

A Systematic Review on Women's Disaster Adaptation Strategies in Changing Climate

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Abstract

Climate change has posed a serious threat to humanity, particularly to women, who are among the most vulnerable. Adaptation as a measure of disaster mitigation has received a lot of attention in the wake of climate change, but nearly all of it has disregarded women's contribution to disaster adaptation as a change agent. This research aims to review the available literature on women's adaptation methods in the face of climate-related disasters. The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) technique was used to guide this research. With a thorough screening method, 19 articles out of 695 were selected utilizing two databases: Scopus and EBSCO discovery service. The findings are presented in a thematic way titled after the various adaption tactics employed by women across the world. The findings suggest that women have demonstrated their ability to use beneficial adaptation techniques in the face of several societal constraints, including reproductive responsibility. As a result of the findings, certain policy recommendations have been made, emphasizing the relevance of women's capacity building in disaster impact mitigation.

Keywords: Women, adaptation strategy, disaster, climate change.

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1. INTRODUCTION

Global climate change is one of humanity's most important concerns and worrisome issues today. The extent to which mankind responds to this crisis will be determined by how well it applies adaptation mechanisms. As a result, careful examination of the adaption possibilities is required along with resources, as well as community responses to these issues, which are essential to ensure a sustainable future, a long-term solution for human happiness (Ubels & Morgan, 2016).

Climate change is causing global hardship nevertheless, those who are already vulnerable will be the worst triggers. People's livelihoods and the socioeconomic position may be affected differently by climate change (Kabir & Serrao-Neumann, 2020). Adaptive capability is closely linked to a vulnerability where intersectionality of gender, poverty, and vulnerability are key issues in climate change adaptation. The ability to adapt determines susceptibility to harm caused by an environmental and social change (Djoudi & Brockhaus, 2011). Due to the necessity to ensure that impacted populations are

reasonably able to deal and appropriately live with degrees and forms of climate variability, in recent years, climate change adaptation has gained significant attention (Onta & Resurreccion, 2011). Scholars concede that People's vulnerability to climate change is thus influenced and differentiated by a variety of biophysical, cultural, institutional, and socioeconomic structures, processes, factors, and drivers and shapes the adaptability as a result (Huynh & Resurreccion, 2014; Kaijser & Kronsell 2014).

However, many more determinants that generate context-specific vulnerabilities and adaptive capacity responses are currently unexplored (Kaijser & Kronsell, 2014). Women and men perceive and experience climate change differently, women are often more vulnerable to climate change due to their reliance on natural resources and institutional inequities in their access to and administration of such resources, according to a significant body of literature on gender and climate change (Nellemann et al. 2011; Nightingale, 2009; Bjornberg & Hansson, 2013) and adaptive strategies also become gendered. Men and

women adopt a different way of adaptation based on their capacity and ability as climate change, vulnerability, and adaptations are socially differentiated. Women are particularly unable to access favorable adaptation strategies as lack adaptation resources and support. The experiences of vulnerability in terms of access to resources vary across impacted individuals, which in turn describe their adaptability as distinct. Unequal risk and vulnerability distributions are said to result from some interconnected factors: inequalities in power, gender discriminations, money, economic resources, gender bound patterns in the allocation of labor, cultural pattern and social roles, and biological variations (Bjornberg & Hansson, 2013).

Adaptation is a costly process and can be described within two types one is short-term adaptation and another is long-term adaptation. Community and family level personal adaptation is mainly for the short term whereas structural changes, capacity building are long-term adaptations initiated by the state, government, and to some extent NGOs. People's adaptive capacities and strategies are largely determined by their socioeconomic status, and disparities in access to and allocation of resources as vulnerability factors can obstruct women's ability to improve adaptations to climatic change as independent actors, resulting in differentiated adaptations among them (Nightingale, 2009). Throughout the world, it is accepted that adaptation is more related to a male figure, not females. The capacity to adapt is undermined by gender along with other drivers. Vulnerability differs from the social construction of female and male identity as well as in the case of adaptation. Despite an increase in the number of climate change adaptation studies and research projects, only a few have looked at the gender and cultural aspects of the process. Individual and group vulnerability has been highlighted as a primary predictor of inequality; however, the gender and cultural components of inequity have gotten less attention (Onta & Resurreccion, 2011). Notwithstanding adaptation capacity often accepted different for men and women, women are much more potential for adaptation or developing adaptation strategies with their indigenous knowledge, although climate change vulnerability and adaptation researchers recognize the value of indigenous knowledge in adaptation and coping with climate change susceptibility. Thus, the study aims at identifying the adaptation strategies predominantly used by women throughout the world in climatic distress.

Although an abundance of studies, as well as reviews, have been published on adaptation and adaptation strategies, still there is a lack of studies, particularly on women's adaptation strategies in disaster or climatic distress and which needs to be addressed as women's contributions are often not acknowledged. This article aims to close the knowledge

gap and identify women's climate change adaptation options.

The sequence in which the paper is delivered is as follows. In the next part, we'll go through the research methodology. The findings are provided in Section 3, which focuses on women's adaptation tactics in climate change research. In the fourth portion, the findings are addressed, followed by concluding remarks in the fifth section.

2. METHODOLOGY

The approach for retrieving articles about women's climate change adaptation techniques is detailed in this section. The PRISMA approach has been employed here, which consists of resources (Scopus and EBSCO Discovery Service) to conduct the systematic review, for eligibility and exclusion criteria, in review process phases (identification, screening, eligibility, inclusion), and to data abstraction and analysis. This study followed the Population-Concept-Context (PCC) framework (Peters, M. D. J, *et al.*, 2020) for determining the research question, its extent, and to get a direction.

Here the population is women, the concept focused on adaptation strategies in disaster and the context is not a specific zone. The research question is-what is the extent and nature of published literature on women's disaster adaptation strategies? Based on this question a systematic review is developed.

2.1. PRISMA

Here PRISMA ((Preferred Reporting Items for Systematic reviews and Meta-Analyses) statement has been used to guide the reviews on adaptation strategies of women. Applicability of using PRISMA in reviews can be seen in the following ways: (i) It helps to clearly define research questions for a systematic review; (ii) it clearly and unambiguously identifies inclusion and exclusion criteria;(iii) it aims at assessing the largest amount of relevant and available scientific literature as possible in a defined time (Sierra-Correa & Cantera Kintz, 2015).

2.2. Resource

The search strategy was based on an electronic database named Scopus and EBSCO Discovery Service (General). The aim was to identify the available studies related to climate change or disaster adaptation strategies of women. Manual searching was also conducted through Google Scholar. The search was carried out by employing relevant keywords as a way to locate publications that were related to the study aim. Key terms used in systematic searching were "women", "adaptation strategy", "adaptation techniques", "climate change", "disaster", with Boolean operators. This research, on the other hand, used a three-step approach to conduct the review: searching for papers, determining relevance, and extracting data.

2.3: Inclusion and Exclusion criteria

Following the formation of the first list of publications, the titles, abstracts, and full-text sections were meticulously examined based on the inclusion and exclusion criteria to collect data from the selected study and evaluate it later. To discover additional relevant papers, exclusion criteria were applied (Borg *et al.*, 2015). Exclusion criteria applied to the articles that were a) paper without full-text b) grey literature c) review paper d) not related with disaster/climate change adaptation strategies e) literature using another

language except English. Inclusion/eligibility criteria were a) literature based on adaptation strategy (here both genders adaptation strategy was accepted as there were not available literature based on women’s adaptation strategy only) b) original paper with empirical data c) paper with the English language. As literature predominantly on women’s adaptation strategy in the disaster was not available enough, that’s why the time limit of publication was not set here. The search was done between 4th August 2021 to 6th August 2021 for identifying the relevant literature.

Table 1: Inclusion and Exclusion criteria

Criteria	Inclusion	Exclusion
Literature	Only journal article	Books, Book chapter, conference proceeding, grey literature
Type	Original published literature with empirical data	Review paper, unpublished paper.
Language	Only literature in English	Non-English literature and not full text
Focus	Focused on disaster adaptation strategy	Focused other concepts rather than adaptation strategy

2.4: Review Process

Here four steps followed for the systematic review process. In the first phase, keywords were selected for searching the literature. Primarily in the identification stage, 477 pieces of literature from the Scopus database, 105 from EBSCO Discovery Service, and by manual searching 113 from Google scholar were identified. At the screening phase, 495 pieces of literature were removed after title screening and removing duplicates. From 200 pieces of literature 149

literature were excluded after the abstract screening. Then comes the third phase of the eligibility check. In this stage put some exclusion and inclusion criteria to find out the literature appropriate for the review and exclude the rest. After this phase from 51 literature, 26 were excluded after the full-text screening. In the last stage from 25 literature, 6 were removed as they were not satisfied with the objective of the research and finally 19 pieces of literature were selected for qualitative analysis that satisfied inclusion criteria.

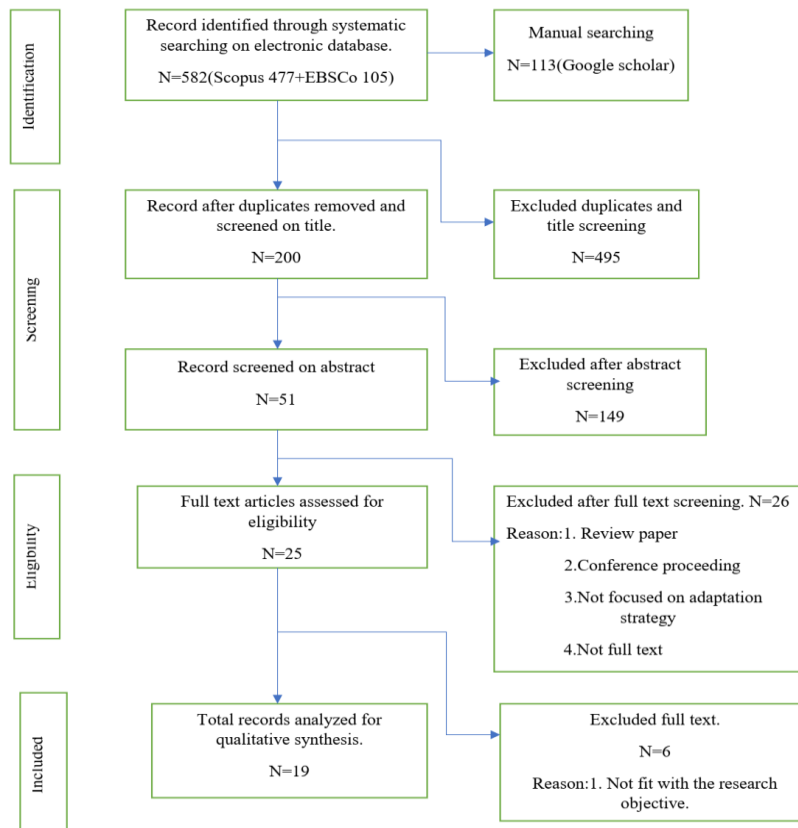


Chart-1: Flowchart of the review process
(Adapted from Hayrol *et al.*, 2018).

3. RESULT

Assessing vulnerability is an important component of any attempt to identify the scale of the hazard in the present alarming context of global warming. A closely related term often focused on disaster studies is adaptation. Furthermore, determining effective means of promoting restorative action to reduce consequences by supporting coping mechanisms and facilitating adaptation begins with vulnerability assessments (Adger & Kelly, 2000). According to the IPCC synthesis report 2001, Adaptation is defined as “Adaptation to *climate change* refers to adjustment in natural or human systems in response to actual or expected climatic *stimuli* or their effects, which moderates harm or exploits beneficial opportunities.” Despite growing awareness of women's contributions to other sectors of life around the world, experts and mainstream policymakers have generally ignored the topic of gender equality in climate change, paying little attention to female contributions to adaptation (MacGregor, 2010). Aiming to fill the gap this study tried to find out the adaptation strategies followed by the women around the world in climatic extremes.

The paper resulted in a descriptive theme related to the adaptation strategies of women in disaster. The result provided a clear description of the adaptation strategies of women and issues related to their adaptation. Predominantly, most of the paper focused on adaptation strategies in general, rather than gender-specific. This study picks up the points from articles related to women's adaptation strategies. Pertaining the year of publication of the selected article of the study, 1(One) in 2021, 4(Four) in 2019, 3(three) studies were published in 2018, 1(One) in 2016, 1(One) paper in

2015, 3(Three) papers in 2014, 3(three) papers in 2011, 1(One) in 2010, 1(One) in 2009, and 1(one) in 2008.

Based on the focused area six study emphasize on Bangladeshi peoples (Both men and women) adaptation Strategy in disaster or changing climate (Raihan & Hossain, 2021; Naz *et al.*, 2018; Sultana, 2010; Tanjeela & Rutherford, 2018; Hossain & Rahman, 2018, Demetriades & Esplen, 2008, and Khalil *et al.*, 2019) whereas three studies were in Vietnam (Huynh & Resurreccion, 2014; Ylipaa *et al.*, 2019; Thi Phan *et al.*, 2019). Furthermore, three studies were based on Nepal and local people's adaptation (Banerjee *et al.*, 2019; Ubels & Morgan, 2014; Onta & Resurreccion, 2011), two based on India (Ahmed & Fajber, 2009; Ravera *et al.*, 2016), one on Mali (Djoudi & Brockhaus, 2011), one on Nigeria (Yila & Resurreccion 2014), one on Erub Island, Torres Strait (McNamara & Westoby, 2011) and one on China (Jianjun *et al.*, 2015).

Based on the selected studies mostly used common adaptation strategies in the disaster were livelihood diversification, labor migration, altered cultivation/crop diversification/disaster-resistant crop management, property selling/selling of resources, borrowing money/loan/microcredit, petty trade, income diversification, structural change. Available work on adaptation strategies often overlooked the contribution of women in disaster adaptation. Gender is a significant indicator of adaptation. Women's adaptation varies on societal class, position in the household, region, economic condition, literacy, societal structure, cultural position, etc alike differentiated vulnerability throughout the world.

Table 2: Findings of the review briefly

Adaptation strategy	Country	Author, Publication year
Income source diversification	India, Vietnam, Bangladesh, Nepal, Mali.	Ahmed & Fajber, 2009; Djoudi & Brockhaus, 2011; Naz <i>et al.</i> , 2018; Khalil <i>et al.</i> , 2019; Huynh & Resurreccion, 2014; Ubels & Morgan, 2014
Livelihood diversification	China, Bangladesh, Vietnam	Jianjun <i>et al.</i> , 2015; Naz <i>et al.</i> , 2018; Ylipaa <i>et al.</i> , 2019; Huynh & Resurreccion, 2014
Altered cultivation/crop management/crop diversification	Nepal, Bangladesh, Mali, Nigeria, Erub Island, Torres Strait, Vietnam	Onta & Resurreccion, 2011; Djoudi & Brockhaus, 2011; Yila & Resurreccion 2014; Ubels & Morgan, 2014; Bjornberg & Hansson, 2013; Naz <i>et al.</i> , 2018; Raihan & Hossain, 2021; Demetriades & Esplen, 2008; McNamara & Westoby, 2011; Huynh & Resurreccion, 2014
Personal loan/Microcredit/Borrowing money	Bangladesh, Nigeria, Vietnam, India	Demetriades & Esplen, 2008; Tanjeela & Rutherford, 2018; Naz <i>et al.</i> , 2018; Khalil <i>et al.</i> , 2019; Sultana, 2010; Yila & Resurreccion, 2014; Phan <i>et al.</i> , 2019; Huynh & Resurreccion, 2014; Ahmed & Fajber, 2009
Saving money and Property selling	Vietnam, Bangladesh	Sultana, 2010; Ylipaa <i>et al.</i> , 2019
Migration	India, Bangladesh, Vietnam, Nigeria	Ravera <i>et al.</i> , 2016; Ahmed & Fajber, 2009; Khalil <i>et al.</i> , 2019; Huynh & Resurreccion, 2014; Yila & Resurreccion, 2014; Tanjeela & Rutherford, 2018
Education/Training	Bangladesh, India, Nigeria, Mali	Demetriades & Esplen, 2008; Naz <i>et al.</i> , 2018; Ravera <i>et al.</i> , 2016; Hossain & Rahman, 2017; Yila & Resurreccion, 2014; Djoudi & Brockhaus, 2011

Adaptation strategy	Country	Author, Publication year
Use of local indigenous knowledge	Erub Island, Torres Strait, Bangladesh, India, Vietnam, Mali	McNamara & Westoby, 2011; Sultana, 2010; Khalil <i>et al.</i> , 2019; Raihan & Hossain, 2021; Djoudi & Brockhaus, 2011; Huynh & Resurreccion, 2014; Ravera <i>et al.</i> , 2016
Petty trade, livestock rearing, home-made product selling	India, Bangladesh, Nepal, Vietnam, Nigeria, Mali	Naz <i>et al.</i> , 2018; Khalil <i>et al.</i> , 2019; Ahmed & Fajber, 2009; Ravera <i>et al.</i> , 2016; Raihan & Hossain, 2021; Banerjee <i>et al.</i> , 2019; Huynh & Resurreccion, 2014; Yila & Resurreccion, 2014; Ylipaa <i>et al.</i> , 2019; Sultana, 2010; Djoudi & Brockhaus, 2011; Tanjeela & Rutherford, 2018
Others	Erub Island, Torres Strait, Bangladesh, Nigeria, Vietnam	McNamara & Westoby, 2011; Yila & Resurreccion, 2014; Ylipaa <i>et al.</i> , 2019; Sultana, 2010; Khalil <i>et al.</i> , 2019

3.1. Women's adaptation strategies in changing climate

Women rely extensively on natural resources such as land, forest, and water, yet their social power is restricted throughout nations and cultures (Djoudi & Brockhaus, 2011). As a result, men are granted special rights and privileges, leaving women with little or no decision-making power where women have less control and decision-making authority over resources in their own homes and their livelihoods because they have weaker access within the gendered hierarchy, at the same time women have rich indigenous knowledge pertaining ecosystem to adapt in changing climate. Adaptation is nothing but taking proper decisions with proper resources at the proper time. Here practiced adaptation strategies of women are presented through the following thematic description based on selected literature.

3.1.1: Income source diversification

Except for those who have lost their spouses, divorced, or relocated, it is a commonly accepted pattern that men are responsible for generating money and women are on the sidelines, supporting their husbands and paying the family expenses. Women have a limited amount of disposable income and savings. When it comes to adaptation in the face of climate change, women do their best to embrace various adaptation alternatives to maintain family support by adding some money. Income source is the main component of livelihood diversification. In India, women in the *katper* village of Gujrat use mills cotton waste to make rope as an additional source of income as their main occupations of fishing, marketing of fish and gardening have fallen owing to increased salinity and lower yield because of climate change and disaster (Ahmed & Fajber, 2009; Djoudi & Brockhaus, 2011) whereas in Bangladesh diversification of household income to support the family to adapt predominant for women, as an example after the cyclonic storm "Aila" which hit the southwestern part of Bangladesh (Khulna Division) and West Bengal in India on 25th May 2009, many women cut the earth as an alternative use of their labor to earn money as a diversified way of income (Naz *et al.*, 2018; Khalil *et al.*, 2019). In some places, women have the access to cultivating but with the differentiated right to irrigation,

labor supply, institutional help. In Vietnam and Mali women raise pig and cattle, collect firewood, fodder instead of cultivation or agricultural production as scarcity of water after harvesting winter-spring crop they can't cultivate summer-fall crop as female heads of families was more hindered than male heads of households in their attempts to adjust to water constraints through irrigation scheduling, as a result, several of them had to scale back their farming operations entirely (Huynh & Resurreccion, 2014; Djoudi & Brockhaus, 2011). In Mali as the impact of environmental change, drought becomes more severe and results in drying of the lake to cultivate. Water scarcity challenged women's daily livelihood as they had to shift water-based to forest-based livelihood to maintain the family income flow like Australia, women developed a new livelihood strategy of off-farm income instead of agriculture. Due to the male migration, new opportunities make women more capable to adapt (Ubels & Morgan, 2014), in the absence of males they can decide their life where charcoal production is a new way of earning for women (Djoudi & Brockhaus, 2011).

3.1.2: Livelihood diversification

Livelihood diversification is a much-preferred adaptation strategy around the world among both genders. Women must face gender norms and gendered division of labor which eventually leads to the gendering of livelihood options, where it is hard to diversify their livelihood pattern to adapt to the undesirable effects of climate change as they lack access to land, resources, decision making, education, information. Women are mostly risk-averse to climate-related hazards (Jianjun *et al.*, 2015), and with limited resources, they must find a way to diversify their livelihood, especially in families where males have migrated, leaving women to decide in the absence of their male partners, widows, divorced women, and so on. In Bangladesh where rural society is male-dominated like Vietnam, female-headed families have less opportunity to adopt adaptation measures for the cultural and social barrier that leads to limited access to land and resources for women, moreover, Bangladeshi women adopt diversifying crop variety as a livelihood diversification strategy within their society imposed limit, though the percentage of the female is lower than

the male to adopt the strategy, in Vietnam, women tend to engage in waged labor instead of agricultural work (Naz *et al.*, 2018; Ylipaa *et al.*, 2019; Huynh & Resurreccion, 2014). In Nepal, as the warming effect decreases crop production bound women to capitalize on their day labor service to survive (Onta & Resurreccion, 2011). Yila and Resurreccion denote in their study that in the semiarid areas of north-eastern Nigeria women along with the male partner (Though here also the patriarchal system of society belongs) adopt measures to diversify their livelihood like off-farm activities to ease the consumption pressure, as these drought-prone area fails to harvest to attain the food security. Ahmed and Fajber showed that coastal villages in Gujarat, India annual flooding and storm make bound to change the normal livelihood pattern like farming, fishing, salt farming, however in Uttarakhand, India women prefer to work as wage labor to diversify livelihood and in Mali shifted water-based to forest-based livelihood (Ravera *et al.*, 2016; Djoudi & Brockhaus, 2011).

3.1.3: Altered cultivation/crop management/crop diversification:

Every year, natural disasters wreak havoc on agriculture. Climate change has an especially negative impact on agrarian communities. Agrarian societies are primarily impoverished areas all over the world. According to research, women are the poorest of the poor. In agrarian civilization, adaptation is a critical indicator for long-term community management. Agricultural output is dominated by men, and men are the ones who conduct agricultural adaptation measures. Adaptive capability is characterized not just by money (assets), but also by the ability to seize opportunities for livelihood diversification. Gender constraints obstruct this ability. It is further hampered by labor division norms and customs, as well as class and ethnic group self-perceptions (Djoudi & Brockhaus, 2011). However, some societies allow women to participate in agriculture to some level, while some societies place a duty on women, allowing them to participate. Despite all these female-headed families, families without a male can apply crop management adaptation measures. In a study, Ravera *et al.* show that in India women emphasize short-cycle crop species, traditional rice resistance to flood to ensure food security at the time of flooding. In Nepal, most of the agricultural employment was split between Lama (a relatively higher caste) and Dalit (a lower caste) women. They plant *fapar*, a drought-resistant crop, to adapt to the changing environment as sharecroppers because they don't have their land to cultivate, also integrate trees into cultivated land, but in Mali, women are active in charcoal manufacturing to adapt to the new threat presented by climate change. Here they work as a sharecropper, though women have access to land but just by name not in work, where social class possesses a vital role in adopting adaptation measures (Onta & Resurreccion,

2011; Djoudi & Brockhaus, 2011; Yila & Resurreccion 2014; Ubels & Morgan, 2014). Yila and Resurreccion show with a lesser percentage than males, Nigerian women chose to intercrop, crop rotation, high yield variety, early maturing crop, sharecropping, and farm relocation as adaptation options. Women in coastal Bangladesh, a frequent disaster-prone area, engage in home-based gardening, salt-tolerant farming, and mangrove regeneration like in Erub Islands re-vegetation and community gardening to safeguard the ecology and adapt to climate change, however in char land women adopted mixed cropping like crop substitution, deep water crop, change planting practice and irrigation pattern to reduce crop damage from the flood, whereas, in haor area in Bangladesh, homestead gardening and floating garden is a preferable way (Naz *et al.*, 2018; Raihan & Hossain, 2021; Demetriades & Esplen, 2008; McNamara & Westoby, 2011). Another study shows that to deal with water constraints, Vietnamese women adapted by producing drought-resistant rice, changing the cultivation time, focusing on irrigation, and increasing productivity (Huynh & Resurreccion, 2014).

3.1.4: Personal loan/Microcredit/Borrowing money

Women are especially in need of adaptation measures in the face of shifting weather patterns and the ensuing environmental disasters (Demetriades & Esplen, 2008; Tanjeela & Rutherford, 2018). Adaptation is a costly process to execute, and it is said that poverty has a women's face. Women and girls with less resources and capacities than males are less able to adjust to present and future climate change impacts, as well as provide essential knowledge and insights to adaptation and mitigation decision-making (Demetriades & Esplen, 2008; Naz *et al.*, 2018; Khalil *et al.*, 2019; Sultana, 2010). Without monetary access buying crucial inputs for adaptation or to help the household is not possible at all thus, money borrowing from the middleman, microcredit, or taking personal loans for adaptation is a common strategy among women during environmental distress. Rural women of Bangladesh are the main drivers of the microfinance sector (Tanjeela & Rutherford, 2018). Naz *et al.* demonstrate that women in Bangladesh seek financial or credit loans from non-governmental organizations (NGOs), where they are given priority in receiving loans, to help their families, to deal with the detrimental consequences of climate change. Drought-prone areas in north-eastern Nigeria, female-headed households take agricultural loans, pesticides, tractors, and other tools from a government scheme to make adaptation choices, whereas women in coastal Vietnam borrow money at a cheaper interest rate, and women in central Vietnam have turned to take out loans to start new businesses to compensate for decreasing rice productivity (Yila & Resurreccion, 2014; Phan *et al.*, 2019; Huynh & Resurreccion, 2014). According to Ahmed and Fajber, women in Gujarat's coastal zone

switch their livelihood from agriculture to lobster rearing because of a climate event, and to do so, they take out loans from various organizations to cover the costs. As previously stated, adaptation is an expensive process.

3.1.5: Saving money and Property selling

Money is the primary indicator when income diversification or livelihood diversification is required as an adaptation strategy. Women are the poorest members of society and have limited access to assets. In these conditions, employing little saving or selling property as an adaptation technique for a limited length of time is seen as a strategy for coping with bad climatic events. In times of crisis, one of the most important adaptation tactics for households is the sale of personal assets, particularly those belonging to women, such as livestock, jewelry, utensils, and household items. In the time of selling property, women's property sells first then men's and women's capacity to save is limited which turns low means of coping capacity (Demetriades & Esplen, 2008). While livestock is vital in preventing malnutrition in many cases, they are undersold during crises, resulting in women becoming even more impoverished (Sultana, 2010). According to Naz *et al.*, char land women in Bangladesh engage in a variety of income-generating activities to conserve money and save so that in times of crisis like a flood, they can help their families manage or adapt to new livelihoods. In rural Vietnam, women emphasized saving money ahead of a disaster to enact climate change adaptation (Ylipaa *et al.*, 2019).

3.1.6: Migration

For landless and marginally impoverished individuals, migration is a crucial adaptation technique. When calamity strikes and there is no other way to survive, migration is the only way to adapt. It could be temporary or permanent, close, or far away. Off-farm earning opportunities arise because of migration. It is not as random for women as it is for men in terms of the adaptation approach. Despite not having legal title to land, male outmigration in Uttarakhand, Gujarat, India, and coastal areas in Bangladesh allows women in deciding on adaption tactics and income diversification choices. Because of the typical society gendered outlook, they confront various challenges in the absence of males, such as access to water for irrigation, loans, labor, and the extra burden of work (Ravera *et al.*, 2016; Ahmed & Fajber, 2009; Khalil *et al.*, 2019). In Vietnam, where water scarcity is reducing agricultural production, women with lower educational levels tend to move as waged labor in or adjacent communities or seasonal labor out-migration, especially during the dry months when they have no farming activity to do (Huynh & Resurreccion, 2014). In a drought-prone area of Nigeria, where agriculture is the primary source of income, female-headed families find it difficult to get the labor for agricultural output and are nearly forced to

migrate their child or themselves for off-farm work to relieve the family's consumption pressure (Yila & Resurreccion, 2014). Migration for off-farm income, mostly in agricultural communities where water shortage has put women in an even more vulnerable position due to their lack of land ownership, has become a crucial seasonal adaptation technique. Ready-made garments (RMG) are a source of hope for women migrating to Bangladesh because 80 percent to 85 percent of ready-made garments workers are women, whether skilled, semi-skilled, or unskilled. Following devastating disasters such as Aila in 2009 and Sidr in 2007 many women, predominantly coastal areas relocated to the city in search of work (Tanjeela & Rutherford, 2018).

3.1.7: Education/Training

Education paves the path for efficient disaster adaption strategies to be used before, during, and after a disaster. Women in underdeveloped countries, particularly in rural areas, lag behind men in terms of education due to gendered socio-cultural norms and practices. Educating and training others has evolved into a preventive adaptive strategy. Older women are more vulnerable to economic and social hardship than elderly men resulting from the combined effect of relatively limited access to employment and education throughout their lives (Demetriades & Esplen, 2008). From their life experience, elderly women want to educate their girls as a long-term adaptation measure. Training is a beneficial option of adaptation for those women who are now unable to attend school, as it allows them to diversify their income sources, diversify their livelihood, innovate, gain farming knowledge, and so on (Naz *et al.*, 2018). Literacy and training are very critical for boosting female adaptation. Access to training and official programs by both men and women may produce varied but complementary bundles of possibilities that households employ for adaptation (Ravera *et al.*, 2016). In Bangladesh flood-affected rural women take training from NGOs for avoiding flood risk by diversifying livelihood options, and in urban areas, poor women send their children to education as preventive adaptive measures (Naz *et al.*, 2018; Hossain & Rahman, 2018). Many organizations give training to women in drought-prone areas of India to help them adapt to and minimize the effects of climate change (Ravera *et al.*, 2016). The level of education of the household head determines how much support they can receive from agencies and how much they can promote adaptation tactics, as education improves the analytical ability to absorb climate adaptation strategies. Although there is a gender education gap in Nigeria, only a small portion of women are literate which helps them to take their own decision (Yila & Resurreccion, 2014). Women in Mali chose education as the most important long-term adaptation option for dealing with the country's recurring drought. Women want their children to be

educated so that they can get paid work and lessen their reliance on natural resources (Djoudi & Brockhaus, 2011).

3.1.8: Use of local indigenous knowledge

In a climactic event, local knowledge and indigenous coping strategy is regarded and acknowledged as critical adaptive technique. Local knowledge is a valuable resource for observing and controlling environmental change, as well as an underappreciated source of adaptive ability (McNamara & Westoby, 2011). Women have crucial resourceful local knowledge that can help with adaptation through the performance of household roles, mitigation as well as the potential to invent new solutions to deal with climate change (McNamara & Westoby, 2011; Sultana, 2010; Khalil *et al.*, 2019; Raihan & Hossain, 2021). The services offered by local ecological systems are tied closely to the actions of women. Women's reliance on natural resources enhances their capacity to collect and spread knowledge and information about ecosystems, therefore their unique talents and understanding provide a climate change adaptation potential (Djoudi & Brockhaus, 2011). In the Fijian islands, people are passing down significant knowledge about adaptive capacity mechanisms from previous catastrophic weather events, which is being passed down from generation to generation and this knowledge sharing has been utilized to plan for future extreme weather disasters. In an adaptation endeavor, context-specific information is critical. Women (locally known as aunts) in the Torres Strait Islands foresee rainfall patterns, wind direction time, and built their settlements with locally available materials to face weather occurrences, bringing self-sufficiency, ensuring food security, and establish adaptive ability, whereas, in Bangladesh, women used indigenous knowledge in rehabilitating, mitigate, prevent in climate change-related hazard (McNamara & Westoby, 2011; Sultana, 2010). Women can leverage their expertise outside their family to generate adaptive strategies through the propagation of grassroots innovation because of their connection with the domestic realm, home-based reproductive obligation (Khalil *et al.*, 2019; Huynh & Resurreccion, 2014). Women in Uttarakhand, India, use their traditional local knowledge to defend their families' food security during disasters and use natural components like ants' wings, birds' wings, the moon, and winds to foresee climatic events as an efficient adaptation method. as an adaptive measure (Ravera *et al.*, 2016).

3.1.9: Petty trade, livestock rearing, home-made product selling:

Several adaptation strategies are utilized all over the globe to alleviate the loss and harm caused by climate-induced stress (Naz *et al.*, 2018). Even though women are bound by many gender norms that imprison them to the family sphere with their reproductive duties

by restricting their mobility, women have also engaged in various income-generating activities to assist in disaster adaption.

Women in Uttarakhand, India, emphasize selling home-made products and petty trade as a strategy for adaptation, such as in Katpar village, Gujarat, India, where, with the help of NGOs, women make rope out of mill waste cotton to sell in the market as an additional income to adapt to the changes that the environment has foisted, and in Bangladesh, women make handicrafts such as pandas, dolls, and Nakshi Katha (cloth with cultural design) to export in a different country as a source of their income which they use for their adaptation in stresses (Ravera *et al.*, 2016; Ahmed & Fajber, 2009; Khalil *et al.*, 2019). Women in rural Vietnam engage in petty trade to combat the threat of climate-related water scarcity (Huynh & Resurreccion, 2014).

Livestock rearing is a common adaptation strategy for women so that they can use the livestock to maintain family nutrition in times of disaster and sell to earn money to meet other household needs. For example, in the Haor area of Bangladesh, women rear ducks as an adaptation measure to some extent, cattle grazing, firewood and fodder collection, animal husbandry for extra income, and poultry raising in Niger are all adaptation strategies for women (Naz *et al.*, 2018; Raihan & Hossain, 2021; Banerjee *et al.*, 2019; Huynh & Resurreccion, 2014; Yila & Resurreccion, 2014; Ylipaa *et al.*, 2019; Sultana, 2010; Djoudi & Brockhaus, 2011).

In some rural areas where food security is difficult to achieve, particularly after a disaster, assessing food becomes too difficult, and women try to consume less food than necessary to adapt to the adverse situation in climate change and feed other members of the family, where being hungry and eating last and less after ensuring others food security becomes an adaptation measure (Naz *et al.*, 2018; Ravera *et al.*, 2016; Ahmed & Fajber, 2009; Sultana, 2010; Tanjeela & Rutherford, 2018; Djoudi & Brockhaus, 2011).

3.1.10: Others

Women across the world use different adaptation tactics depending on their local knowledge, location, resource availability, social class, caste, religion, education level, and so on. Adaptation initiatives are viewed differently by men and women. In general, the women must make required preparations for the household, food, family members, and personal possessions before and during a disaster. Erub islands houses were built with local materials using indigenous knowledge to be protected and sustain from cyclones, stored foods for further use as temporary adaptation measures as well as African and Vietnamese women

who use to keep food stored, fetch water, collect firewood for short term coping (McNamara & Westoby, 2011; Yila & Resurreccion, 2014; Ylipaa *et al.*, 2019). Women in Bangladesh are both resourceful and vulnerable. They build a portable burner to cook on, store food and fuel in a safe and high location and build a high platform out of trees to store possessions during floods so that they may utilize it in the future, whether during or after the flood. Women can be inventors and contribute to sustainable adaptation measures with the right guidance and training, as Queen a woman from Bangladesh did when she invented homemade organic compost for using *macha* (High platform above the ground) system gardening on saline water, allowing crop diversification to reach new heights in flood-prone areas (Sultana, 2010; Khalil *et al.*, 2019).

4. DISCUSSION

The purpose of this research is to conduct a thorough evaluation of the current literature on women's natural calamity adaptation techniques in the face of climate change. Climate emergency is not gender-neutral; rather, it exacerbates existing gender imbalances, making life more difficult and vulnerable for women. Researchers have already recognized that reducing vulnerability, building resilience, and adapting to a sustainable way of living are all-important. After a systematic review of 695 pieces of literature 19 literature has been chosen for this study by using two electronic databases. Men and women have different perspectives on climate change adaptation depending on their access to resources, power, education, experience, decision-making authority and access, socio-cultural boundaries, space, and other aspects. Due to their reproductive duties, women cannot contribute as much to adaptation as men do, but they do make a major contribution within their boundaries, which is often disregarded in the literature all the way. Women's contributions have been acknowledged in this study, and literature has been chosen accordingly. The findings of this study show that women's active role in adaptation is still not recognized but, despite a range of constraints and obligations, women all over the globe contribute considerably to adaptation through several short- and long-term techniques. The results are provided in the form of themes derived from women's adaptation techniques.

Women should not be thought of as a homogeneous population in terms of adaptation because there is intersectionality based on race, class, location, and culture, as they use a variety of adaption strategies (Djoudi & Brockhaus, 2011; Huynh & Resurreccion, 2014). Diversification of income sources is the first theme used here. Gujarat is a coastal zone in India where several disasters occur annually, such as cyclones, salty water, floods, and droughts, for which the residents of the region must choose various income diversification techniques to adapt to climate danger.

Women in these areas contribute to adaptation to help their families, such as rope making, but they are unable to make basic adaptation decisions due to gender intersecting with caste, lack of education, gender identity, lack of clear legal authority over land, lack of access to information, and socio-cultural barriers (Ahmed & Fajber, 2009). Gender constraints, gendered values, and class in Mali tradition limit women's spontaneous behavior, even though they have equal access to land as men. Water shortages prompted them to diversify their income sources, such as charcoal manufacturing, to adapt to climate change, but this extra work eventually burdened women, as males prefer to travel for adaptation and women don't have access to decision-making and must deal with land ownership issues (Djoudi & Brockhaus, 2011). In Bangladesh, women often undertake a lot of money-generating labor to support their families' income, but they face several obstacles such as a lack of resources, decision-making authority, education, socio-cultural barriers, movement restrictions, power structure, religious hurdles, and lack of knowledge (Naz *et al.*, 2018; Khalil *et al.*, 2019). Adopting a diversified source of income in Vietnam, like in Mali, is more difficult for women than it is for males, given society's conventional attitude toward women (Huynh & Resurreccion, 2014; Djoudi & Brockhaus, 2011). Diversifying income sources as a disaster adaption technique is more difficult for women than for men in all societies, according to studies.

Diversification of livelihoods is a widely used adaptation approach all around the world. Not every society enables women to vary their sources of income, and women tend to diversify where they are allowed or accepted by their families and society. Women in Mali are shifting their livelihoods to forest-based labor owing to water constraints and grazing cattle. Women are intimately tied to the environment and have a multi-dimensional perspective on how to manage and use it. For example, when a man's livelihood is converted to a forest-based one, he tends to focus on wood output, but women prefer to use trees for a variety of purposes such as fuel, fodder, and shade, in Nigeria, Nepal women adopt off-farm activity as agricultural activity fails to ensure food security because of drought (Djoudi & Brockhaus, 2011; Yila & Resurreccion; Onta & Resurreccion, 2011). Even though climate adaptation is critical in a natural resource-based society, due to climate change in Vietnam, farm-based activities have become devalued, and men have shifted to off-farm activities, leaving women to manage the farm as an adaptation strategy with limited mobility and few other options for finding work. They also employ waged labor to diversify their sources of income. Women's livelihood diversification is hampered by the social milieu, which does not recognize their contribution (Huynh & Resurreccion, 2014; Ylipaa *et al.*, 2019). Women in India and Bangladesh, where they are a marginalized demographic, contribute to supplement

family income through diversifying livelihood options. Work as hired labor, engage in off-farm activities even though class, caste, and macho culture place additional pressure and restrictions on them, and they lack even land rights and decision-making authority (Ravera *et al.*, 2016; Ahmed & Fajber, 2009; Naz *et al.*, 2018; Khalil *et al.*, 2019).

Because women are less qualified for other employment due to their socially imposed responsibility or have only agricultural knowledge, agriculture-based livelihoods have sought to adapt within the agricultural sector. Women in agrarian civilizations work alongside their male spouses to accept new agricultural practices to adapt to climate change, while in certain societies, women are largely responsible for agricultural labor. To adapt to climatic change women, tend to cultivate short term crops so that they can harvest before disastrous periods, put the effort into irrigation in drought-prone areas, cultivate flood-resistant, drought-resistant crops (*Fapar*), produce charcoal, try to cultivate in *macha* (high bed made of tree or bamboo) to survive within the climatic hazard (Ravera *et al.*, 2016; Ubels & Morgan, 2014; Djoudi & Brockhaus, 2011; Naz *et al.*, 2018). In some cases, they change the harvesting time, use floating garden, home garden, change the time and place of cultivation, intercropping, sharecropping, and so on (Yila & Resurreccion 2014; Naz *et al.*, 2018; Raihan & Hossain, 2021; Demetriades & Esplen, 2008; McNamara & Westoby, 2011; Huynh & Resurreccion, 2014). Female-headed households confront labor shortages, can't afford good irrigation, social institutions aren't ready to accept women as farmers or landowners, and gender stereotypes stifle them at every step of the adaption process, according to the study. Male migrating families appoint women as *ad hoc* family heads to make decisions, but because of a lack of resources, abrupt responsibility places additional strain on the women with their reproductive responsibility, and mobility restrictions prevent them from accessing assistance and getting the proper price of their product. The socio-economic barrier to access land and assets still create problem in adopting proactive adaptation decision.

Borrowing money from a person, NGOs, an institution is a common measure to bear the expenses of adaptation as adaptation is a costly process. In Bangladesh, women can get micro credit easily to diversify their livelihood options such as buying livestock, running a small business, invest in cultivation to adapt to the adverse situation caused by climate change, as women are the main stakeholder of microcredit (Tanjeela & Rutherford, 2018; Naz *et al.*, 2018). Nigerian, Vietnamese, Indian women take loans either any of the sources to bear the cost of livelihood or income diversification, and the loan repayment rate is high among women (Yila & Resurreccion, 2014; Djoudi & Brockhaus, 2011; Phan *et al.*, 2019; Huynh &

Resurreccion, 2014; Ahmed & Fajber, 2009). The problem arises when women get the loan but cannot make the decision about where and how to spend it. They can use it with the permission of the male part. Women often have a lesser saving capacity than males. To adapt, a steady flow of money is required, which women lack. Personal jewels, land, cutlery, and cattle are examples of assets that can be sold. When it comes to property, women usually obtain less productive land, but when they need to sell, they sell their property first, and as a result, women become poorer, making them more susceptible and leaving them incapable of purchasing critical inputs (Demetriades & Esplen, 2008). Money is a strength that raises the status, decision-making power in the family and may assist in problem resolution, but women lack of it.

Migration is a viable option for adapting to climate change, as disasters often leave the impoverished and marginalized with no possibility of survival. Though in terms of catastrophe effect, women are the most impacted and vulnerable because of their traditional position in the home, limited mobility, lack of access to information, and socio-cultural norms, males prefer to move, leaving defenseless women in search of alternative livelihoods (Tanjeela & Rutherford, 2018; Naz *et al.*, 2018). Though men migration put an extra burden of responsibility on women, in the long run, it develops the capacity of women to take an important decision in absence of males (Ravera *et al.*, 2016; Ahmed & Fajber, 2009; Khalil *et al.*, 2019). The positive side is some opportunities are opening for women to migrate for alternative livelihoods, such as in Bangladesh RMG (Ready-made Garment) sector is mostly women worker dependent with no experience and low payment, in Vietnam women tend to off-farm activity and thus migrate temporarily nearby area (Tanjeela & Rutherford, 2018; Huynh & Resurreccion, 2014). Being brutally damaged by disaster women choose to migrate to the city in search of work to survive. But their children become insecure as there is nobody to take care of and traditional society is not ready to send their unmarried girl to the city as they think it is disrespectful.

Literacy and training become an adaptation strategy because they allow people to gain experience, obtain knowledge, choose an alternate livelihood choice other than farming, generate income, and make informed decisions. In many countries, women who lack access to training or education are encouraged to send their daughters to school as a preventative adaptation approach. Their expertise, training, and education make it simple to implement appropriate adaption steps (Demetriades & Esplen, 2008; Naz *et al.*, 2018). Whether it in Bangladesh, India, Nigeria, Mali getting education for women is a challenge, moreover by the help of NGOs they are getting training in

different aspects like cultivation hand made products, income-generating activities to survive with the climate-related threats (Naz *et al.*, 2018; Hossain & Rahman, 2017; Ravera *et al.*, 2016; Yila & Resurreccion, 2014; Djoudi & Brockhaus, 2011). Women from undeveloped or developing nations find it difficult to get warning information due to a lack of knowledge, education, However, the socio-cultural environment is still in the opposite position in terms of female education, even though many countries have made it free for women to close the literacy gap between men and women.

Because of their strong relationship with ecology and nature, women are resourceful agents of local indigenous knowledge. Women utilize local knowledge to anticipate disasters, adapt during and after disasters, ensure food security of family, and build disaster-resistant structures in their homes. It is well known that local community-specific information is extremely important in disaster adaptation since livelihood patterns and perceptions differ greatly among communities (McNamara & Westoby, 2011; Sultana, 2010; Khalil *et al.*, 2019; Raihan & Hossain, 2021; Djoudi & Brockhaus, 2011; Huynh & Resurreccion, 2014; Ravera *et al.*, 2016). If this crucial information is included in an institution's long-term disaster adaptation strategy, it will result in a shift in disaster adaptation and mitigation. Rather of employing all these strategies, women engage in small business, food storage, firewood preservation, and multidimensional activities to adjust to the disaster impact, even being hungry to ensure family members food security is also an adaptation measure of women (Yila & Resurreccion, 2014; Ylipaa *et al.*, 2019; Ravera *et al.*, 2016; Ahmed & Fajber, 2009; Sultana, 2010; Tanjeela & Rutherford, 2018). Women's adaptability potential is hampered by several reasons, according to the study. They are power relations, gender gap, gendered responsibility, access to education, training, and information, socio-cultural norms, lack of legal property rights, restriction in mobility, lack of resources so on.

The study had flaws, such as the fact that it used two databases to choose literature, resulting in a low take-up of literature and the inability to generalize the results. More discoveries might improve the study's value. Another flaw is that only journal articles were chosen, even though additional sources may have provided more thorough knowledge. Moreover, generated knowledge will be critical in gaining a comprehensive understanding of women's disaster adaptation strategies and the need of recognising their contributions. Despite these flaws, we feel the study's observations will contribute to a better understanding of the larger conceptual scope of women's disaster adaptation tactics in a changing climate, as well as the obstacles that impede women's action.

5. FUTURE DIRECTION

Women's adaptation strategies are unclear and unknown since extant literature has not focused on this critical subject. There are still a few holes to fill, including the need for further cross-regional, comparative case study research. Women's disaster adaptation should receive more attention because they are the most susceptible in disaster situations across the world and literature on women's adaptation is still in the primary stage whereas there are numerous pieces of literature on adaptation in disaster in general. Most of the literature portrayed women as subordinate groups in society who cannot take proper initiative but work as a side-line guide to men. Knowing women's selected approach for adaptation might provide policy recommendations a new dimension and help to empower them. As a result, various areas of study must be addressed.

Women are not homogeneous when it comes to disaster adaptation, and they have varied perceptions of fact and reality, thus policy should focus on their identities though, the most notable work of which is the strong reliance on generalizations that do not apply to all people in all settings. Along with adaptation, the method of minimizing hindrance factors that limit women's ability to adapt should be emphasized in the literature with adequate explanation and policy should be taken properly so that sustainable adaptation can be initiated, and intersecting inequalities can be traced. Accepting the contribution of women will empower them and enable them to fight back in the future.

To acquire a good picture of women's demands and experiences, more study should be done stressing qualitative methods. It should also focus on how women's disaster adaptation expertise and initiative can contribute to positive change in disaster mitigation, such as encouraging meaningful participation of women and girls in disaster adaptation decision-making. It contributes to the reduction of gender disparities by enhancing the visibility and status of women and girls in the community and challenging misconceptions about their abilities. Development policies should be adaptation targeted so that they can minimize vulnerability. Priorities are needed to possibilities for adaptation tactics that aren't focused on the land.

6. CONCLUSION

This study attempted to present a comprehensive picture of how women, the most vulnerable section of society in disasters, adopt various adaptation strategies despite numerous limitations imposed by society and family institutions by conducting a systematic review and analysis of the existing literature. Current adaptation is predominantly focused on men-based adaptation where women are in minor positions. The relevance of women's adaptation techniques to climatic disaster has been underlined in

this systematic study. According to this study, because of their strong relationship with the environment and indigenous local knowledge, which enables them to adopt appropriate and situation-specific steps to survive in a disaster, and women are essential actors in disaster adaptation. The study found the responsible factors that restrict women's adaptations are power relations, gender gap, gendered responsibility, access to education, training, and information, socio-cultural norms, lack of legal property rights, restriction in mobility, lack of resources existing inequalities. In this study adaptation strategies of women are presented through some themes named based on strategies. Moreover, suggests several recommendations for future studies focused on the shortcoming of existing work on women's adaptation strategies in disaster.

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