategies during a disaster.

7.4. Scope for future research

This thesis first tried to find out the determinants of natural disasters in India and similar countries. Then in the selected field areas where floods are becoming a recurring event due to climate change, analyzed gender vulnerability which gave a clear idea that access to resources can act as or will, in a way, reduce the vulnerability of the affected people, which will in a way help them to cope with the climate disasters. Also, the coping strategies adopted by women were analyzed.

The study identified the problems faced by the local community caused by the frequent flood disaster caused by climate change in the field area. Though the study stated the issues and recommended the possible policy recommendations, a solution-based approach is needed to understand the problems better and move toward a more solution-oriented approach. The study on climate change and gender analysis is complex and needs to be addressed in an interdisciplinary and intersectional approach. We are facing a great threat due to Anthropogenic activities combined with climate change which needs to be addressed urgently. To better understand and figure out

possible solutions, interdisciplinary studies are essential. The approach should be different, where the resources from all the disciplines should be combined.

Therefore, further research can focus on other natural events, as this research has focused only on flood disasters. Also, the research can be extended by analyzing the vulnerability of people in different states of India to flood disasters, which was impossible due to time and resource constraints.

Also, a more focused analysis prioritizing the intersectional power relations during disasters can assist in understanding the situation of the community in the disaster-hit areas and their coping and adaptation strategies in a better way.

"We have a little bit of time to change everything"- Donna Haraway

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Appendix

Questionnaire for Data Collection

INFORMED CONSENT

Research Title: Issues related to natural disasters and effect of the same across gender and coping behaviour of empowered women

Researcher: Bincy George

I am a PhD scholar from BITS Pilani Hyderabad Campus, and I am in the process of conducting my PhD research. As part of the research, I have chosen a topic that explores the effect of natural disaster on gender and coping behaviour of empowered women. The information gathered through this survey will help me understand the effect of natural disaster on gender and how they are able to cope with such a situation especially the empowered women. The interview may take around 30 minutes to complete. Please feel free to ask me any questions regarding the survey. Your identity will be kept confidential and will not be shared with anyone, apart from my supervisors. Your participation in the survey is voluntary. If I ask you any question you don't want to answer, just let me know and I will go on to the next question or you can stop the interview at any time.

If you have any questions regarding this study, please feel free to contact me through phone or email- Ph: 8547567024.bincyg2@gmail.com

Thank you

Bincy George

Research Scholar (2018PHXF0019H)

Department of Economics &Finance

BITS-Pilani, Hyderabad Campus

I have no objection to participate in this survey. I have understood the broad objectives of the research and am willing to participate in the study

Date:

Name and Signature of the respondent:

Table A. 1: Questionnaire for data collection

PART I: Questionnaire for Household			
	Name		
1.	No. of household members	a)1 b)2 c)3 d)4 e)5 f)6 g) More than 6	
2.	No. of female members in the household	a)1 b)2 c)3 d)4 e) Above 4	
3.	Category of house	a) Own house b) Rented house	
4.	Monthly income of the household (Rs.)	a) Less than 5000 b) 5000-10000 c) 10000-25000 d) 25000-50000 e) Above 50000	
5.	Household assets (Tick)	a) Toilet b) Television c) Refrigerator d) AC e) Air-cooler f) Microwave oven	g) Landline telephone h) Mobile Phone i) LPG Connection j) Two-wheeler (bike or scooter k) Four-wheeler (car) l) Bicycle	m) Computer (Desktop) n) Laptop o) Study Table p) Sewing machine q) Washing Machine
6.	If household owns any of the livestock	a) Cows b) Goats c) Poultry (chicken, duck etc.) d) Pigs e) Others, specify	
7.	Type of family	a) Nuclear b) Joint	
8.	Religion	a) Hindu b) Muslim c) Christian d) Others, specify	
9.	No. of children in the household	a)0 b) 1 c) 2 d) 3 e) 4 f) 5 e) More than 5	
10.	Were your children safe during the disaster		a) Yes b) No
	If no, what happened		
11.	Whether children were sent to live with relatives		a) Yes b) No
	If yes, for how long?	1-week b) 2 weeks c) More than 2 weeks	
12.	Disaster in anyway affected the health of children		a) Yes b) No
	If yes, were they given medical assistance on time		a) Yes b) No
	If yes, how much was the hospital expense		
13.	Did all your children get vaccinated?		a) Yes b) No
14.	Do the children go to school?		a) Yes b) No
	If yes, which type of school		a) Public b)Private
15.	The drop in household income in anyway affected the education of children		a) Yes b) No
	If yes, how much income allocated to education reduced		
16.	Whether children know swimming		a) Yes b) No
17.	Were there any pregnant women in your household during the flood		a) Yes b) No

	If yes, does the disaster changed her food/nutritional intake		a) Yes b) No
	If yes how much did it reduce?	a) Less than 10% b)10-20% c) 20-30% d) 30-40% e) 40-50% f) More than 50%	
18.	Did she get medical assistance from time to time?		a) Yes b) No
19.	How high did the water get around the house	a) Less than 0.5-meter b) 0.5-1m c) Greater than 1 meter	
20.	Flood water duration	a) Less than 1-day b) 1–2 days c) 3–4 days d) 5–6 days	
21.	Is house in a flood prone area		a) Yes b) No
22.	Damage caused due to flood	a) House(complete/partial) d) Food stock h) Household items b) Land/crop e) Vehicle i) Others, specify c) Kitchen items g) Livestock	

	Damage to house	Number of days required to reconstruct the house	Total expense for house reconstruction (Rs.)
	a) No damage b) Slight damage c) Moderate damage d) Extensivedamage e) Complete damage	a) 3 days/less than 3 days b) 1 week c) 2weeks d) 1 month e) More than 1 month	a) Less than 5000 b) 5000-100000 c) 10000-20000 d) More than 20000

b)	Damage to land/crop	a) Less than 10% b) 10-20% c) 20-30% d) 30-40% e) 40-50% f) More than 50%	
	Whether crop is grown after the flood		a) Yes b) No
d)	Loss of Food stock	a) Less than 10% b) 10-20% c) 20-30% d) 30-40% e) 40-50% f) More than 50%	
c)	Loss of Kitchen items	a) Less than 10% b) 10-20% c) 20-30% d) 30-40% e) 40-50% f) More than 50%	
d)	Loss of Household items	a) Less than 10% b) 10-20% c) 20-30% d) 30-40% e) 40-50% f) More than 50%	
e)	Loss of livestock	a) Less than 10% b) 10-20% c) 20-30% d) 30-40% e) 40-50% f) More than 50%	
f)	Loss of vehicle		

23.	What is your household's main source of drinking water throughout the year?	a) Pipe borne water untreated e) Rain water b) Bore hole/hand pump f) River, lake, pond c) Covered well g) Truck, vendor d) Uncovered well h) Other (Specify)
24.	After flood what was your main source of drinking water?	a) Pipe borne water untreated e) Rain water b) Bore hole/hand pump f) River, lake, pond c) Covered well g) Truck, vendor d) Uncovered well h) Other (Specify)

25.	Whether the water was clean after flood?		a) Yes b) No
	If no, what was done and how met the water needs?		

26.	Impact of flood on the economic situation of the household?	a) No effect b) Moderate c) High d) Severe effect
27.	Total land holdings of the family (cents/acres)	
28.	Total cultivable land available with the family (cents/acres)	
29.	Total non-cultivable land available with the family (cents/acres)	
30.	Land of family affected by flood	a) 100% b) 80% c) less than 50% d) Nil
	How did the household react to the flood?	a) Sale of livestock b) Sale of grain stock/agricultural produce c) Sale of other property d) Sent children to live with relatives e) Took away children from school f) Engaged with other revenue-generating activities g) Borrowed money from family, friends, employer, etc. h) Took a loan from a financial institution i) Received assistance from the family and friends, (how much) j) Received assistance from NGO or the government, (how much) k) Reduced food consumption p) Other, specify l) Reduced non-food consumption m) Emigration of family members to work n) Resorted to household savings o) Didn't do anything

a)	Sale of livestock			
	No. of livestock owned before disaster	How many livestock you had after flood	How many was sold to meet the expenses	How much you earned by selling livestock
b)	Sale of grain stock/agricultural produce			
	What Agricultural produce you had		How much you earned by selling	
c)	Sale of other property			
	Which property was sold		How much you earned by selling	
	Who would you say has main decision-making control over [livestock, agricultural produce, property] after flood (e.g., whether to sell, to trade or to give away)?		a) Wife e) Self and other household member(s) b) Husband f) Husband and another household member c) Wife and husband together g) Other, specify d) Another household member	
d)	Engaged with other revenue-generating activities			
	What activities were undertaken	How much did you earn	Are you still continuing this work	

			a) Yes b) No
e)	Borrowed money from family, friends, employer, etc.		
	How much you borrowed	From whom did you borrowed	Amount	What was the frequency of borrowing
				a)1 b) 2 c) 3 d) more than 3
f)	Took a loan from a financial institution		
	Type and Source of loan	Amount of loan taken	Interest rate	Duration of repayment
g)	Reduced Food consumption of household		
	Percentage of total expenditure spend on food before flood	Percentage of total expenditure spend on food after flood	
h)	Reduced monthly expenditure on non-food consumption on cloth, foot ware, fuel, rent, education, healthcare, durables of household		
	Percentage of total expenditure of household spend on non-food before flood	Percentage of total expenditure of household spend on non-food after flood	
	How saved due to the reduction in non-food expenditure		
i)	Emigration of family members to work		
	Where to	Was there any significant difference in family earning	If yes, how much additional income was generated
		a) Yes b) No	
j)	Resorted to household savings		
	What kind of saving did you had	How much you had as saving	How much saving used
31.	Was your household discriminated in distribution of relief	a) Yes b) No Cash (y/n) Temporary shelters(y/n) Relief materials(y/n) Permanent shelters(y/n) Others, specify	
	If yes, who was responsible for your discrimination	a) Community c) Govt. b) Political party's influence d) Others, specify	
32.	Decision-making done in the family during the time of flood	a) Head of the family b)Father c) Mother d) By all	
PART II: To assess the gendered effect of natural disaster in Kerala (to both men and women)			

1.	Gender	Educational level	Relation to the head of the household	Marital status	Age & age group of the respondent in years	Job category	Main occupation
	a) Male b) Female c)Transgender d)Others	a) Illiterate b) Class V pass c) Class X pass d) Class XII pass e) Graduate and above	a) Head b) Wife c) Child d)Grandchild e) Niece/nephew f) Father/mother g) Sister/brother h) Uncle/aunt i)Son/daughter in law j) Other, Specify	a) Single b) married c)widowed d)separated e) divorced	a) 18-30 b) 30-40 c) 40-50 d) 50-60 e) 60 & Above	a) Permanent b) Casual c)Unemployed	a) Agriculture b) Poultry farming c) Fisheries d) Daily wage e) Industrial worker f) Services g) Business h) Others, specify

2.	If employed, Monthly income (Rs.)	a) Below 5000 b)5000-10000 c)100000-250000 d)250000-50000 e) Above 500000										
3.	Were there any significant changes in pre- and post-disaster income immediately after 2019 floods	a) Yes b) No										
	If yes, how much reduced	a) Less than 10% b)10-20% c) 20-30% d) 30-40% e) 40-50% f) More than 50%										
4.	Whether income restored to pre-flood period	a) Yes b) No										
5.	How much percentage you contribute to the total household income? (now)											
6.	Do you know how to swim	a) Yes b) No										
	If yes, are you confident of saving others also?	a) Yes b) No										
7.	Do you know how to climb trees?	a) Yes b) No										
8.	Did you use any of these techniques during the flood? (swimming, climbing trees)	a) Yes b) No										
9.	Did you face any other problem/losses due to flood?	a) Yes b) No										
	If yes, specify											
10.	Food consumption {everyday (1); 2 to 4 times per week (2); once per week (3); 2 to 3 times per month (4); once a month or less (5); never (6)}											
	Consumption of	Before disaster						After disaster				
		1	2	3	4	5	6	1	2	3	4	5	6

	Cereals (wheat, maize, rice, barley, oats, etc)													
	Potato or sweet potato													
	Eggs													
	Meat													
	Fish & seafood													
	Pulses or beans													
	Green leafy vegetables													
	Other vegetables													
	Fruits													
	Seeds/Nuts													
	Dairy products (fresh Milk, curd, butter)													

11.	monthly expenditure on non-food consumption (on cloth, foot ware, healthcare, durables etc.)			
	Before disaster		After disaster	
12.	Household activities done by the respondent	a) Cleaning/washing b) Cooking c) Child/Elderly care d) Maintenance of properties		
	Household activities	Time spent before flood	Household activities	Time spent after flood
	Cleaning/washing		Cleaning/washing	
	Cooking		Cooking	
	Child care/Elderly care		Child care/Elderly care	
	Maintenance of properties		Maintenance of properties	
13.	Were you involved in any of these activities		a) Clear debris b) Organize remaining belongings	
	If yes, Time spent on Clearing debris		Time spent on Organize remaining belongings	
	Do you have access to these information tools	a) Radio b) Television c) Telephones		
14.	Did the information provided by these sources helped you in anyway to be prepared from the flood			a) Yes b) No
	If yes, how?			
15.	Where do you go for treatment	a) Govt./Municipal Hospital b) Private Hospital/Clinic c) At Home d) Elsewhere		
16.	Frequency of visiting hospital in a year	a) Once b) Twice c) Thrice d) More than 3		
17.	Money spent on health care before disaster(yearly in Rs.	Money spent on health care after disaster (yearly in Rs.)		

18.	Do you have health insurance coverage	a) Yes b) No - Govt/private(tick)
19.	Were you aware regarding diseases like Malaria, Diarrhoea and Hepatitis C during the flood	a) Yes b) No
20.	Whether Medical Services available during the time of flood	a) Yes b) No
21.	Source of Medical Service during flood	a) Medical sub centre b)PHC c)Private clinics d)Hospital/dispensary
22.	Were you exposed to any diseases after flood	a) Yes b) No
	If yes, which disease	a) Malaria c) Hepatitis C e) Fever g) Fracture i) Others, specify b) Diarrhoea d) Cholera f) Skin diseases h) Traumatic situation
23.	Were you moved to shelter camps	a) Yes b) No
24.	Was there separate place for male and female	a) Yes b) No
	If yes, was that safe for women in terms of security	a) Yes b) No
25.	Were the camps provided were hygienic	a) Yes b) No
26.	Were you provided with clean drinking water	a) Yes b) No
27.	Were you able to get the food supply provided by the govt.	a) Yes b) No
	If yes, was it sufficient?	a) Yes b) No
	Whether any extra care given to the needs of pregnant and breast-feeding women in terms of food?	a) Yes b) No
28.	Whether there was sufficient space in shelter camps	a) Yes b) No
29.	For how many periods you were in shelter camps	1-week b) 1-2 weeks c) 2-3 weeks d) More than 3 weeks
30.	Capacity to adapt If extreme flooding were to become more frequent, how likely is it that your household could change its source of income and/or livelihood, if needed?	4-point scale: (1) Extremely likely; (2) Very likely; (3) Not very likely;(4) Not at all likely.

PART III: Questionnaire for women

1.	Property owned [1-belongs to respondent, 2- belongs to husband, 3-both,4- others]	a) No property d) House/shop b) Agricultural land e) Jewelleries c) Livestock(quantity) f) Others, specify
2.	Do you have bank account	a) Yes b) No
	If yes, type of account	a) Individual b) with husband c) Joint with others, specify,
3.	How often do you save in your account	a) Daily b) Weekly c) Monthly d) Never
4.	How much do you save monthly (Rs.)	a) Below 500 b) 500-1000 c) 1000-1500 d) 1500-2000 e) Above 2000

5.	Were you confident enough to look for alternative income sources when income reduced due to flood								a) Yes b) No	
6.	During loss of employment due to flood was there any alternative income source for you								a) Yes b) No	
7.	Have you ever borrowed after the disaster								a) Yes b) No	
8.	If yes, Source of loan	a)SHG b)Nationalised bank c)Scheduled bank d)Money lenders e)Cooperative bank e)Others, Specify								
9.	No. of loan	Loan amount (Rs.)	Purpose(tick)							
			Income generative				Non-Income Generative			
			Agriculture	Livestock	Trades	Business	Education	Medical	Housing	Marriage
10.	How much borrowed amount was spent on income generating activity		a) 100% b) 80-100% c) 50-80% d) Less than 50% e) Nil							
11.	Who was the most important person in deciding whether to take this loan		a) Self b) Husband c)Decision taken with my husband d) Father e) Mother f) Brother g) Other, specify							
12.	Who decides how to spend your loan	a) Self b) husband c) Decision taken with my husband d) Others, specify								
13.	Who decides on how to spend your salary/Income	a) Self b) Husband c) Both d) Other, specify								
14.	Do you have separate savings/financial assets from your husband								a) Yes b) No	
15.	Whether your contribution to the household income changed due to flood?	a) Increased b) decreased c) no change								
16.	Can you use your savings without your husband's permission?								a) Yes b) No	
17.	Skills & hobbies	a) Artistic skills (singing, dancing, painting, drawing, florist) b) Culinary skills c) Embroidery/sewing d) Gardening e) Others, specify								
18.	Whether used this skill to make income								a) Yes b) No	
19.	Do you agree that a wife has a right to buy and sell things in the market without asking the permission of her husband								a) Yes b) No	
20.	What are your most important sources for information about what the government is doing	a) Relatives, friends, neighbours b) Community bulletin board d) Newspaper e) Radio g) Groups or associations h) Community leaders i) Internet j) Other, specify_____								

		f) Television		
21.	Do you read/watch a newspaper, magazine or TV	Newspaper a) Daily b) At least once a week c)Less than once a week d)Not at all	Magazine a) Daily b) At least once a week c)Less than once a week d) Not at all	TV a) Daily b) At least once a week c)Less than once a week d)Not at all
	If yes, what programmes do you prefer to watch on TV	a) News b) TV serial c) Movie d) Others, specify		
22.	How often do you follow politics in the news (on the radio, television, or in the newspapers)	a) Every day b) Several times a week e) Never c) Once or twice a month d) Once or twice a year		
23.	How frequently do you discuss politics with people outside of your family	a) Never c) Every week b) Once in a month d) Every day		
24.	Do you participate in or are you a member of any social or political organizations			a) Yes b) No
25.	Which organizations do you belong to/participate in	a) Women's self-help group c) Political party b) NGO d) Other, specify_____		
26.	Do you have a leadership role in this group			a) Yes b) No
27.	What is your level of participation in the group activities	a) Very active b) Somewhat active c) Not active		
28.	Do you take part in the decision making within the organisation			a) Yes b) No
29.	Are you still an active participant of the group			a) Yes b) No
30.	Did you get any assistance form the organisation after flood			a) Yes b) No
31.	Does your husband drink			a) Yes b) No
	If you have money that you have earned, can you refuse to give some to your husband to purchase alcohol?	a) Often c) Rarely b) Sometimes d) Never		
32.	Are you aware of various schemes/acts that have been introduced by the government for the health welfare of women?			a) Yes b) No
33.	Do you need permission to leave house			a) Yes b) No
34.	Which of the following places are you allowed to go to mark 1,2,3?	a) Friends'/relatives' houses e) Cinema/fair b) market f) Religious place— c) Healthcare centre/hospital mosque/temple		

	[respondent-1, with someone- 2, not at all-3]	d) NGO clinic/training centre /church within
35.	How frequently do you talk to your husband/family about? (never-0, sometimes-1, often-2)	a) Your work/agricultural activities b) What happens at home c) Your expenditures d) What happens in your community or area e) Your health
36.	Who decides on the following matters? [respondent-1, jointly-2, husband/father/relatives-3]	a) Major Household purchases e) Family planning b) Health related to child f) education of children c)Health related to self g) On choosing the clothes you wear d) Who decides when selling or buying items for family such as jewellery, car, house, land, etc
37.	Do you have to ask the permission of other household members to buy the following? [Yes/No]	a) personal supplies items d) family's daily consumable food -soap -shampoo e) household needs - Groceries -dental paste -sanitary napkins - Utensils -Vegetables -others, specify -Cloths -Others, specify b) medicines for yourself f) cookies, ice-creams for your children c) clothing for yourself

Part IV: COVID-19 Questionnaire (to both men and women)

1.	Has there been an increase in time spent on caring duties in the household due to Covid-19?	a) Yes b) No

If yes indicate if primarily done by male (M) or female (F) household members (in brackets)

Unpaid household works	Time spent before/day	Time spent after/day
Cooking		
Child care		
Elderly care		
Cleaning, washing		
Time spent on sanitising and washing vegetables		

2.	Whether you had to cope with illnesses/health issues during lockdown	a) Yes b) No
	If yes, got medical help?	a) Yes b) No
3.	Any other COVID-19 impacts you may like to highlight?	

	Do you have any recommendations on what actions to address these issues?	

Questionnaire for Household

1.	Was there any reduction or unavailability of food consumption during the lock down period and after?				a) Yes b) No
	Availability of food groups immediately after lockdown (March-July)	yes	No	sometimes	
	Starch (Cereals, flour, bread, potato, sweet potato)				
	Protein rich animal source foods (eggs, meat, fish& seafood)				
	Pulses or beans				
	Green leafy vegetables				
	Other vegetables				
	Fruits				
	Nuts/seeds				
	Dairy products (fresh Milk, curd, butter)				
2.	Have you or any of your family member suffered job loss due to Covid-19?				a) Yes b) No
	if the person who lost job has gained employment again?				a) Yes b) No
	If no, think about 3 months from now, how likely do you think it is that you will be employed at that time?	a) Extremely likely c) Moderately likely e) Not likely at all b) Very likely d) Not too likely			
3.	Have you experienced depletion of savings since lockdown?				a) Yes b) No
	Savings	Before covid-19		Since covid-19	
4.	Have you received any help from the government since lockdown (in form of money, food grains etc.)?				a) Yes b) No
5.	Has there been a reduction in level of salary/income at household level since lockdown of March,2020?				a) Yes b) No
	If yes, how much(percentage)				
	If yes indicate if primarily male (M) or female (F) household members impacted				
6.	How the household coped with reduced income?	a) Borrowing money from friends/relatives c) Sold assets e) Other (Specify) b) Family received regular income d) Loans (write source)			
7.	Household affordability				

	Category	Before COVID-19			Since COVID-19		
		Fully	Partially	Not at all	Fully	Partially	Not at all
	Food						

	Cooking items (gas, wood)						
	Rent (if applicable)						
	Healthcare						
	Loan repayment						
	Personal hygiene and sanitation products						
8.	How does Covid-19 affect your family financially?	a) Extremely badly b) Very badly c) Moderately d) Affected, but not much e) Not at all					

Table A.3. 1: List of SAARC Countries included

Afghanistan#	Bhutan #	Nepal	Sri Lanka
Bangladesh	India	Pakistan	

# Denotes whether a country is only included in 2000 model

Table A.3.2: List of Indian states and UTs included

Andhra Pradesh	Jharkhand#	Punjab
Assam	Karnataka	Rajasthan
Bihar	Kerala	Tamil Nadu
Chhattisgarh#	Madhya Pradesh	Tripura
Goa	Maharashtra	Uttar Pradesh
Gujarat	Manipur	Uttarakhand#
Haryana	Meghalaya	West Bengal
Himachal Pradesh	Nagaland	
Jammu & Kashmir	Odisha	

# Denotes whether a state or UT is included in only 2000 model.

Table A.3. 2: Data sources used: SAARC countries

Variable	Description	Source
Total deaths	"Number of people who lost their life because the event happened." (EM-DAT)	EM-DAT https://www.emdat.be
Total people affected	"People requiring immediate assistance during a period of emergency, i.e. requiring basic survival needs such as food, water, shelter, sanitation and immediate medical assistance." (EM-DAT)	EM-DAT https://www.emdat.be
Economic losses	"The amount of damage to property, crops, and livestock. In EM-DAT estimated damage are given in US$ ('000). For each disaster, the registered figure corresponds to the damage value at the moment of the event, i.e. the figures are shown true to the year of the event. In EM-DAT, the value of estimated damage in monetary terms is given in Dollars (US $). So, in the analysis the monetary damages have been converted to real terms using deflator indexes using 2015 as the reference year". (EM-DAT)	EM-DAT https://www.emdat.be
Real per capita GDP	"GDP per capita growth (annual %)" (WDI)	WDI https://datacatalog.worldbank.org/dataset/ world-development-indicators
Population density	"Population density (people per sq. km of land area)" (WDI)	WDI https://datacatalog.worldbank.org/dataset/ world-development-indicators
Gross capital formation	"Gross capital formation (% of GDP)" (WDI)	WDI https://datacatalog.worldbank.org/dataset/ world-development-indicators
Urban population	"Urban population (% of total population)" (WDI)	WDI https://datacatalog.worldbank.org/dataset/ world-development-indicators
Average years of total schooling	Average years of schooling attained	Barro-Lee Data http://www.barrolee.com/update.htm#2016_4_Feb_Update http://www.barrolee.com/update.htm#2018_6_June_Update

Table A.3. 3: Data sources used: Indian states

Variable	Description	Source
Total deaths	"Number of people who lost their life because the event happened." (EM-DAT)	EM-DAT https://www.emdat.be
Total people affected	"People requiring immediate assistance during a period of emergency, i.e., requiring basic survival needs such as food, water, shelter, sanitation and immediate medical assistance." (EM-DAT)	EM-DAT https://www.emdat.be
Economic losses	"The amount of damage to property, crops, and livestock. In EM-DAT estimated damage are given in US$ ('000). For each disaster, the registered figure corresponds to the damage value at the moment of the event, i.e., the figures are shown true to the year of the event. In EM-DAT, the value of estimated damage in monetary terms is given in Dollars (US $). So, in the analysis the monetary damages have been converted to real terms using deflator indexes using 2015 as the reference year". (EM-DAT)	EM-DAT https://www.emdat.be
GSDP	State wise Gross Domestic Product (GSDP) in India (At constant 2011-12 prices, in ₹crore)	Indiastat https://www.indiastat.com/
Population density	State wise density of population (per square km)	Census of India https://censusindia.gov.in/
Gross capital formation	State wise gross capital formation (% of GDP)	Annual survey of Industries http://mospi.nic.in/annual-survey-industries
Urban population	State wise population in urban area (% of total population)	Census of India https://censusindia.gov.in/
Gross enrolment ratio	State wise Gross Enrolment Ratio (GER) in India (Primary education, class I-V)	Indiastat https://www.indiastat.com/

Table A.3. 4: Descriptive statistics

	SAARC 1969				SAARC 2000			
Variable	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max
Log (total deaths)	5.997	1.983	.693	12.613	5.823	1.723	.693	11.215
Log (total affected)	13.603	2.951	1.609	19.664	13.193	3.096	1.609	19.664
Log (total real damages)	7.441	2.975	-.965	12.318	7.126	3.607	-1.973	12.318
Log (per capita GDP)	5.595	.706	4.296	7.123	5.153	1.307	2.698	7.123
Gross Capital Formation (% of GDP)	22.304	7.688	4.698	51.756	12.445	1.445	10.548	14.914
Urban population (% of total population)	12.633	1.409	11.046	14.914	29.974	12.723	12.557	67.91
Log (population density)	21.609	8.515	3.911	36.666	26.782	7.319	13.397	40.895
Average years of schooling	6.542	.609	5.602	8.278	6.951	.651	5.8	8.278
	INDIA 1990				INDIA 2000			
Variable	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max
Log (total deaths)	-1.473	4.269	-8.714	9.187	-1.688	4.299	-8.714	7.352
Log (total affected)	6.236	4.365	-8.164	15.808	6.109	4.43	-8.164	15.761
Log (total real damages)	-.07	4.257	-8.08	11.956	-.321	3.726	-7.033	11.956
Log (per capita GSDP)	1.662	.599	.173	3.666	1.861	.564	.304	3.666
Gross Capital Formation (% of GDP)	22.83	26.573	-204.288	144.956	27.534	11.194	8.683	62.166

Urban population (% of total population)	26.538	11.035	7.615	62.166	28.699	30.849	-24.604	151.596
Log (population density)	5.616	.734	3.85	7.009	5.671	.688	4.29	7.009
Gross Enrolment Ratio	105.376	20.52	62.3	195	108.008	21.233	62.86	195

Table A.5. 1: Marginal Effects

Variables		Obtained credit			Government assistance			Reduced food consumption		
		dy/dx	p>|z|	95% CI	dy/dx	p>|z|	95% CI	dy/dx	p>|z|	95% CI
Women empowerment index		.0474*** (0.009)	0.000	0.030- 0.064	.0049 (0.007)	0.488	-0.009 – 0.019	-.0003 (0.006)	0.960	-0.013 – 0.012
Age of the respondent		-.0032 (0.002)	0.153	-0.008- 0.001	.0002 (0.001)	0.913	-0.003 – 0.003	.0006 (0.001)	0.673	-0.002 – 0.003
Religion	Hindu[R]									
	Muslim	.0004 (0.082)	0.996	-0.159- 0.160	.0226 (0.055)	0.682	-0.085 - 0.130	-.0606 (0.071)	0.395	-0.200 – 0.078
	Christian	-0.1060* (0.061)	0.084	-0.226- 0.014	-.1106* (0.065)	0.090	-0.238- 0.017	-.0572 (0.047)	0.225	-0.149 – 0.035
Caste	General[R]									
	OBC	-.0142 (0.069)	0.838	-0.150- 0.122	.0671 (0.057)	0.243	-0.045- 0.179	.0142 (0.046)	0.755	-0.075 – 0.103
	SC/ST	-.1347 (0. 096)	0.159	-0.322- 0.052	-.0337 (0.097)	0.730	-0.224- 0.157	.0899 (0.056)	0.111	-0.020- 0.200
Sex of household head	Male[R]									
	Female	-.0279 (0.058)	0.629	-0.141- 0.085	-.0360 (0.048)	0.450	-0.129- 0.057	-.0069 (0.037)	0.852	-0.079- 0.066

Exposure to political/general awareness	Never or less often[R]									
	Everyday	.0891	0.148	-0.028- 0.207	.0582	0.271	-0.045- 0.162	.0373	0.400	-0.049- 0.124
		(0.060)			(0.053)			(0.044)		
Phone usage	Calling & texting[R]									
	Calling, texting, and browsing	-.1888*** (0.067)	0.005	-0.319-0.057	-.0975* (0.050)	0.055	-0.197- 0.002	-.0298 (0.049)	0.540	-0.125- 0.065
Income		.0250*** (0.005)	0.000	0.014- 0.035	.0064 (0.005)	0.242	-0.004- 0.017	-.0085* (0.005)	0.067	-0.017- 0.000
Place of residence	Wayanad[R]									
	Alappuzha	-.0891 (0.057)	0.120	-0.201- 0.023	.1345*** (0.046)	0.004	0.043- 0. 225	.8380*** (0.040)	0.000	0.760- 0.915
Observations		262			262			262		

Note: R-Reference Category; *** p<0.01, ** p<0.05, * p<0.1
Source: Authors' computations using the field survey data

List of Publications

- George, B., Kumar, R. & Banerjee, S. (2022). Vulnerability of women in the face of climate change: a study of Wayanad district of Kerala, India. *Journal of Chinese Economic and Foreign Trade Studies*, 15 (3), 279-297. https://doi.org/10.1108/JCEFTS-09-2021-0058 (Scopus indexed)

- George, B., Banerjee, S. & Kumar, R. (2021). Determinants of impact of natural disaster in SAARC countries with special reference to India. *Economic Research Guardian,* 11(1), 64-77. https://www.ecrg.ro/files/p2021.11(1)2021ySI4y6.pdf (Scopus indexed)

- Banerjee, S., Alok, S. & George, B. (2020). *Determinants of Women Empowerment as Measured by Domestic Decision-Making: Perspective from a Developing Economy*. *Advances Issues in the Economics of Emerging Markets, International Symposia in Economic Theory and Econometrics*, 27, 1–12, Emerald Publishing Limited, pp. 1-12. https://doi.org/10.1108/S1571-038620200000027001 (Scopus indexed)

Conferences

- George, B., Kumar, R. & Banerjee, S. (January 2023). Coping strategies adopted by women and its determinants during flood: Evidence from Alappuzha and Wayanad districts of Kerala, India. The 57th annual conference of The Indian Econometric Society (TIES) organized by University of Hyderabad
- George, B., Kumar, R. & Banerjee, S. (December 2022). Coping strategies adopted by women and its determinants during flood: Evidence from Alappuzha and Wayanad districts of Kerala, India. Annual General Conference on Contemporary Issues in Development Economics organized by Economics Department, Jadavpur University, Kolkata.
- George, B., Kumar, R. & Banerjee, S. (December 2022). Coping strategies adopted by women and its determinants during flood: Evidence from Alappuzha and Wayanad districts of Kerala, India. The Second Biennial Conference on Development: Sustainable Development Goals Amidst Multiple Global Shocks: Progress, Challenges and Way Forward organized by the Indira Gandhi Institute of Development Research (IGIDR), Mumbai.

- George, B., Kumar, R. & Banerjee, S. (December 2022). Coping strategies adopted by women and its determinants during flood: Evidence from Alappuzha and Wayanad districts of Kerala, India. Doctoral Colloquium on Management and Development organized by the Institute of Rural Management Anand (IRMA), Gujarat. (accepted)

- George, B., Kumar, R. & Banerjee, S. (February 2022). Vulnerability of women in the face of climate change: a study of Wayanad district of Kerala, India. International Conference on Contemporary Issues in Economics organized by School of Economics of XIM University, Odisha, in association with the "Indian Council of Social Science Research (ICSSR), (ICCIE 2022)

- George, B., Kumar, R. & Banerjee, S. (January 2022). Vulnerability of women in the face of climate change: a study of Wayanad district of Kerala, India. 4th international webinar on Women and Development organized by the Department of Economics, University of Kerala

- George, B., Kumar, R. & Banerjee, S. (November 2021). Vulnerability of women in the face of climate change: a study of Wayanad district of Kerala, India. The 3rd Rajagiri Conference on Economics and Finance (RCEF 2020) in Association with The Indian Econometric Society (TIES) and the Waikato Management School, New Zealand.

- George, B., Banerjee, S. & Kumar, R. (November 2020). Determinants of impact of natural disaster in SAARC countries with special reference to India. The 2nd Rajagiri Conference on Economics and Finance (RCEF 2020) in Association with The Indian Econometric Society (TIES) and University of Economics, Ho Chi Minh City (UEH).

- George, B., Banerjee, S. & Kumar, R. (October 2020). Determinants of impact of natural disaster in SAARC countries with special reference to India. The 1st Rajagiri Management Conference (RMC) organized jointly by Rajagiri Business School, Rajagiri College of Social Sciences Kochi, India and Victoria University of Wellington, New Zealand.

- George, B., Banerjee, S. & Kumar, R. (January 2020). Determinants of impact of natural disaster in SAARC countries with special reference to India. The 56th annual conference of The Indian Econometric Society (TIES), Madurai Kamaraj University.

Biography of the Candidate

Bincy George holds a master's and Bachelor's in Economics from the University of Calicut. She is a UGC-NET holder in economics (2016).

During her doctoral studies, she Completed the course Gender, Justice, and Environmental Crises in the Bergen Summer Research School (BSRS) conducted by the University of Bergen, Norway and prepared a policy brief for UNICEF in the interdisciplinary session during the summer school. She also took part in the online training programme on Gender Equality, Climate Change and Sustainable Development Goals organized by National Institute of Disaster Management (NIDM), Ministry of Home Affairs, Govt. of India in collaboration with IMPRI. she has published three articles in international journals and one book chapter. She has also presented her works at national and international conferences.

Biography of the Supervisor

Prof. Sudatta Banerjee is currently an Associate Professor of Economics in the Department of Economics and Finance at BITS Pilani-Hyderabad Campus, India. She holds a Ph.D. in "Issues Relating to Quality of Human Capital and their Relationship with Economic Growth", from Jawaharlal Nehru University, New Delhi. She is involved in teaching, research, and consultancy for the last 9 years. Her research, publications, talks, and sponsored projects involve empirical developmental issues, education, health, gender studies, applied econometrics, and behavioural issues. Furthermore, she is presently guiding seven doctoral candidates (three as supervisor and four as co-supervisor). As regards research accomplishments, she has published 13 articles in reputed national and international journals and has 4 book chapters to her credit. She has also contributed to one government report. Additionally, Prof. Banerjee has presented her works at 22 conferences. Also, she has completed four external projects on themes of flexi-working, savings of low-income households, women's empowerment, and women's career persistence funded by august institutions such as the Indian Council of Social Science Research and Dvara. She is currently involved in three new, externally funded projects on themes of credit access and employment opportunities for women with disabilities, women's entrepreneurship, and women's labor force participation. These are funded by the Indian Council of Social Science Research and the National Human Rights Commission.

Biography of the Co-supervisor

Prof. Rishi Kumar is currently an Associate Professor of Economics in the Department of Economics and Finance at BITS Pilani-Hyderabad Campus, India. He holds a Ph.D. in Development Economics from Indira Gandhi Institute of Development Research (IGIDR), India. He is presently guiding seven doctoral candidates (five as supervisor and two as co-supervisor). As regards research accomplishments, He has published 16 articles in reputed national and international journals. Additionally, Prof. Kumar has presented his works at 21 conferences. Also, he has completed four external projects. He is currently involved in three new, externally funded projects.