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GEOGRAPHY AND THE ENVIRONMENT**

**AN EXPLORATION INTO THE IMPACT OF OUT-
MIGRATION ON THE CHOICE'S WOMEN MAKE IN
PREPARING FOR OR RESPONDING TO RAPID ONSET
WEATHER HAZARDS IN THE INDIAN BENGAL DELTA**

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**This dissertation is submitted as part of an MSc degree in Sustainability at the University
of Southampton**

Statement of Originality

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Abstract

The vulnerability of deltaic environments is being increasingly recognised, with a multitude of stressors threatening the lives of communities and re-shaping livelihood decisions. Women, as a vulnerable and marginalised group, experience this the most acutely. The largest deltaic region is the Ganges-Bhramputra-Meghna (GBM) delta, the Eastern Indian region of the delta is referred to as the Indian Bengal Delta (IBD). Weather hazards are characteristics of these deltas, of these, cyclones, floods and storm surges are most dominant. Climate change and natural hazards research converges to identify adaptation as a key concept to reduce risk and vulnerability to natural hazards. Adaptive strategies are undertaken to prepare for and respond to these natural hazards. Migration is recognised, as one of the three sustainable livelihoods, alongside livelihood diversification and agricultural intensification. Primarily men migrate, therefore, women are left behind to look after the household and livelihoods. There is limited research exploring the impacts of out-migration and the adaptive strategies women undertake, particularly within the IBD. Therefore, the aim of this research is to explore the impact of out-migration on the choice's women make in preparing for or responding to rapid onset weather hazards in the IBD. This research study will employ an explanatory sequential mixed methods approach, with secondary quantitative survey data and in-depth interviews to allow for an exploration of the complexities of adaptation and migration inclusive of gender. The findings of this study show that women are impacted by out-migration, with social aspects highlighted as the main mediating factors for how positively or negatively women experience out-migration and in turn the adaptive strategies they undertake. These findings have important implications for management and policy of rural, deltaic regions.

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Abbreviations

IBD	Indian Bengal Delta
DECCMA	DEltas, Vulnerability and Climate Change: Migration and Adaptation
GBM	Ganges Brahmaputra Meghna Delta
SHG	Self Help Groups
UNFCCC	United Nations Framework Convention on Climate Change
SPSS	Statistical Package for the Social Sciences
PIS	Participant Information Sheet
WRT	Wealth Rank Tool
IPCC	Inter-Governmental panel on Climate Change
WMO	World Meteorological Organisation
UNEP	United Nations Environment Programme
NGO	Non-Governmental Organisation
DRR	Disaster Risk Reduction

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Chapter 1

Introduction

1.0 Background

Over 500 million people reside in deltaic, coastal regions, relying on these environments for their livelihoods (Cazcarro et al, 2018; Tessler et al, 2015). These regions are recognised for their economic and environmental importance, which sustain rural and urban populations (Ericson et al, 2006). Deltaic environments have been classified within the Sustainable Development Goals (SDG's) as vulnerable regions, with focus on mitigating the impacts of environmental change and developing sustainable approaches for delta management to ensure food security and socio-economic development (United Nations Development Programme (UNDP), 2015). Deltas are classed as 'dynamic coastal systems that are unique in their close links to both land-based fluvial and coastal ocean processes' (Ericson et al, 2006). Ganges-Brahmaputra-Meghna (GBM) is the largest delta spanning Bangladesh and Eastern India. The Indian national boundary of the GMB delta is referred to as the Indian Bengal Delta (IBD) (DELtas, Vulnerability and Climate Change: Migration and Adaptation (DECCMA), 2018). A study assessing risk and sustainability of 48 coastal deltas globally, categorised the GBM Delta as being at high risk of natural hazards because of its socio-economic vulnerability, concluded from mapping deltaic risk, which involved measuring exposure to hazards, population density and socio-economic vulnerability (Tessler et al, 2015).

Deltaic regions are particularly at risk from multiple weather hazards, the low-lying environment leaves rural populations exposed and vulnerable to the impacts of these. Weather hazards are defined as both rapid onset, cyclones and floods, and slow onset, drought and salinity. Rapid onset are the dominant hazards which demonstrate significant implications for these rural communities, threatening both lives and livelihoods alike (O'Hare, 2001). Bio-physical characteristics combined with population growth and urbanisation are causing both rural and urban populations to be under increased risk and vulnerability (Tessler et al, 2015). Within climate change and natural hazards literature, lies adaptation and mitigation, two concepts which have grown to be critical aspects developed to reduce risk and vulnerability. This literature is inherently interdisciplinary, drawing on both bio-physical and socio-economic dimensions at all spatial and temporal scales. Within adaptation discourse, adaptive strategies are defined, by the Intergovernmental Panel on Climate

Change (IPCC) as ‘the process of adjustment to actual or expected climate and its effects’ (Klein et al, 2014). These adaptive strategies occur at a variety of scales, including governance, household and individual (Mallick, 2011; Mazumdar et al, 2014; Hajra, 2017). Household adaptation research within the IBD has been increasingly documented in recent years. The current literature suggests a wide range of adaptations across these scales. Household adaptations undertaken to cope with rapid onset weather hazards have been documented in the IBD, including taking out loans (Chowdhury, 2016), diversification of livelihoods (Bhattacharjee and Behera), preserving food and fuel (Hajra et al, 2017) and migration (DECCMA, 2018).

Within rural, deltaic environments, three sustainable livelihoods have been identified; migration, livelihood diversification and agricultural intensification (Kundu, 2013; McDowell and de Haan, 1997). Of these livelihoods, migration has played a crucial role in the recent history of West Bengal, contributing to reducing socio-economic vulnerability (Banu, 2016; Debnath and Nayak, 2018; Keshri and Bhagat, 2013). Whilst current research primarily explores migration networks and migrants at the place of destination, there is a growing amount of research exploring the impacts of out-migration in rural deltaic communities and the place of origin. Primarily, these studies have explored and documented the characteristics of out-migration, including migrant flows and remittance networks, with relation to national census data (Banu, 2016; Debnath and Nayak, 2018). Men are the household heads, primarily observed as the breadwinners, decision makers and migrants within households. When men out-migrate, women are left to adopt additional household roles, decision making powers, and are the de facto household head. Women can be defined as a vulnerable and marginalised group, with a lack of representation within deltaic environments, adaptation and migration literature. The impact of out-migration on women is often referred to as the ‘migration left-behind nexus’ within literature. On the one hand, this literature has identified that out-migration has been seen to increase women’s autonomy and agency from greater influence in household decision making (Desai and Banerji, 2008; Sabhlok, 2011; Sangeeth *et al*, 2013). On the other hand, out-migration has shown to significantly impact women’s wellbeing through social isolation and loss of household members (Ghosh et al, 2018).

The impact of out-migration on the adaptive strategies women undertake when preparing for and responding to weather hazards has been an area of research increasing within deltaic regions globally (Nelson et al, 2002; McLeman and Hunter, 2010; Chindarkar, 2012). After cyclone Alia hit the GBM delta in 2009 coupled by the recognition of increasing vulnerability of deltas, there has been an increase in research exploring adaptive strategies of women in the IBD. Before this

however, the IBD received very little research. Researchers continue to highlight the future changes in climate and the implications that they pose significant challenges for society (Adger, 2003). These challenges will be experienced differently at local, national and international scales but also, within different societal groups. Marginalised and vulnerable groups, including women, have been shown to experience the impacts of natural hazards the most acutely and with the least capacity to prepare for and respond to these impacts (Demetriades and Esplen, 2008). After outlining the background and rationale for the research and study area, the aim, research objectives and research questions will be presented.

1.1 Aim

To explore the impact of out-migration on the choice's women make in preparing for or responding to rapid onset weather hazards in the IBD.

1.2 Research Objectives and Research Questions

To explore the aim, the following research objectives and subsequent research questions have been developed and are presented in Table 1.

TABLE 1: RESEARCH OBJECTIVES AND RESEARCH QUESTIONS

Research Objectives	Research Questions
1. To document the characteristics of out-migration of the IBD	<ul style="list-style-type: none"> What are the main characteristics of out-migration in the IBD?
2. To identify and categorise the main adaptive strategies that are undertaken by non-migrant households, migrant households and women in migrant households to prepare for and respond to rapid onset weather hazards	<ul style="list-style-type: none"> How are rapid onset weather hazards perceived by households and what causes them to adopt strategies? Which adaptive strategies have been undertaken by migrant and non-migrant households? What adaptive strategies do women in migrant households undertake?
3. To explore whether out-migration impacts migrant women's wellbeing and the adaptive strategies they use to prepare for and respond to rapid onset weather hazards	<ul style="list-style-type: none"> How does out-migration impact women in migrant households? Do the impacts of out-migration impact the choices and adaptive strategies women undertake? Are there any barriers to adaptation experienced by women in migrant households?

1.3 Study Area: The Indian Bengal Delta and Case Study Area

The IBD refers to the India national area of the GBM delta (DECCMA, 2018). The IBD national area has an area of 14,054sq.km, this has been defined by DECCMA because the areas is 5m of mean sea level. The IBD and the case study area are presented spatially within Figure 1.

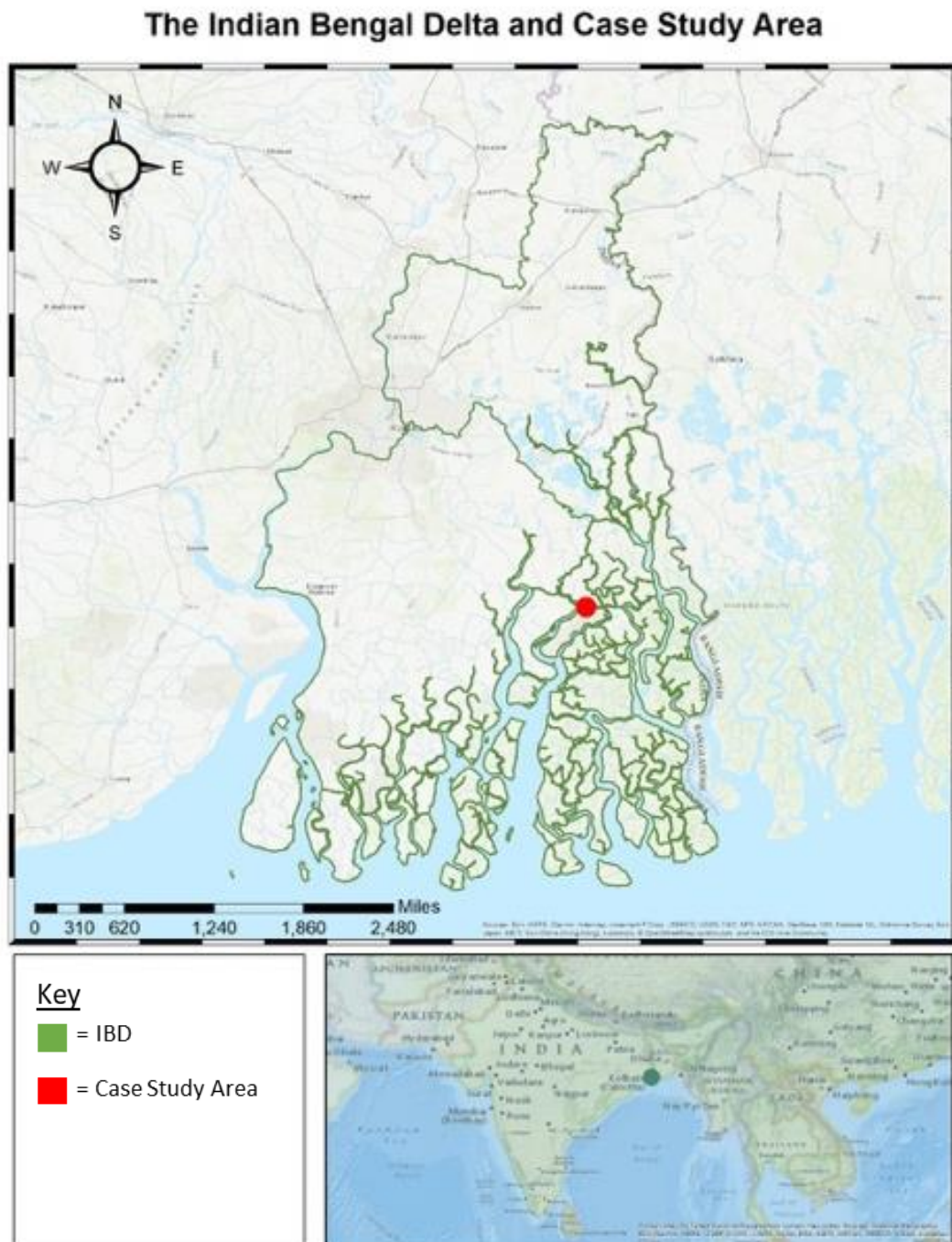


FIGURE 1: MAP OF THE IBD AND CASE STUDY AREA (AUTHORS OWN)

It is populated with over 18 million people. Situated at the south of the IBD is a protected natural environment, home to the Royal Bengal Tiger, called the Sundarbans (DECCMA, 2018).

1.4 Summary

The IBD can be categorised within a unique social and cultural context, the implications of out-migration have been extensively researched, with a high mobility categorised in the delta. Migration is an important livelihood strategy, which is primarily undertaken by men. Women in these areas are left behind with additional household, child rearing and day-to-day livelihood activities. Whilst out-migration and its impact on women and how they adapt to weather hazards has been researched and documented in literature, it is not well explored within the context of the IBD, with existing literature inherently contradictory. This research study will address the gap in current literature by firstly, documenting the characteristics of out-migration within the IBD. The dynamic nature of migration warrants the need for documenting the contextual foundation to build on the impact of out-migration on the adaptive strategies women undertake. Secondly, it will identify and categorise the adaptive strategies undertaken by households (non-migrant, migrant and women in migrant households). Finally, it will gain insight and explore whether out-migration impacts women's ability to undertake adaptive strategies. It will identify any factors that influence and impact women's wellbeing and the adaptive strategies women undertaken in preparing for and responding to rapid onset weather hazards.

To explore this phenomenon, this research study will be presented in six chapters. Following Chapter 1, this research study will proceed with Chapter 2 consisting of a review of the current literature on the research objectives and questions. Chapter 3 will present the mixed methods explanatory sequential research design, inclusive of methodological issues and considerations. Chapter 4 will present and analyse the results from the quantitative and qualitative data. This will be presented according to the research objectives: Out-Migration, Observed Adaptation (migrant households, non-migrant households and women in migrant households) and Impacts of Out-migration. Chapter 5 will synthesise the results and analysis section in relation to current literature, focussing on the value of the study and the limitations. Chapter 6 will provide a conclusion to the research study, summarising the key insights, detailing the implications for policy and highlighting the areas of future research.

Chapter 2

Literature Review

2.0 Introduction

As outlined in Chapter 1, the focus of this dissertation is on the vulnerability of women in relation to the impacts of out-migration, adaptive strategies and weather hazards in deltaic environments. Denton highlights the vulnerability of women, stating that '70% of the 1.3 billion people in the developing world, living below the threshold of poverty, are women' (2010). Women, as a marginalised group, are inherently under represented within literature and policy. Within the context of deltas, this has been increasingly recognised and is reflected in the growth in gender inclusive research within the developing world and deltaic regions. Deltaic environments are defined as inherently mobile communities, with men often out-migrating for economic reasons from these regions and leaving women within the rural areas. A growing amount of literature has been devoted to exploring women in the context of vulnerability within migration processes (Islam, 2011; Warner et al, 2010; Amuedo-Dorantes and Pozo, 2006; Taylor, 1999; Curran and Saguy, 2001).

To document and review the current literature in relation to this focus, this chapter will firstly provide context on deltaic environments. It will outline the rapid onset weather hazards and their prevalence and impacts on communities in the IBD, with reference to climate change. Adaptation, its definition and the key concepts, will be discussed in relation to observed adaptation within the IBD and barriers to adaptation. Out-migration will form the final section of the literature review, with an exploration of impacts on out-migration on women and its outcomes within rural communities. It will then summarise and highlight the gaps in the current literature.

In order to explore the current literature, a tiered search was applied to find relevant textual papers. The search engine SCOPUS was used to carry out the search by combining the terms from each tier systematically, shown within Table 2. The use of truncated words and interchangeable words for the IBD were also used to ensure breadth of literature. The search aimed to include a large range of literature including systematic reviews, books and peer-reviewed journals, to ensure the full range of literature was filtered for review. Furthermore, a Google search was applied to explore additional relevant documents, including reports, policy and initiatives, related to the current literature.

TABLE 2: EXAMPLE TIERED SEARCH TERMS APPLIED TO FIND THE LITERATURE

Tier 1: Location	Tier 2: The Hazard	Tier 3: Unit of Interest	Tier 4: The Action
'Indian Bengal Delta'	Hazar*	Wom*	Impact*
India*	Flood*	Hous*	Resilien*
Sundarbans	Monsoon	Migra*	Vulner*
Delta*	Cyclone	Men	Cop*
Rural	Rapid-Onset	Rela*	Adapt*
	Climat*		'left behind'
	'Climate change'		

2.1 Rapid Onset Weather Hazards

Weather hazards are defined within literature as rapid and slow onset. Rapid onset weather hazards occur quickly often with little warning, with the ability to forecasting their effects, duration and frequency (Kovats and Akhtar, 2008). Slow onset weather hazards occur slowly and over many years (Kovats and Akhtar, 2008). Throughout Asia, there is evidence to show that there are increases in the intensity and frequency of extreme weather events, especially rapid onset hazards, tropical cyclones and flooding from intense rainfall (Klein et al, 2014; Cruz et al, 2007; Hazra et al, 2003). The impacts of these, amongst others, have been observed as loss of income and livelihoods, threats to life and wellbeing (Klein et al, 2014; Cruz et al, 2007). Furthermore, the predicted increases in rainfall and glacial melting, from anthropogenic impacts, could change the duration and intensity of the monsoon periods (Cruz et al, 2007). This could pose significant challenges for flood-prone areas within Asia, such as the IBD (Mallick and Vogt, 2014). The environmental and development problems have been observed to be exacerbated by climate change, leaving coastal communities increasingly vulnerable to multiple stressors (Klein et al, 2014; Cruz et al, 2007).

2.1.1 Climate Change

Global climate change is the changes in the climate caused by anthropogenic impacts (United Nations Framework Convention on Climate Change (UNFCCC), 2007). Controversy surrounding this topic lies in extensive political, scientific and behavioural debate surrounding the 'change' in climate (Adams, 1990; Bianchi and Allison, 2009; McMichael et al, 2006). Early climate researchers, Landsberg and Machta, predicted in 1974 that climate change would become a major environmental

issue. They stated, with certainty, that anthropogenic impacts on the climate would be experienced locally, with global consequences.

Within the large body of global climate change research and debate, deltas have been established as particularly vulnerable regions to climatic change and sea level rise, with the social, economic and environmental implications unknown (Cazcarro et al, 2018). A UNFCCC report reviewing literature on regional impacts of climate change has documented, with certainty, that Asia will be implicated by climate change within 'water resources, agriculture and food security, ecosystems and biodiversity, human health and coastal zones' (2007). Coastal zones and deltaic environments are highlighted as a significant sector affected by climate change. Human impacts are increasingly degrading the environment attributing to a loss in environmental productivity and provision of natural resources (Klein et al, 2014). The UNFCCC states that the 'environmental and development problems in Asia will be exacerbated by climate change' (2007).

The importance for documenting climate change within this study is to present the facts and controversy surrounding the impact on rural communities and weather hazards. Global climate change is set to impact people and the environment significantly in the future, but these impacts are not well known or understood. Deltaic environments have been categorised as the most vulnerable regions globally, especially to the impacts of climate change (Wassman et al, 2009; Thomalla et al, 2006). The projected sea level rises have shown the impacts of salinity, increasing frequency of natural hazards, such as cyclones and monsoon patterns, which may leave populations living in these areas exposed to multiple and increased stressors (Adger, 1999; Kelly and Adger, 2000; Ericson et al 2006). It is fair to summarise that the impact of global climate change will, or is, going to impact deltaic regions. Global climate change, out-migration and natural hazards exist, but their association is unknown and complex.

2.1.2 Rapid Onset Weather Hazards in the IBD

As a low-lying, coastal and deltaic environment, the IBD is a region highly subject to natural hazards. Cyclones, flooding and storm surges are the dominant rapid-onset weather hazards in the IBD. Flooding is experienced on an annual cyclical basis, particularly, during monsoon season, with the risk of flooding limited and localised throughout the delta and the risk stratified over the wider delta

(DECCMA, 2018). Cyclones on the other hand, are less frequent, with cyclone Alia, which hit the IBD in 2009, one of the largest disasters experienced in the last 20 years.

Ghosh et al (2018) explored the impacts of cyclone Alia attributing the event as a direct consequence of climate change. As previously discussed, deltaic regions are prone to weather hazards and disasters and this is a prime example of attribution of localised events to climate change. The instance of Landsbery and Matcha's 'certainty' around the anthropogenic impacts and the 'uncertainty' surrounding the scale of impacts provides a perfect example of the controversial 'attribution' of this phenomenon to local natural hazards, changes in environment and climate. Whilst early researchers believed that climate change would significantly impact the local scale, the scientific evidence of today the impacts can be identified on a global scale. Many scholars suggest the impact on the local scales, often attributing migration and increasing frequency of natural hazards, to this phenomenon. The evidence to this affect is unproven. Whilst there are many correlations and causalities between events, other stressors within this phenomenon are present. A vast amount of research has been conducted to assess and understand the connections between socio-economic and bio-physical dimensions and the impact climate change is set to have on these coastal regions (Cazcarro et al, 2018). From this research, climate mitigation and adaptation have emerged, which contribute to developing sustainable development and management plans for deltaic environments.

2.2 Adaptation

The aforementioned recent developments in climate change and natural hazards research have led to an evolution of terms, concepts, frameworks and extensive research (Kelly and Adger, 2000; Smit and Pilifosova, 2003; Smit and Wandel, 2006). Mitigation and adaptation are the primary concepts. Mitigation was the original goal within the climate change field, with adaptation presently taking preference. Adaptation strategies aim to offset, moderate and mitigate the impacts of weather hazards and climate change scenarios. The term adaptation has been applied differently in a range of disciplines, with its origins lying in political ecology and evolutionary biology, it has become an emergent subject within climate research. Unlike climate change, sustainable development and migration, the term adaptation has no singular universal definition, but is used as frequently (Jones and Boyd, 2011; Kelly and Adger, 2000). Whilst the IPCC define adaptation simply, Smit and Pilifosova's (2003) definition can add dimension and depth to the concept of adaptation as a;

‘This term refers to changes in processes, practices, or structures to moderate or offset potential damages or to take advantage of opportunities associated with changes in climate.’

Moser and Ekstrom (2010) prefer to define adaptation in relation to specific temporal and spatial aspects;

‘strategies and actions can range from short-term coping to longer-term, deeper transformations, aim to meet more than climate change goals alone, and may or may not succeed in moderating harm or exploiting beneficial opportunities.’

The development of the adaptation definition is important; adaptation is a concept that is constantly evolving and its applicability within spatial and temporal scales important. Within the field of adaptation research, the key terms vulnerability and adaptive capacity are at the heart of conceptual frameworks and debate (Smit and Wandel, 2006). Adaptations, interchangeably used with adaptive strategies, are manifestations of adaptive capacity, whereby, changes within a system are undertaken to deal with vulnerability, exposure or sensitivity (Franhauser et al, 1999; Fussel, 2007; Smit, 2000).

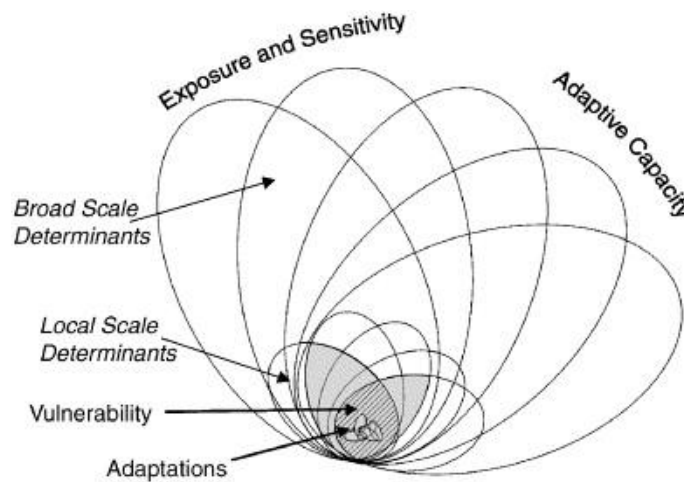


FIGURE 2: NESTED HIERARCHY MODEL OF VULNERABILITY (SMIT AND WANDELL, 2006)

Figure 2 represents the nested hierarchy model of vulnerability, whereby the different factors are shown to interplay within a variety of scales. Adaptations are at the centre of this diagram, which represents their importance for influencing vulnerability (exposure and sensitivity) and adaptive capacity. *Adaptive capacity* is inherently context specific, varying from and within country to country, amongst social groups and at household and individual levels (Smit and Wandel, 2006).

Temporal and spatial aspects also play critical roles within adaptive capacity, for example households and individuals are dependent on communities and regional processes, within unspecific and specific timeframes. Literature has aimed to label differences within short term and long-term capacity. 'Coping ability' and 'adaptability' (Watts and Bohle, 1993; Smit and Wandel, 2006) are often used in reference to short term capacity, whereby, normal climatic conditions and small deviations from the norm are easily adapted to. The majority of scholars predominantly employ 'adaptive capacity' for longer term adjustments whereby exposure to extreme events or a multitude of stressors may need more sustainable adjustments for a community to cope (Kelly and Adger, 2000; Smit and Skinner, 2002; Park et al, 2012). Moser and Ekstrom (2010) emphasise the importance of intentional and planned adaptation to ensure long term thought within adaptation, instead of short-term actions, with shallower goals.

Vulnerability by definition is a broad term, however, within the field of climate change sciences, it is related to 'resilience, marginality, susceptibility, adaptability, fragility, and risk' (Paul, 2013). It converges the fields of natural hazards, development and environment. Similarly to adaptation, the term has no singular universal definition or meaning but can be defined within these fields as:

'an internal risk factor of the subject or a system that is exposed to a hazard and corresponds to its intrinsic tendency to be affected, or susceptible to damage.' (Paul, 2013)

Theoretically and conceptually the key terms and broad models are fairly consistent throughout the literature, however, adaptive capacity is context-specific with no universal model or categorising system to assess communities, households or specific scales.

Adaptive strategies take many forms and levels of which scholars have aimed to use categories and typologies to document. Smit and Wandel (2006) outline four forms and levels of adaptive strategies; timing relative to stimulus, spatial scope, intent and form. The timing relative to a stimulus can be anticipatory, concurrent or reactive (Hoffmann and Sgro, 2011). The spatial scope of an adaptive strategy can be local, within a community or household, or more widespread (Grothman and Patt, 2005). The intent of adaptive strategy refers to autonomous or planned actions (Fussler, 2007; Park et al, 2012). The form can be a technological, behavioural, financial, informational or institutional (Smit and Skinner, 2002; Adger, 2003). However, complexity lies in the categorising of these adaptations within a multitude of scales and to multiple stressors. Smit et al (1999) presented an extensive set of categories to document adaptive strategies undertaken by households, which can

advances Smit and Wandel's four forms and levels (2006). The purposefulness, timing, temporal scope, spatial scope, function, form and performance are seven concepts and attributes of adaptive strategies. The use of the categories 'Reactive and Proactive' within timing allows an investigation into the adaptive strategies undertaken to both respond to and prepare for weather hazards, to document the coping strategies undertaken in relation to weather hazards, within the context of households and individuals (Grothmann and Patt, 2005; Füssel, 2007).

2.2.1 Adaptive Strategies undertaken in the IBD

A large proportion of natural hazards, environment and climate change research undertaken within the GBM Delta is focussed within Bangladesh (Rahman and Rahman, 2015; Abdullah et al, 2016; Shimi et al, 2010). Of the limited body of literature in the IBD, most has been conducted within the last 20 years (Kumar, 2010; Mazumdar, 2014). The increasing focus on deltaic regions and their importance and vulnerability have attributed to this rise and increased focus of literature. Perhaps the biggest demonstration of this, was the stark increase in literature after cyclone Alia in 2009 within the IBD (Mallick, 2011, DasGupta and Shaw, 2015; Mazumdar et al, 2014; Hajra, 2017).

The adaptive strategies undertaken in the IBD have been documented within many research studies, from households, agriculture, fisheries, water resource management and Disaster Risk Reduction (DRR). In relation to an exploration of rapid onset weather hazards; cyclones (Raha et al, 2013; Mondal, 2014), flooding (Mazumdar et al, 2014), and storm surges (Raha, 2014). These studies have identified the following, household adaptations within the IBD, including 'borrowing money from friends/relatives, money lender, selling assets and livestock, diversification of livelihoods, migration, elevation of the height of houses, preserving food and fuel stocks (Raha et al, 2013; Mondal, 2014; Mazumdar et al, 2014).

Upon review of the current literature, primarily the documented adaptations are being undertaken due to exposure to prolonged environmental stress to natural hazards (DECCMA, 2018). A study by Chowdhury (2016) attempted to document the economic vulnerability of the IBD, with reference to livelihood adaptations. It was found that, through the use of the wealth rank tool (WRT), that 45% of the population were under economic stress (Chowdhury, 2016). Hajra et al (2017) surveyed 783 households in the IBD and documented their vulnerability to impacts of rapid onset weather hazards, with vulnerability predominantly being caused by loss of life and loss of assets which contribute to deteriorating livelihoods. The perceived and experienced impacts of rapid onset weather hazards, include loss of life, loss of seasonal income, loss of land, household stress and

livelihood implications. These are the major drivers for households to undertake adaptive strategies. There is very limited literature documenting household and vulnerable group adaptations in the IBD, despite previous studies presenting empirical evidence of the extent of vulnerability (Chowdhury, 2016; Hajra et al, 2017).

The current studies document adaptations undertaken at specific levels, such as community or specific spatial boundaries. Although vulnerable and minority groups are identified, studies rarely explore adaptations being undertaken within these groups. There is a significant amount of literature exploring the gendered dimensions of adaptations, within male and female household heads (Nabikolo et al, 2012). Of this literature, gendered differences have been rarely explored within the IBD. A study of 136 households in Uganda found that male and female headed household reacted and implemented adaptations differently, with women undertaking adaptations in relation to decreases in household assets primarily and men being influenced by vulnerability of land use (Nabikolo et al, 2012). Gendered differences are significantly recognised within previous studies, with perception of vulnerability, specific adaptations undertaken and impacts experienced differently by genders.

2.2.2 Barriers and Constraints to Adaptation

Within the body of literature in the climate change field, the concept of barriers and constraints to adaptation have emerged. Defined as;

‘factors that make it harder to plan and implement adaptation actions. They restrict the variety of options for actors to secure their objectives. E.g. lack of resources such as funding, technology or knowledge’ (Klein et al, 2014)

Evolving significantly throughout the IPCC’s reports, barriers and constraints to adaptation were extensively reported and explored in Annual Report 5 (AR) (Klein et al, 2014). Since, there has been a vast amount of research aiming to explore, categorise and document barriers and constraints. The IPCC’s AR5 outlines eight categories of constraints; physical, biological, economic, financial, human resources, social and cultural and governance and institutional (Klein et al, 2014). Whilst the IPCC aims to categorise and define these constraints, they highlight that it is not a ‘well researched’ area within literature. Scholars in recent years, have been increasingly exploring barriers and constraints (Le Dang et al, 2014; Jones and Boyd, 2011; Biesbroek et al, 2013; Moser and Ekstrom, 2010). With adaptation high on the international agenda, there has been an emerging discourse for barriers to

adaptation (Klein et al, 2014). This has been increasingly highlighted as important for developing, disaster prone and environmentally vulnerable areas to allow policy and decision makers to implement and assist these communities.

Upon review of frameworks to categorise adaptation, perhaps one of the most applicable analytical frameworks was presented by Jones and Boyd (2011) in Figure 3. Whilst simple and not completely exhaustive, this analytical framework grouped barriers and constraints into three inter related categories; Human and Informational, Natural and Social. Furthering the IPCC's eight categories, Jones and Boyd (2011) aimed to identify and categorise barriers to adaptation and their interrelations, reviewing its success and applicability within a case study exploration of Western Nepal.

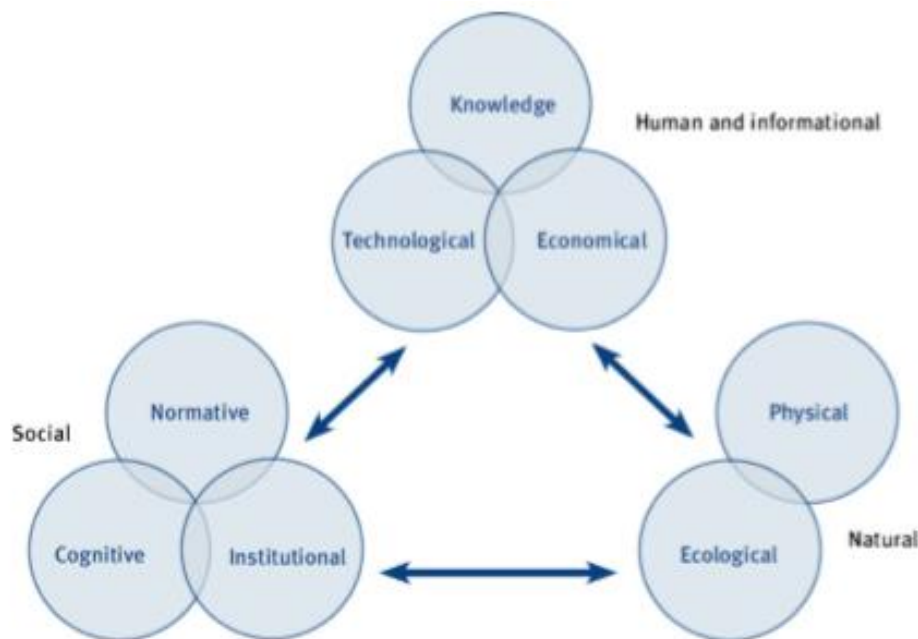


FIGURE 3: BARRIERS OF ADAPTATION (JONES AND BOYD, 2011)

2.3 Migration

Migration research has gained momentum in recent decades and has been defined in many contexts throughout academic literature. Migration is defined as ‘the movement of people from one place to another, within the country or geographical region’ (Debnath and Nayak, 2018). Out-migration is an aspect within this process, which can be further defined as proportion of total out-migrants from the given area to total population of that area during the specific period of time (Debnath and Nayak, 2018; Kundu, 2013). Migration is not a modern phenomenon, particularly in Asia, however, there is extensive debate about the reasons for migration in research.

2.3.1 Out-migration and the IBD

Migration has played a crucial role in the recent history of West Bengal, contributing to socio-economic transformation (Banu, 2016; Debnath and Nayak, 2018; Keshri and Bhagat, 2013). Banu (2016) statistically explored the trends in out migration and its links to socio-economic transformation within West Bengal, using census data over the recent 50 year period. This account of the study area provided an extensive cultural, social and economic context surrounding migration. A regional pattern and determinants study into male out-migration undertaken by Debnath and Nayak (2018), found that whilst male out-migration is experienced throughout West Bengal, certain regions such as southern regions and groups experience it differently. Both studies documented an increase in out-migration since the 1980’s. Seasonal migration was found to be a significant livelihood strategy within poorly developed agricultural areas and landless farmers (Kundu, 2013; McDowell and de Haan, 1997).

There are various types of migration, including rural-rural, rural-urban, circular, permanent, cyclical and seasonal. Reasons behind out-migration are broad by definition and often there is no singular reason (Kundu, 2013). Migration forms a two-way process whereby close links between destination and origin are maintained through communication and remittances (McDowell and de Haan, 1997). In a recent study undertaken by DECCMA (2018), three main reasons for migration in the IBD were noted. Firstly, the state of agricultural productivity combined with a lack of economic opportunities pushed people to seek employment outside of the delta. Secondly, aspirational pursuits for education also encouraged people to move. Thirdly, migrant households had a higher perception of environmental stressors which motivated household members to migrate. DECCMA undertook data collection for these findings after cyclone Alia devastated the region, therefore agricultural productivity and environmental stressors could have been exacerbated. These findings, however,

support the previous reports of migration within the delta. Recent studies have highlighted that environmental and climatic changes have forced people to adopt migration and leave their place of origin (Massey et al, 2010). A review of migration literature by De Haan (1999), documents the occurrence of displacement of a large number of people within the GBM delta in both India and Bangladesh from environmental stressors. Whilst wrongly attributing this migration to climate change, Banerjee *et al* (2012) notes that migration is an effective mode of adaptive strategy in response and to prepare for natural hazards.

After reviewing the chronology of the current literature and research studies, out-migration has been observed to be increasing in frequency, which is set to continue. The high mobility of the region, development, aspirational and educational pursuits and perception of environmental stressors are attributed to this increase. There is an apparent relationship between environmental stressors and migrants (Banerjee et al, 2012; Keshri and Bhagat, 2013; Bit and Banerjee, 2013). Out-migration however, is a complex phenomenon with many causal relationships of migrant rates.

2.3.2 Out-migration and Women

Considering the aforementioned establishment of vulnerability and underrepresentation of women in the current literature coupled by the frequency rates of out-migration, it is surprising to find a lack of studies exploring the impacts of out-migration on women in the IBD. Out-migration and its impact on women 'left behind', in rural settings, is becoming an increasingly researched area within literature, particularly in rural, developing countries (Wrigley-Asante and Agandin, 2015). It is important, for the purpose of this research study to firstly, discuss the documented impact of out-migration on women globally and within the context of India, and to secondly, highlight the gender differences and specific socially constructed roles of Indian women.

The impacts of out-migration on women has been extensively mentioned within literature, often being referred to as the 'migration left-behind nexus' (Islam, 2011; Warner et al, 2010; Amuedo-Dorantes and Pozo, 2006; Taylor, 1999; Curran and Saguy, 2001). Within the growing amount of migration literature, deltaic regions are being increasingly explored. The recent developments in literature highlight the increasing recognition of the migration and adaptation with aims focussed around adaptation to climate. DECCMA (2018) for example highlights, with aims focussed around adaptation to climate change, the importance of gender sensitive research, for applicability for policy makers. Migration lies at the centre of the research undertaken by DECCMA, highlighting further the current context of this phenomena and the mobility of deltaic communities.

Primarily, men migrate in India, which reflects traditional gender roles, the gendered division of labour and livelihood activities. Although, these roles are slowly being changed, with women observed to be migrating for education or factory work (Mistri, 2013). This has been reflected in research, with an increasing number of studies exploring women migrants (Mistri, 2013; Sen and Pattanaik, 2017). There have been noted differences between household livelihoods and the impact of out-migration on women. Women are still inherently in charge of the household, and childcare, whereas men are seen as the primary breadwinners (Bose et al, 2017). Women have always ‘helped’ men in the fields, but their primary position is in the household. Decision making for agricultural land lies with men. Changes have been seen within households where migrants are present, the responsibility for land, livestock and livelihoods often transfers from the men, when they migrate, to the women (Sarker and Islam, 2014). Despite the global trend and recognition of the gendered dimensions of migration, the literature surrounding women in deltas and the IBD, who aren’t migrating, is surprisingly lacking, considering their role in the migration process and the observed household changes when men migrate (Desai and Banerji, 2008).

2.3.3 Impacts and Outcomes of Out-migration

After review of the ‘migration-left behind nexus’ literature globally and in the IBD, several impacts and outcomes of out-migration on women, which can be grouped into the following six categories; women empowerment, feminisation of agriculture, labour force participation, women’s autonomy, decision making, self-help groups (SHG) and remittances. Bose et al (2017) explored the consequences of male out-migration on women’s empowerment within the IBD with several interesting findings. Firstly, it was concluded that the change in gender roles that women undertake during the absence of men has been gradual through the expansion of women’s roles within the household and livelihoods. Women’s autonomy, defined as the capacity and control women have to act independently, is identified as critical for empowerment of women (Osamor and Grady, 2016). It has been attributed and identified as a crucial aspect for women to undertake adaptive strategies.

A study exploring male migration specifically in relation to ‘left-behind’ wives in India found that the household structure formed the main factor of the impacts felt by women (Desai and Banerji, 2008). Whilst women in extended families were significantly more supported, their autonomy was less than women who were alone. They concluded stating that out-migration fuels women’s autonomy, allowing more freedom from a transfer of household decision making powers. They stated that women felt more empowered and more in control of decisions. Desai and Banerji’s (2008) study

employed a quantitative methodology, and it is evident that it lacks depth and exploration of feelings and real life accounts of women. Furthermore, there are many gender differences and relations across India. The employment of statistical analysis, ignores gender contexts between rural and urban areas, poor and vulnerable groups.

There has been a vast array of research into the role of SHG's in rural communities, particularly in India. SHGs are microfinance programmes, formed of 10-20 women and are female only, which allows women to access savings when economically constrained (Tesoriero, 2005). A large proportion of literature on SHG's is focused within Southern India and the IBD with findings showing a vast improvement in decision making and the importance of these groups in the lives of women (Sabhlok, 2011; Sangeeth *et al*, 2013; Swain and Wallentin, 2009; Tesoriero, 2006; Vijayanthi, 2002; Morgan and Olsen, 2012). Some researchers discuss that SHG's are non-existent with only small groups able to access them (Swain and Wallentin, 2009). The existing literature portrays SHG's as critical for gender empowerment and development, documenting the successfulness of these groups for supporting, empowering through accessing economic means (Tesoriero, 2006; Vijayanthi, 2002; Morgan and Olsen, 2012). Whilst limited, research suggests that households with women involved with SHG's that have a migrant in the household are significantly more supported. SHG's allow for social and economic support of women. A study conducted by Ghosh *et al* (2018) found that SHG's not only help women, but increase and support their autonomy. The literature suggests that SHG's should contribute to a women's ability to employ adaptive strategies, especially in the absence of remittances. Current studies have highlighted many impacts of out-migration on rural communities. A recent study by Ghosh *et al* (2018) explored the impact of out-migration after cyclone Alia, reporting that self-help groups were critical for helping women in the aftermath of the cyclone.

Many studies have documented the emotional impacts on women when household members migrate, with Wrigley-Asante and Agandin (2015) reinforcing the importance of economic empowerment programmes. Their study of 59 'left behind' wives employed an investigation on economic, social, psychological and emotional impacts during out-migration. Despite undertaking the physical work of male roles, the women were predominantly affected by the emotional impacts of supporting their extended families and taking on the decision making. Their study, whilst based in Ghana, has important similarities to those noted in current studies in the rural areas of the IBD (Tesoriero, 2005; Osamor and Grady, 2016). The remittances, distance and the impact of abandonment have shown both negative and positive impacts of out-migration on women, with inherently contradictory summaries noted within current studies.

2.3.4 Out-migration, Adaptive Strategies and Women

Whilst current literature establishes the impacts of out-migration on women and establishes the gendered differences in adaptive strategies, there is limited research in exploring how out-migration impacts the adaptive strategies undertaken by women. There is a vast array of migration literature about the IBD but there is a surprising lack of studies documenting the impact of out-migration on the places of origin and vulnerable and marginalised groups. A recent study by Ghosh et al (2018) stated that women were left alone to shoulder the burden the effects of cyclones. Out-migration literature suggests that women are not 'left alone to shoulder the burden', but the absence of men actually empowers women and increases their autonomy. With Bose et al states that there are four dimensions that empower women: 'access to remittance and control over income, mobility, household and community decision- making and freedom from threat or fear of violence' (2017). The extent to how out-migration impacts the adaptive strategies women undertaken to prepare for and respond to rapid onset weather hazards is unknown and undocumented within current literature situated in the IBD.

2.4 Summary and the 'Gap'

On review of existing literature, the gap is three-fold. Firstly, out-migration is a phenomenon and characteristic of deltas globally, with mobility prevalent within rural communities. Whether climatically influenced, or not, migration has been increasing in recent decades. It is very uniquely experienced within a delta and is constantly evolving and dynamic. Migration in the IBD has been extensively documented, within the dominant body of literature exploring network flows, the characteristics of out-migration are less documented. Many studies researching out-migration focus solely on husbands or men, however, the lack of documentation of any of type out-migration in the IBD, leads this research study to explore all members of a household migrating. Secondly, the impacts of global climate change are set to increase the vulnerability of deltaic environments and the frequency and intensity of natural hazards. With the aforementioned nature of adaptation research and the relevance to current global issues, the stark limited research within the IBD highlights the gap in current literature, research and policy information. The documentation of household adaptation strategies is limited with very few research studies presenting empirical evidence of adaptation IBD. Thirdly, women are more often than not 'left behind' in rural areas, where primarily male members out-migrate. Within the large body of literature exploring adaptive

capacity and documenting observed adaptation within the IBD, women are underrepresented. Very few studies explore the impact of out-migration on the adaptive strategies undertaken by women. Therefore, to address the gap in the literature, the overarching aim of this research study is to explore the impact of out-migration on the choice's women make in preparing for or responding to rapid onset weather hazards in the IBD. The research objectives and research questions of this study, presented in Chapter 1, have been developed to explore this aim.

Chapter 3

Methodology

3.0 Introduction

The Methodology Section will outline the mixed research methods approach used for data collection, data analysis and data presentation within the research study design. Following this, it will present both the quantitative data collection and analysis method. Thirdly, it will present the case study area and both the qualitative data collection and analysis methods. Throughout, it will highlight limitations, ethical considerations and the importance of the mixed research methods approach. To conclude, it will highlight the integration and relevance of the mixed research methods approach in relation to the aims and research questions.

3.1 Research Study Design

This research applies a mixed methods approach which involves the use of qualitative and quantitative methods to collect and analyse data to develop the research process (Leech and Onwuegbuzie, 2009). Doyle et al (2016) outlines the primary approaches to mixed methods research as triangulation, expansion, exploration, completeness, and illustration. Tashakkori and Teddlie (2003) identified over forty mixed-methods research designs, of which, six are predominantly used. One of these, the sequential explanatory design, is often employed within social sciences and particularly adaptation research (Fraizer et al, 2010). Whereby, the application of methods are used in a sequence or concurrent to one another. Within adaptation and migration research, sequence designs have proved important for gaining insight into the 'big' phenomena through statistical data from quantitative research and providing real life experiences through qualitative research to further explore and gain insight into context. The rationale for applying a mixed-methods approach to research is predominantly that neither method is appropriate for exploring adaptation, gender and out-migration independently (Ivankova et al, 2006; Kumar, 2007; Paul and Routray, 2011; Maharjan et al, 2012). Whilst Tanyanyiwa and Kamyepi describe 'definitional, paradigmatic and methodological issues with mixed methods' (2015), it has been gaining rigour, validity and

recognition in recent years. Upon review of the mixed methods research designs, a sequential explanatory design will be employed in this research study.

Gioli et al (2014) implemented a competent and logical mixed methods approach to explore migration and its implications for women in Pakistan. The use of questionnaires and descriptive statistics, followed by Focus Group Discussions (FDG) and content analysis, allowed for completeness, insight and illustration to explore the perception of migration and the wellbeing of women, whilst situating the research into a larger context with the quantitative data. Similarly to Gioli et al's (2014) approach to exploring the gendered implications of out-migration and upon review of the integration of mixed methods in previous studies, the quantitative data will employ the use of secondary data collected by DELtas, Vulnerability and Climate Change: Migration and Adaptation (DECCMA) in the IBD. Thereafter, the qualitative data will employ the use of primary data collected through a case study and in-depth interviews to add a deeper and more contextualised understanding of the impacts of out-migration on women.

As highlighted in a critical review of the sequential exploratory design, three potential limitations can arise through the implementation of both methods, the weighting and justification of the methods and the integration of the results (Ivankova et al, 2006). Ivankova et al (2006) emphasise the value of visual presentation of the study phases and procedures to overcome the key limitations. Upon drawing on mixed methods literature, Ivankova et al (2006) presents '10 rules' to be adhered to for visual designs in relation to process, procedure and outcome. To outline and introduce the research study design, the mixed methods approach is presented visually in six stages (Figure 4). Firstly, variables relevant to the research objectives were identified from the quantitative data. Once chosen, these variables were explored through descriptive statistics, frequency distributions, cross tabulations and chi-squared tests. Patterns and findings were identified as the initial outcomes. Upon initial completion of the quantitative data analysis, the qualitative research method was developed. The qualitative method, including the case study, interview structure and participant sampling technique was then developed to further explore, understand and explain the quantitative data. The interview data was subsequently coded to illuminate the key themes. The qualitative and quantitative data was collected and analysed through an explanatory sequential to allow for effective integration of both methods.

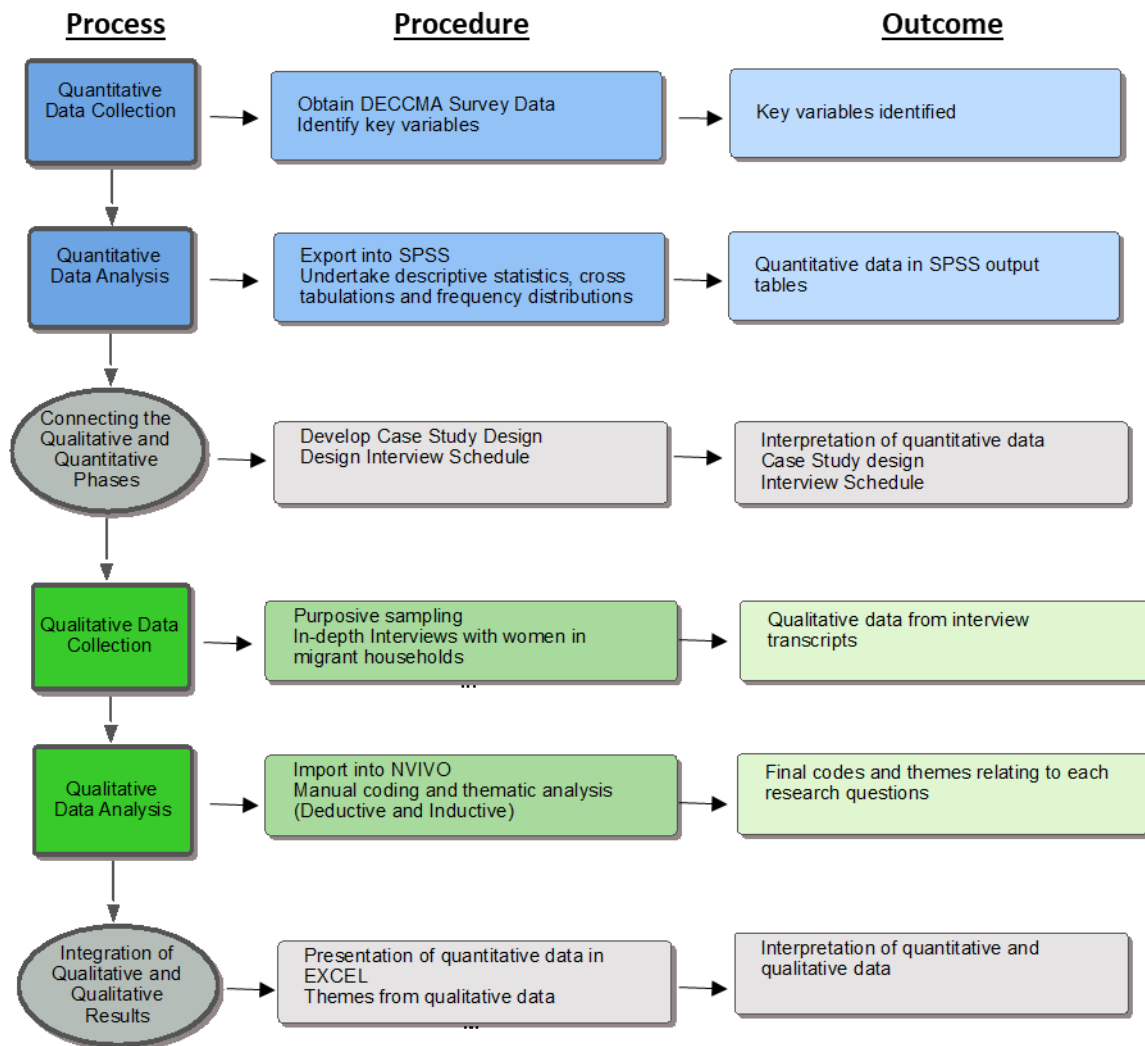


FIGURE 4: THE EXPLANATORY SEQUENTIAL RESEARCH STUDY DESIGN APPROACH

3.2 Quantitative Research Method

The quantitative research method is presented first to reflect the chronological thought of the mixed methods design. The data collection process and the use of household questionnaires will be discussed. This will be followed by outlining the data analysis process. The limitations of the questionnaire data will be outlined thoroughly and throughout.

3.2.1 Household Survey

The household survey, formulating the quantitative secondary data for this research study, was implemented, designed and carried out as part of a 5 year study by DECCMA. The DECCMA project can be described as a 'programme of applied research on the adaptation options, limits and potential in deltaic environments to current weather variability and extremes, as well as climate change' (DECCMA, 2018). The project designed and implemented household surveys in 4 major deltas; GBM Delta in Bangladesh, Volta Delta in Ghana, Mahanadi Delta in India and the IBD. The DECCMA main aims are;

1. 'To evaluate the effectiveness of adaptation options in deltas
2. To assess migration as an adaptation in deltaic environments under a changing climate
3. To deliver policy support to create the conditions for sustainable gender-sensitive adaptation' (DECCMA, 2018)

These aims demonstrate the relevance of the DECCMA data and the applicability of the research to this research study. The data, which explores the impacts of migration with a gender-focus and the exploration into the impact of weather hazards, lends itself specifically for gaining insight into the research objectives of this study. The IBD household survey was conducted from December 2016 to February 2017, which included the in-house training for the enumerators, pilot studies, data collection and data checking. The survey was designed and integrated both a household survey and female only survey, to allow for the exploration of gender perceptions and positions. The DECCMA data was collected at a total of 50 locations within the districts of these are North Twenty Four Parganas and South Twenty Four Parganas.

A two-stage cluster design was implemented to source participants according to demographic and migration characteristics, as well as, hazard vulnerability. Firstly, a multi-hazard map was developed in relation to household vulnerability and exposure to natural hazards. This clustered households into five zones; very low, low, medium, high and very high. Thereafter, 10000 households were selected across these zones based on demographic and migration characteristics. After the two-stage cluster design, participant households were selected through proportionate random sampling, of which a total of 1500 households across 50 locations were selected. A total of 30 households were selected in each location; very low (13 locations), low (11 locations), medium (10 locations), high (9 locations) and very high (7 locations). Of the 1500 households, data was present from a total of 1315 households within the IBD, with 236 households recording migrants. A total of 185 households had missing data, which can be explained as the first limitation of the household survey, using equipment within the field and carrying out fieldwork.

3.2.2 Quantitative Data Analysis

The household head and female only questionnaires were explored for variables related to the research objectives. Once selected, the variables were then split into three sections: Out-migration, Observed Adaptations and Impacts of Out-migration. The variables used are presented in Appendix 1. Variables such as perception of the environment, migrant perspectives and documenting economic wellbeing were excluded from the analysis. The reasoning for excluding the economic wellbeing variables are that communities in the IBD often do not solely exchange money, but goods and services are used by way of payment and the unreliability of answers. Furthermore, the perception of the environment questions were noted by DECCMA (2018) during data collection as primarily answered by the household head and male household members. These variables above all did not contribute to the exploration of the research objectives, and were beyond the scope of this research study.

Many of the variables in the sections of migration characteristics and adaptation strategies were also answered predominantly by the household head and the male household members. However, they are useful for exploring how out-migration is experienced and documentation of adaptive household strategies which is crucial for providing a foundation of adaptive strategies within households to build on and identify adaptive strategies undertaken by women specifically. The statistical software, Statistical Package for the Social Sciences (SPSS), was selected to analyse the variables (George and Mallery, 2016). The data was cleaned to ensure all variables were present and data was categorised correctly.

Firstly, to explore the migration characteristics, frequency distributions were carried out to find document the characteristics of migrant households including age, gender and the member within the household of migrants. As well as exploring the main livelihoods of migrant households, household headship, type of migration and number of migrants in a household. It also explored the reasons of migration stated within the survey and the use of remittances within a household.

To document the adaptation strategies, frequency distributions were used to analyse the adaptations being undertaken by migrant and non-migrant households. The household survey reported fifteen variables related to household and livelihood adaptations. The percentage of migrant and non-migrant households were used to compare and explore the prevalence of adaptations. Whilst the household head was a potential variable, it was considered inappropriate

because there was a possibility of excluding migrant households where the household head was migrating. It was not possible to explore the adaptive strategies undertaken by women from the household survey, because men primarily answered the survey on behalf of the household. Therefore, the type of household (Migrant or Non-migrant) were chosen to observe differences and the gender differences to added from the qualitative data.

To explore impacts of out-migration, cross tabulations and frequency distributions were used to explore wellbeing variables of migrant households and women. A cross-tabulation was formulated to explore differences in decision making within migrant and non-migrant household between male and females. Frequency distributions were used to explore the survey responses to women's wellbeing in migrant household's statements because these were asked solely to women in migrant households.

3.2.3 Summary of the Quantitative Research Method

The initial quantitative data was explored within SPSS. This was used to identify aspects to be explored in the qualitative research methods. The case study design was developed in relation to the three categories identified in the exploring Out-migration, Observed Adaptations and Impacts of Out-migration aspects will be explored within the in-depth interviews.

3.3 Qualitative Research Method

On presentation of the quantitative research method, the Case Study will be presented, including the data collection process, participant sampling and the data analysis used to code the data. The limitations of the research method, positionality and interpretation will be discussed in relation to the implementation of the qualitative method.

3.3.1 Case Study Area: Dulki and Sonagar

The case study villages of Dulki and Sonagar are situated in the centre of the IBD and border the Sundarbans National Park (Figure 5). Fieldwork was carried out on an Island where both villages are situated.

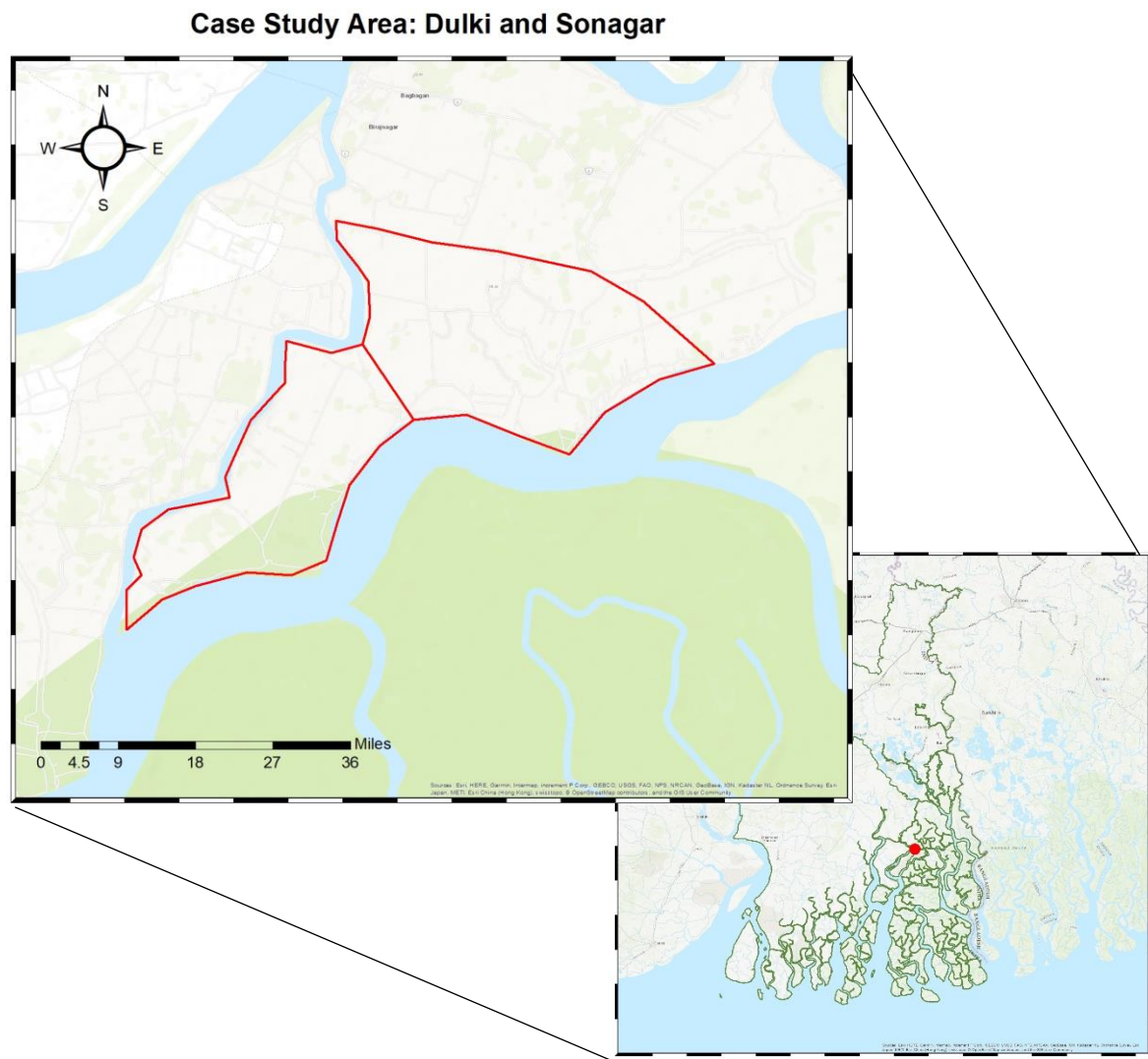


FIGURE 5: CASE STUDY AREA: DULKI AND SONAGAR (AUTHORS OWN)

3.3.2 In-depth Interviews

A case study was employed as the qualitative research method and to collect the data in-depth interviews were employed. In-depth, face-to-face, semi-structured interviews are a popular research method which seek to explore individual experiences and perspectives within a phenomenon (DiCicco-Bloom and Crabtree, 2006). The primary data was collected through in-depth interviews which were conducted during fieldwork in June 2018. A total of 17 interviews of approximately 45 to 60 minutes were conducted through the use of translators. Data collection took place over seven days, which included a training day for the translators, orientation in the field and pilot interviews. The duration of data collection was limited due to time restrictions of the university timetable and the timing of the monsoons. However, this was predominantly overcome with the use of purposive

sampling to maximise the interviewing time in the field. A researcher from the Jadavpur team conducted a survey to explore the access and suitability of different locations and presence of desired participants for relevance to my study aims, prior to my arrival in the study area. The survey documented the number of migrants in the household, the location of the household on the island, the status of the migrant (return or current) and number of members in the household.

The interviews were semi-structured, containing six initial open-ended questions allowing for follow up questions. The interviews were designed upon reflection of the initial quantitative analysis and review of the literature (Appendix 2). Several limitations related to language were experienced, including word meanings and cross-languages. Whilst the translators had a firm understanding of English, words in Bengali often significantly differed in meaning from the English translation. Whilst there were many notable challenges in using translators, noted in previous field work studies (Winchester, 1999; Gjersing et al, 2010), the primary challenges with using translators led to me gaining some of the most in-depth insight into the women's lives. The researcher prevented asking sensitive questions that may have implicated the women or made them feel uncomfortable (Wrigley-Asante and Agandin, 2015). Predominantly, women were interviewed alone and within their houses to ensure that males did not influence answers.

The training day, orientation and pilot interviews were used to overcome and attempt to mitigate any potential limitations. For example, the translator initially misunderstood the meaning of several questions. After discussion and rewording, the meaning of the questions were understood and the questions changed to be presented more simply. The interviewee profiles documented in Appendix 3, show the characteristics of each participant interviewed. To ensure anonymity, all interviewees were given a participant number and code for reference within the text.

3.3.3 Qualitative Data Analysis

The content and thematic analysis pursued as the qualitative data analysis. Coding is defined as a 'dynamic, intuitive and creative process of inductive reasoning, thinking and theorizing' (Basit, 2003). Coding involves assigning words and sentences labels of descriptive meanings to text (Basit, 2003). These codes are often an inductive, data driven, and deductive, theory-driven, but can also be a hybrid approach of the two. Fereday and Muir-Cochrane (2006) argues that a hybrid approach allows for continuity of exploration of quantitative data and allows for a further exploratory approach to investigate the situation further. The use of both inductive and deductive coding is a useful for theme development and will be used to code the in-depth interviews. An initial set of

codes are produced from theory and then additional codes are then generated from the data itself (Thomas, 2006). Initial emergent themes, defined as clusters, are then grouped. Thereafter, primary themes are created from these clusters. Inter-rater reliability, a process of independent coding and where coding is compared for agreements, is argued amongst qualitative researchers as an important stage for ensuring rigour and transparency within the research was used (Armstrong et al, 1997). The codes were evaluated by an MSc student and discussed. Finally, selective themes are created in relation to the study research objectives. The use of a systematic procedure in analysing qualitative data ensure reliability and validity within findings (Thomas, 2006).

After review of coding methods, the coding of the interview data pursued in 6 titled stages; initial coding, cluster analysis, initial clusters, secondary coding, inter-rater reliability and selective coding (Figure 6). These stages were undertaken in NVIVO to ensure a manual but methodological approach to qualitative data analysis through a reliable data management programme (Feredy and Muir-Cochrane, 2006; Zamawe, 2015). During the coding process, primary themes and final themes were identified to ensure a rigorous approach to exploring the overarching themes.

Codes from Code Book	Initial Coding	Cluster Analysis	Initial Clusters	Primary Themes	Inter-Rater Reliability	Final Themes	Selective Coding
Adaptation	Bamboo fences	Adaptation undertaken by women	Protect	Reactive (Respond)	Response	Adaptations Undertaken by Women	Observed Adaptation
	Money sent to market			Proactive (Prepare)	Prepare		

Coding Process



FIGURE 6: EXAMPLE OF THE CODING METHOD

3.3.4 Summary of the Qualitative Research Method

Overall, the approach allowed for a thorough and exhaustive identification of overarching themes relating to and exploring the quantitative data. There were eight final themes identified; Reasons, Remittances, Adaptation Strategies, Characteristics of Out-migration, Decision Making, Family Structure, Wellbeing and Barriers. Upon identification of final themes, selective coding was used to assign each theme to the quantitative data categories of Out-migration, Observed Adaptations and Impacts of Out-migration. This allowed for the themes to be used for further insight into the quantitative findings.

3.4 Ethical Considerations

The vulnerability and cross-cultural nature of the study highlights the importance of ethical consideration and regulations. The study was submitted for ethical approval to the University of Southampton's, Ethics and Research Governance Online (ERGO) (See Appendix 7 and 8). It received ethical approval before data collection was undertaken (ERGO ID. 41112). The study employed a Participant Information Sheet (PIS), consent form and de-brief form to inform all participants of the nature of the study and to ensure consent was obtained to confirm their willingness to participate (See Appendix 4, 5 and 6). Anonymity and data protection was fully outlined within the PIS, assuring participants that they or identifying features would not be published within the study.

3.5 Summary: Integration and Relevance

The mixed methods approach to this study has been invaluable for shaping the study design and gaining insight into the aims and objectives of this study. It is often argued that a mixed methods approach allows 'for the limitations of each method to be reduced because of the strength of the other' (Doyle, 2016). This is inherently evident within the design of this research study. Firstly, this research study and DECCMA's aims and objectives were inherently similar in their relevance to migration and integration of gender, a vital aspect which allowed me to gain a significant amount of detail from the quantitative data.

The gender dimensions however, were best explored from a qualitative approach. For example, several studies have employed a similar survey to explore gender aspects of out-migration within

India, but through a solely quantitative method. The attribution, assumptions and generalisations of the gender roles, cultural values and social norms are assumed within these studies, ignoring inter and intra-regional differences within India (Desai and Banerji, 2008). This emphasises the importance of the qualitative research method for ensuring a gendered perspective. The mixed methods approach is inherently grounded within current literature and builds on this by providing a deeper understanding of the context behind adaptive strategies undertaken by women in households in the IBD. Furthermore, it allows the added dimension of exploring women in these households by adding 'voice' through qualitative methods within a complex phenomenon (Doyle et al, 2016).

The development of the quantitative and qualitative methods, including data analysis of the secondary data and data collection of the in-depth interviews, has been developed in a sequential approach. The final stage of the research design, the integration of the data, will be further informed by the research objectives. In order to explore the aim 'explore the impact of out-migration on the choices women make in preparing for or responding to rapid onset weather hazards in the IBD', the results have been categorised in relation to the three research objectives and to answer the research questions. The qualitative and quantitative data will be integrated within Out-migration, Observed Adaptation (household and women in migrant households) and Impacts of Out-migration on women, which will further inform how the data will be presented in the Results and Analysis Section

Chapter 4

Survey and Case Study: Results and Analysis

4.0 Introduction

The Results and Analysis Section will be categorised in accordance to the main objectives of this study: Out-migration in the IBD, Adaptive Strategies (migrant, non-migrant households and women in migrant households) and Impacts of Out-Migration. It will describe and analyse the quantitative and qualitative data in an integrated presentation within each category. Firstly, the characteristics of out-migration in the IBD will be identified. Secondly, it will document the main adaptive strategies undertaken by households and address the differences between non-migrant, migrant households and women in migrant households. Thirdly, the impacts of how out-migration affects the adaptive strategies women undertake. It will also categorise the barriers to adaptation women experience and present the interrelations and interactions of the impacts of out-migration and the adaptive strategies women undertake. Finally, the section will be summarised.

4.1 Out-migration in the IBD

This section will present the results to address the following research objective: to document the characteristics of out-migration and how it is experienced in the IBD. It will present the main characteristics of out-migration, which will be presented from the survey data, with further insight provided from the qualitative themes: Reasons and Remittances.

4.1.1 Characteristics of Out-migration

The characteristics of out-migration are outlined within Table 3.

TABLE 3: CHARACTERISTICS OF OUT-MIGRATION

Out-migration Characteristics		Frequency
Gender of Migrants	Female Migrants	43
	Male Migrants	181
Age of Migrants	>19 years old	21
	20-29 years old	46
	30-39 years old	43
	40-49 years old	23
	50< years old	7
Household Member Status	Household Head	16
	Partner of Household Head	32
	Married Child	42
	Partner of Married Child	2
	Unmarried Child	50
	Brother or Sister of Household Head	9
	Brother in Law or Sister in Law of Household Head	2
	Niece or Nephews of Household Head	2
	Parent	2
Type of Migration	Grandchild	22
	Permanent Migration	24
	Seasonal Migration (Migrates once or twice a year)	94
	Circular Migration (Migrates often for short periods)	31
Type of Migrant Household Head	Other (International etc.)	87
	Male Household Head	182
Main Livelihoods of Migrant Households	Female Household Head	54
	Crop Farmer	48
	Unpaid home carer	44
	Construction worker	28
	Retired	20
	Other	17
	Factory worker	13
	Trader/Dressmaker	11
	Fish/Shrimp Farmer	9
	Domestic worker	8
	Regular Salaried Employ	6
	Transport worker	6
	Unemployed	5
	Hawker	1
	Livestock farmer	0
Number of Migrants per Household	1 migrant	70
	2 migrants	18
	3 migrants	6
	4 migrants	9
	5 migrants	0
	6 migrants	0
	7 migrants	0
	8 migrants	1

There is a significantly higher proportion of male migrants. All ages are observed to be migrating however, typically migrants are younger, aged between 20-40 years old. The survey showed that out-migration in the IBD is inherently seasonal, with migrants travelling for work within India. Permeant and circular migration is also experienced. There is a higher prevalence of female household heads within migrant households, which can be attributed to primarily male migrants. Within interview responses, women were often referred to as a household head when the household head migrates. Whilst household heads and partners do migrate, there is a higher prevalence of migration by household children. Furthermore, it can be attributed that unmarried migrants are more likely to migrate than married migrants. Whilst all livelihoods experience migration, the main livelihoods of migrant households are crop farmers and construction workers. Unpaid home carers are also classified as a migrant household livelihood, within the survey data. This could be attributed to a female member of a household, whereby migrants have left and send remittances home.

The qualitative sample consists of 17 responses from women in migrant households within the case study villages (See Appendix 3). Women between the ages of 25 – 65 years old were interviewed. Migrant characteristics in these households varied, for example, remittances received, number of migrants in the household, role of the migrating member and reasons for migrating.

4.1.2 Reasons for Out-Migration

Figure 8 shows the reasons for out-migration from the household survey data. Seeking employment, family obligations and seeking education were the three primary reasons for out-migration reported (See Appendix 11). Seeking employment was also the primary reason for out-migration stated in the interviews. However, one significant difference between the datasets, upon follow up questioning, was the multitude of different reasons for migrating. Whilst, many people migrated to find employment, the need for this was differently reported within interviews. The main reasons for migration were; loans, environmental reasons, perceptions of wildlife, cyclone Alia and the unavailability of work.

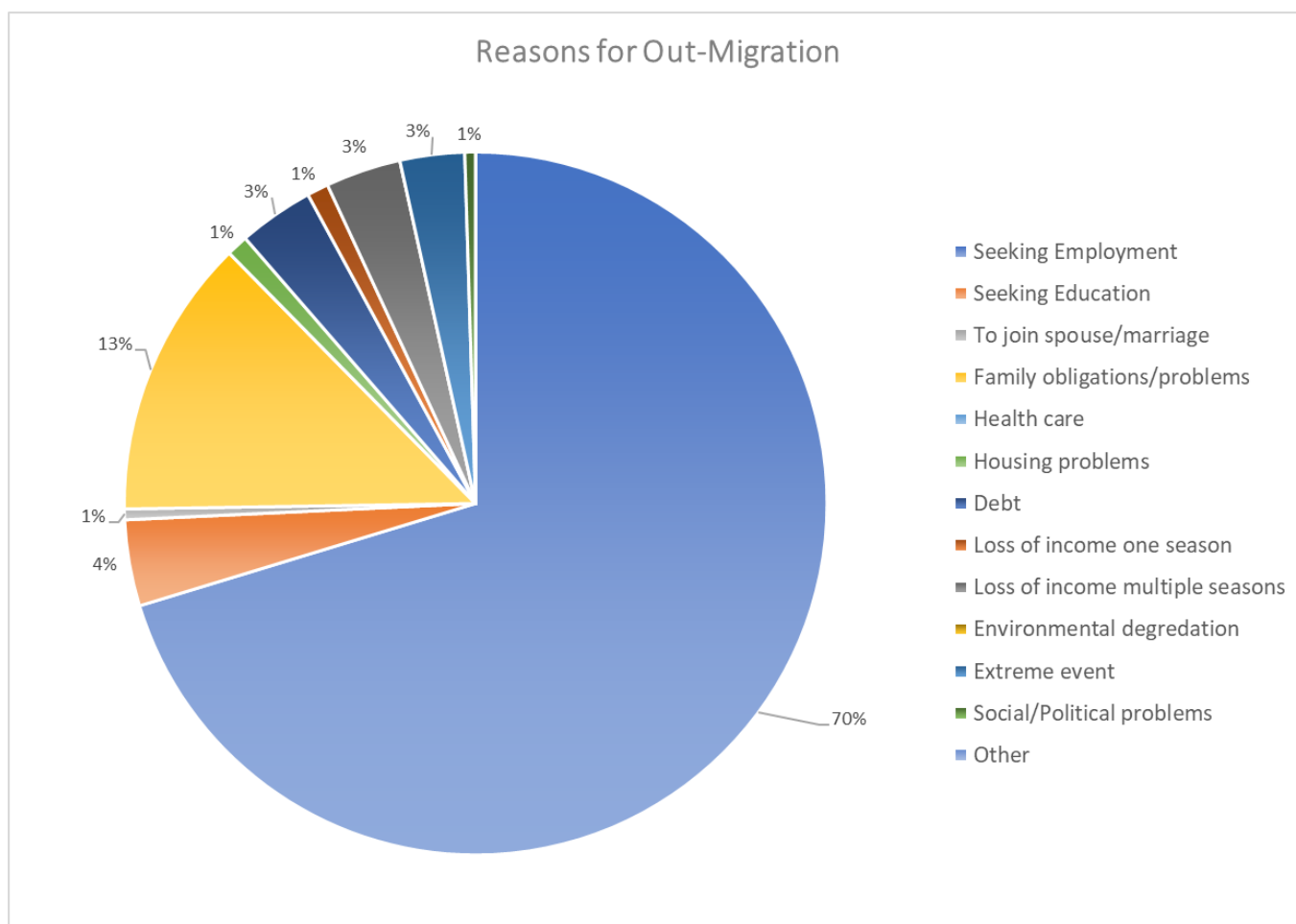


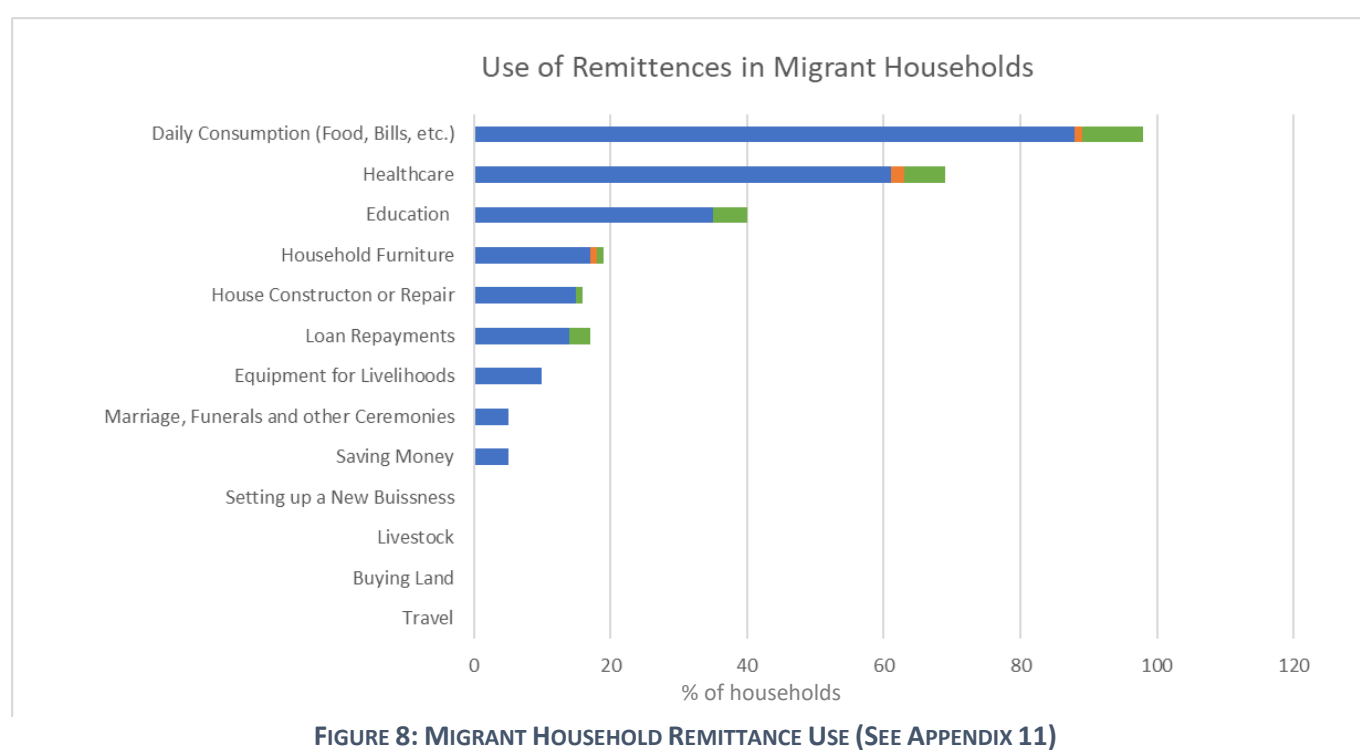
FIGURE 7: REASONS FOR MIGRATION IN MIGRANT HOUSEHOLDS (CURRENT MIGRANTS) (SEE APPENDIX 11)

Migrant households reported the reason for the migrant seeking employment and work outside their village was due to the burden of taking out a loan. Interviewees discussed several environmental reasons for migration. Agricultural productivity was stated to have declined within agricultural households, with many saying that the produce could not support the family and the prospect of higher wages from migration destinations was more attractive. Several interviewees perceived the wildlife within the IBD negatively. There was uncertainty and worry from fishing activities and hunting in the Sundarbans forest of family members. The perceived negativity arose from stories and first-hand accounts from encounters with tigers, sharks and crocodiles. One prominent reason for out-migration was related to cyclone Alia. The destruction of households and assets, the availability of work and inability to conduct agricultural or fishing activities, because of

flooded land and salinization, forced household members to migrate. All interviewees reported that the government had provided them with 10,000 rupees and some received Non-Governmental Organisation (NGO) assistance following the cyclone. The financial support did not cover the assets, household reconstruction and long term impacts on livelihood activities, therefore, loans were taken out by households to meet financial needs. Another reason for out-migration mentioned by interviewees in reference specifically to younger migrants was the availability of work. Many noted that migrants can earn over double the amount at migrant destinations, the work opportunities were more attractive than jobs within the village, where most of the work is laborious and agricultural. Out-migration was rarely caused by one reason, being exposed to a multitude of stressors was seen throughout the interviews.

4.1.3 Remittances

Remittances were usually sent from the migrant to the household monthly or every 2-3 months as reported by the household survey. Whilst this was consistent throughout the interviews, interviewees noted that a remittance network was not established immediately. Sometimes it would take between two and six months for households to begin to receive remittances, which was not highlighted within the household survey. Once received the remittances were used primarily for daily consumption, healthcare and education of children. Figure 9 shows the use of remittances within migrant households from the household survey responses.



Interviewees reported the use and significance that remittances had on household and livelihood activities. Many reported the remittances were significant in modification of household roofs from thatch to tin and a shift from mud to concrete houses. Household use of remittances from interviewees reflected the household survey data. It was highlighted that the most important use of the remittances was to repay household loans and allow children to continue with educational pursuits.

4.2 Observed Adaptation in Households in the IBD

This section will present the results to address the following research objective: to identify and categorise the main adaptive strategies that are undertaken by non-migrant households, migrant households and women in migrant households to prepare for and respond to rapid onset weather hazards. To do this it will explore how rapid onset weather hazards are perceived by households and what drives them to adopt strategies. Secondly, it will identify adaptive strategies that have been undertaken by migrant and non-migrant households. Thirdly, it will identify and categorise the adaptive strategies women in migrant households undertake. The observed adaptations of non-migrant and migrant households will be explored through the use of survey data, to understand the differences. It will further present the interviewee responses from the theme: Adaptive strategies.

4.2.1 Perception of Rapid Onset Weather Hazards

The survey data showed that migrant and non-migrant households were affected by rapid-onset weather hazards differently with the frequencies presented in Figure 9.

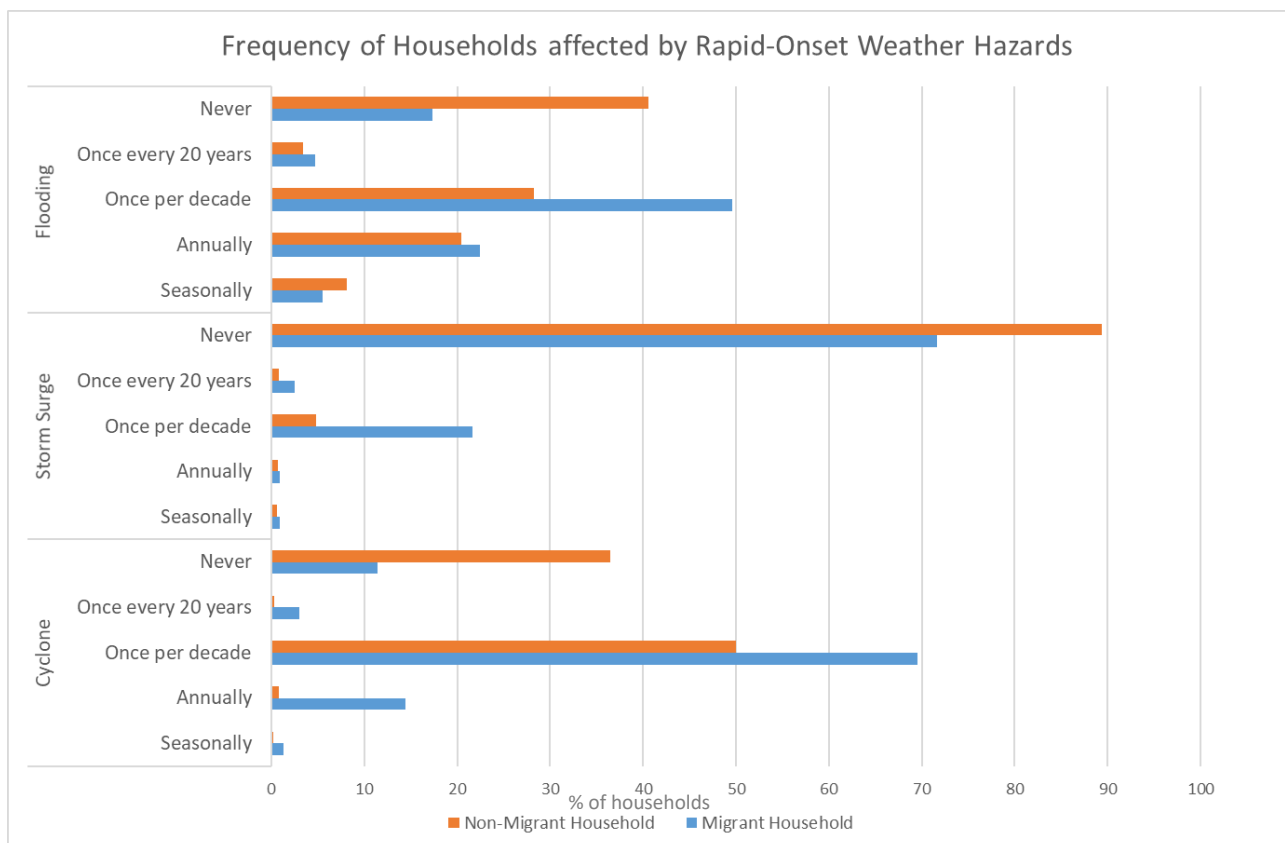


FIGURE 9: FREQUENCY OF HOUSEHOLDS AFFECTED BY RAPID ONSET WEATHER HAZARDS (SEE APPENDIX 12)

Predominantly both non-migrant and migrant households were affected by rapid onset weather hazards 'Once per Decade'. Overall, flooding has the highest impact on households across all time scales. Conversely, cyclones impacted households predominantly on a once per decade basis. Overall, migrant households have been affected by rapid-onset weather hazards more than non-migrant households. The survey data represented household from 50 locations within the IBD, whereas the interviews were undertaken solely in one location in the south of the IBD, which is at closer proximity to the fluvial and coastal processes seen in deltas.

The interviewee responses can add depth to how households are affected by rapid-onset weather hazards. It was reported from the responses that cyclone Alia was a significant turning point in the perception of cyclones in the IBD, which could explain the uptake of adaptations by migrant households. Several adaptive strategies undertaken by women were as a direct consequence of the impact cyclone Alia had on them, in which they chose to undertake certain adaptations to prepare for a similar. In relation to the monsoon season, households reported that it was starting earlier and ending later, describing the season as having 'no set period' anymore (Participant 6). Flooding was perceived as increasing in duration and frequency. An interesting and unexpected finding, which was reported across all interviews, was the increased prevalence of thunder and lightning storms. Women reported that they are:

'more common now' (Participant 8)

'Thunderstorms are a very recent event. In the next village, livestock has been killed by them'
(Participant 6)

The women discussed that the creation and development of electric lines within and around the village, causes lightening to strike during the thunderstorms. It was perceived that people and animals were increasingly in danger, with many stating that livestock have been killed during storms. They stated this was a recent event.

4.2.2 Observed Adaptation in Non-Migrant and Migrant Households

The quantitative survey identified fifteen specific adaptations in relation to the IBD. These adaptations and their frequency within non-migrant and migrant households are presented in Figure 10. It was observed that adaptations are being undertaken, primarily at the household level. Although still prevalent, agricultural and other livelihood adaptations were less reported. The survey

data represents adaptations undertaken by households within a five year period, between 2011 and 2016.

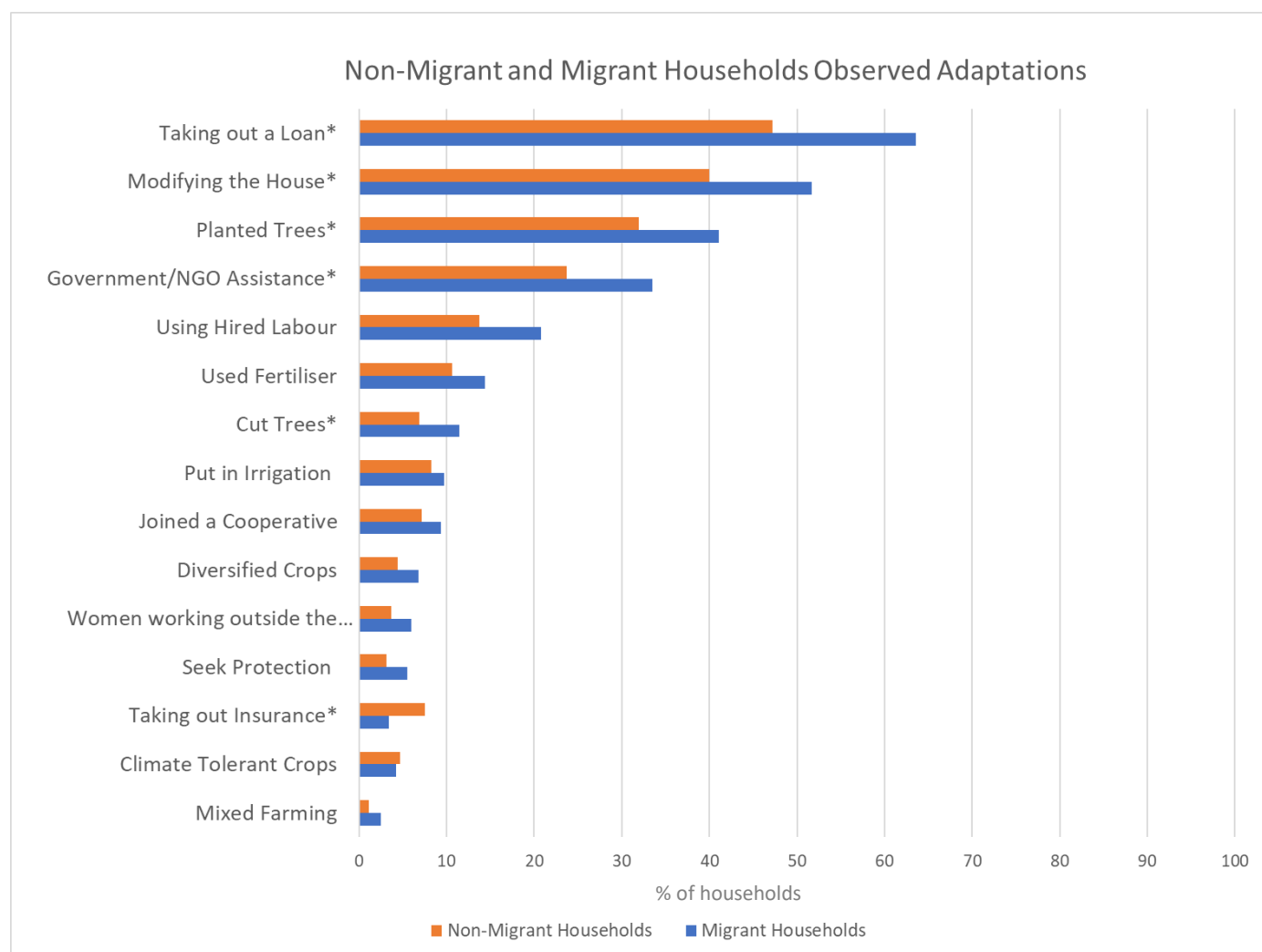


FIGURE 10: OBSERVED ADAPTATIONS IN MIGRANT AND NON-MIGRANT HOUSEHOLDS (SEE APPENDIX 13)

Between 2011 and 2016, over 63% of migrant households took out a loan, in comparison to 47% of non-migrant households. Interviewees reported the reason for migration was the need to repay loans, which may correlate to the reasons for out-migration, which is employed to repay loans. Modifying the household was also undertaken, with 53% of migrant households and 40% of non-migrant households undertaking these adaptation. Interviewees stated that they needed to shift from mud and thatch houses to concrete and tin to ensure safety during weather hazards. Whilst, mud and thatch houses are easily replaced, households were making significant and constant

changes to these households when they were damaged by hazards. This was in response of the damage caused by cyclone Alia and to prepare for and accommodate the impacts of future cyclones. Furthermore, over half of migrant households have undertaken house modifications compared to 40% of non-migrant households. Migrant households reported that they could make house modifications because they received higher incomes from migrant remittances, than previous livelihoods incomes.

After the occurrence of cyclone Alia, it is expected that the NGO/government assistance variable is high because assistance was present and there was intervention following the cyclone. Within the agricultural livelihoods variables, there are little differences in uptake of adaptations and generally a lower prevalence of undertaking adaptations than household variables. However, there is a higher prevalence of using hired labour amongst migrant household than non-migrant households. This was noted as being untaken by interviewees because of the lack of a household member. It was shown that there is a higher prevalence of women working outside the home in migrant households.

There are interesting outcomes related to taking out insurance. 8% of non-migrant household took out a loan, compared to 4% of migrant households take out insurance. One interviewee discussed that migration in itself provides an insurance of the household and members. The remittances sent each month allow the household to prepare for and anticipate costs of the household. When the migrant is away from the household and a hazard hits the area, there will still be an income. If the migrant is at the household, then they may not be able to work because of the environmental conditions restricting livelihood activities or the death of livestock.

4.2.3 Observed Adaptation of Women in Migrant Households

The adaptive strategies undertaken by women have been documented and categorised, into Smit et al (1999) 'Proactive and Reactive' in Figure 11. The interactions between adaptations undertaken in migrant and non-migrant households will be discussed further in relation to the adaptive strategies women undertake.

Adaptive Strategies undertaken by Women in Migrant Households	
Proactive/Anticipatory	Reactive/Responsive
Saving money	Placing bricks on the ground
Sending money to the bank	Collecting rations from the market
House modification	Collecting water
Local emergency contact in place when migrant is away	Covering houses and animal houses in plastic
Accessing female only SHG	Making bamboo fences
Cutting trees down to protect house	Accessing NGO assistance
Increasing social interaction	Covering themselves in plastic to continue farming
Increasing social activities	Increased responsibility for making decisions to protect the household
Planting trees for land stability	Seeking help
Increased awareness for forecasting weather patterns	Travelling to market with neighbours and friends
Start working outside the home	Increased awareness of household and farming activities for decision making purposes
Using hired labour	Diversification of labour activities
Use or diversification of climate tolerant crops	Re-organisation of day
Mixed Methods Farming	Stop working outside the home

FIGURE 11: OBSERVED ADAPTATION OF WOMEN IN MIGRANT HOUSEHOLDS

The proactive and anticipatory measures noted as the primary differences in adaptations undertaken by women in migrant households were mainly social actions and decision making differences. There were significant differences and gender specific adaptations undertaken by women, in addition to the observed adaptations within households. The women stated that they undertook adaptive strategies differently during out-migration.

Proactive: To prepare for rapid onset weather hazards

One adaptation undertaken was the use of mixed farming methods; during the monsoon season women undertook additional livelihoods and income activities, often fishing. This was noted to support the household if a migrant was not at home and to continue the household livelihoods. A woman with three migrating members of the household stated;

'I have two bighar land, but during the rainy season I have to sell fish because I do not receive remittances' (Participant 17)

Women stated that they were more socially active during periods of out-migration of family members. They increased social interaction and activities to improve their emotional wellbeing and asked support if they needed physical help within household and livelihood activities. Women entered and joined SHG's both to pursue and continue individual and household livelihoods and activities, particularly if migrating members did not send remittances.

The remittances received by women, were reported as being saved for emergencies and sent to the bank. One interviewee stated that she does this to ensure that;

'When a cyclone or flooding hits, I have money to support the house and repair damage.' (Participant 15)

Reactive: To respond to rapid onset weather hazards

Women noted that they have an increased awareness of household and farming activities for decision making purposes. When a migrant leaves, the women taken on extra roles in the household. Women took on the decision making powers for the household and livelihood activities. Interviewees stated that there are problems when a migrant is not around and a cyclone or flooding hits. They reported:

'If my husband is here, he will go to the market, he will tend the agricultural land. When he is not here, I struggle to maintain everything'

'[The migrant] would help me collect water during the monsoon season, when he is absent, I have to do it alone' (Participant 14)

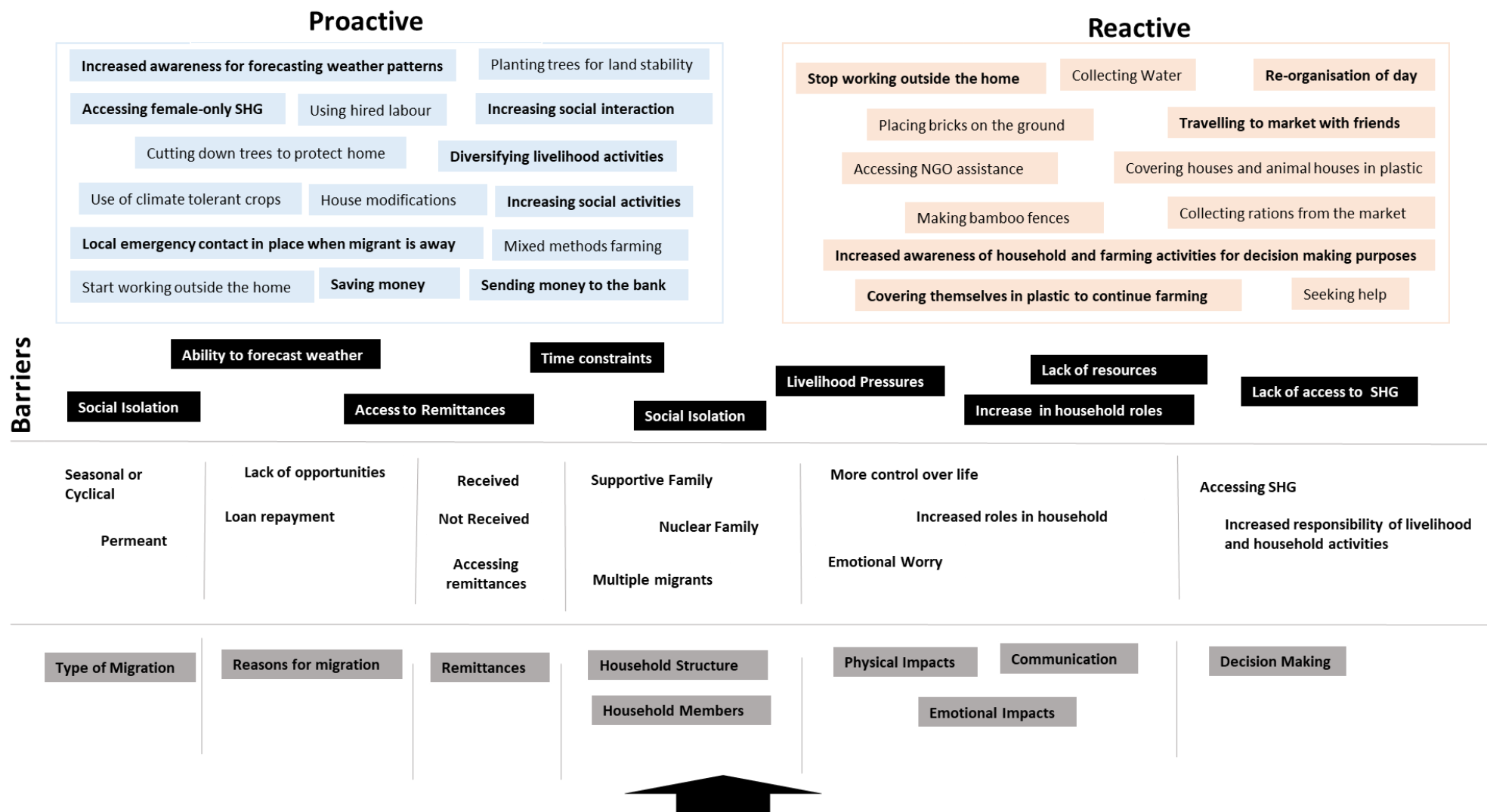
This leads directly on to additional adaptations, including re-organisation of the day, placing bricks on the ground, collecting rations from the market, collecting water, covering houses and animal houses in plastic, making bamboo fences and covering themselves in plastic to continue farming. The roles that women have to fill during out-migration, caused them to undertake additional adaptive strategies and take on strategies the migrating members would usually do. This is particularly evident during out-migration of a husband, leaving just the woman and children in the household.

Furthermore, women increased their social interaction and activities when the household member migrated so that they were better supported in decision making. Women often mentioned that they forecasted the weather more frequently when a member migrated, both within the village and the migrant destination. To ensure they could prepare for weather hazards and to ensure their family member was safe. Women noted that they had a local emergency contact in place whilst a household member was migrating. This was noted as a neighbour, extended family member or a household friend with a market shop. This acted by way of insurance, which women could call on for physical help and economic support.

The adaptive strategies have been outlined and will be further discussed within the Impacts of Out-migration on Women in the IBD section.

4.3 Impacts of Out-migration on Women in the IBD

This section will present the results to address the following research objective: to explore whether out-migration impacts migrant women's wellbeing and the adaptive strategies they use to prepare for and respond to rapid onset weather hazards. It will firstly identify how out-migration impacts women in migrant households. It will then explore whether the impacts of out-migration affect the choices and adaptive strategies women undertake in response to rapid onset weather hazards. It will also identify any barriers to adaptation experienced by women in migrant households. The impacts of out-migration on women will be explored through decision making and wellbeing variables from the survey data. It will then present further insight into the impacts of out-migration on women from the qualitative themes; Characteristics of Out-migration, Decision Making, Family Structure, Wellbeing and Barriers.



Impacts of Out-migration on Women

FIGURE 12: IMPACTS, BARRIERS AND ADAPTIVE STRATEGIES

4.3.1 Impacts of Out-migration

There were several impacts of out-migration, identified within the data that implicate, cause and affect the adaptive strategies women undertake. The impacts of out-migration are complex and open-ended, with many potential implications, both positive and negative. There were also barriers to adaptation identified within the data. The impacts of out-migration on women, their potential outcomes, the barriers to adaptation and the adaptive strategies women undertake to prepare for (Proactive) and respond to (Reactive) weather hazards have been presented within Figure 12. The adaptive strategies highlighted in bolder writing are identified as primarily being affected by the impacts out-migration. The impacts of out-migration identified by the survey data and interviewee responses will be discussed in six categories.

4.3.2 Characteristics of Out-Migration

The type of out-migration (seasonal, cyclical or permanent) was reported to have different implications for women. Seasonal and cyclical migration was preferred because the migrant often lived closer to the area. They could return home, or the migration duration meant that they would be at home, to prepare the household for and provide support during rapid onset weather hazards. This is particularly in reference to monsoon flooding because it can be more easily forecasted and it is expected annually, therefore, migrants can return home, in anticipation. Cyclones however, were observed to impact women significantly more, because migrants could not help women in the time of response to these. Women expressed their concern for the migrating family members, especially children, and preferred them to be at a closer location. One interviewee's husband migrated for a year at a time, returning home once a year for a month. Whilst potentially an exceptional case, this woman was very emotional about her situation and said;

'During heavy rain and monsoon seasons, I have to do everything in the home. I need to go out to collect drinking water, go to the market so I have to lock my young children in the house. I do not speak to my or my husband's family, I am all alone.' (Participant 13)

This was reported differently by women and was primarily overcome by social factors. When women were living in supported extended families, or increased their social interaction and activities, they did not report these problems.

The reason for migration often reflected the impacts experienced and subsequent adaptive strategies the women undertook. When loan repayment and severe economic conditions were experienced by the household, the women often had to continue working in the village and had more responsibility of livelihood activities, such as looking after the livestock, farming or fishing. One woman had two migrating family members, her son and husband. She reported that she had to take on their previous household roles because their remittance is solely used to repay a loan. Therefore she covered herself in plastic to continue with livelihood activities. Other women also reported that they had to undertake all aspects to protect the household from weather hazards, including collecting water, making bamboo fences, placing bricks on the ground, covering houses in plastic and collecting rations from the market. In all circumstances, the women would have been helped by the migrating member of the household during a weather hazard.

The primary uses of remittances, previously discussed in the Characteristics of Out-Migration section, had significant impacts on women's daily life. Interviewees reported that the remittances would go to education or healthcare costs of the children, repaying loans, house modifications and lastly, it would go to supporting the women directly. For example, one interviewee reported that she would put her children and house first, instead of hired labour costs or buying food at the market, which would drastically help her, despite the fact she was physically struggling with these tasks. Remittances did however, have a positive impact on women's responsibility to undertake both household and livelihood activities. In some cases, it was reported that remittances allowed women to focus solely on the household, without additionally having to support livelihood activities. Other women reported that they only undertook extra livelihood and income activities if time allowed. One woman stated that:

'Our whole family and our life is supported by my husband's migration and the money he sends'
(Participant 16)

Additionally, migrant incomes were reported to be significantly more than the income they earned in previous livelihood activities. This allowed women to save a little extra money and was described by several interviewees as a type of insurance. One woman stated this in detail;

'When my husband worked in the village, income is equal to expenditure, if there are any health problems or money needed for emergencies, there is no money left to support us. When my husband migrates, we can save money, we know that we will receive money each month.' (Participant 15)

When migrant households do not receive remittances it was noted by interviewees that they significantly affected both emotional and physical wellbeing. Amongst others, primarily women

could not undertake the adaptations saving money or sending money to the bank, which impacted the household to prepare for weather hazards. The missing household member added more pressure onto the women. An elderly wife discussed her and her husband's struggles upon the migration of their three children. Whilst potentially an exceptional case, none of the children sent remittances home and the couple lacked physical help and financial support.

A stark finding and aspect of remittances discussed by the interviewees was the difficulties in obtaining the sent remittances. Primary forms of receiving remittances were when migrants returned home, paid into bank accounts and sent to family members to give to the women. Some women could not collect remittances because the household was in debt and could not open a bank account, there were time constraints placed on the women from added household responsibilities. This was noted as a lack of access. To overcome these barriers, women undertook the adaptations social interaction and activities, as well as, re-organising their day. They often travelled in small groups to the bank, during school hours or members of the family would look after the children. Some migrants left provisions in place for neighbours to receive remittances for women to collect more easily.

4.3.3 Decision Making

Out-migration of a household member had surprising impacts on women's household decision making powers. Overall, the survey data showed that both male and female adults and female adults decision making was higher in migrant households than non-migrant households, shown in Figure 13. The decision to treat sick children was undertaken by female adults in 24% of migrant households. The characteristics of out-migration reflected mainly male migrants and it can be anticipated that women become de facto household heads and in turn the responsibility of the decision making



FIGURE 13: DECISION MAKING IN NON-MIGRANT AND MIGRANT HOUSEHOLDS (SEE APPENDIX 15)

Many women reported the worry they experienced when their family member migrated. Often discussing this as the most negative impact of out-migration. Considering the decription of added physical activities from missing household members, this was a suprising finding throughout the interviews. Several women said that they worry about the migrant when the weather is bad in the village. With little ability to communicate, the women say they often cry themselves to sleep and do not eat. When communication between migrant and household is upkept, women felt better equipped and less alone to deal with natural hazards. The decision making powers in migrant and non-migrant households show that it is often shared between



FIGURE 14: PROTECTING AGRICULTURAL CROPS (AUTHORS OWN PHOTO)



FIGURE 15: LIVESTOCK AT A HOUSEHOLD (AUTHORS OWN PHOTO)

Whilst women help in the field and within livelihoods, women in migrant households whereby the migrant is primarily in control of livelihood decision making were seen to struggle to undertake both household and additional livelihood decision making and added roles. Inexperience in these livelihoods often added pressure to the lives of women. Figure 14 and Figure 15 shows a farming technique used to protect the crops and also livestock at a household, as well as others, women are often struggle with these types of added livelihood responsibilities. However, women often mentioned that they forecasted the weather more frequently when a member migrated, both within the village and the migrant destination. This was observed to be firstly, an outcome of added livelihood responsibility and also, allow for communication with migrants or friends to gain advice.

Furthermore, women often heavily invested and supported migrants, whilst it was a household decision usually, women gave as much as they could to support the migrants. Parents and women gave children a large amount of money to help them get set up in the destination area, which was a huge investment for the households. Some interviewees say they sacrificed this so that they could eventually receive remittances.

4.3.4 Household Structure

The household structure, including extended family, was a significantly influences how a woman experienced and was impacted by out-migration. Some interviewees lived within, what was described as 'nuclear' and 'fragmented' families whereby women were not in contact or supported by their extended family members. Women who were supported had a network of security and safety that they could call on when the migrant was away. The women described their family members as:

'uncle as very helpful and supportive' (Participant 8)

'mother-in-law and father-in-law were very supportive' (Participant 4)

Family members lent them money when they were struggling, when they needed assistance with their children during flooding or when their homes were seriously damaged from natural hazards. Neighbours and friends were discussed as significant supporting members of a woman's social network. Interviewees discussed the role of their neighbours and friends during times of natural hazards, amongst responses were the following:

'I have a huge bond with my neighbours, yes we are poor but they provide huge mental and emotional support when my husband is migrating' (Participant 6)

Neighbours and friends acted in place of, or extensions of family, greatly supporting women during out-migration of household members.

The presence of certain household members during out-migration and the role of the migrating member within the household have significant impacts on women. Where there are children in a household, the primary aim for them is to pursue education. There was a significant shift from children's responsibilities to educational pursuits within the interviews. This often led women to have higher pressures at home, with many attempting to do more jobs throughout the day whilst the children were at school. They also prioritise their children's educational costs above those within the household. The role the migrant had in the household, i.e. a husband, son or grandchild, had significant impacts on women. Despite the women taking on similar extra roles, when any member migrated, the presence of a husband directly impacted women. This was because of the emotional and mental support husbands provided, as well as the roles the women undertook. Amongst interviewee responses, women often described their husband as:

'when problems arise, my husband and I sit together and find a solution' (Participant 15)

'my husband helps me physically, in the house and with the livestock' (Participant 7)

'he is so caring, I speak to him each and every day' (Participant 4)

The physical burden of the loss of household members was mentioned as an impact, but was often counteracted from remittances and social support whilst the member of the household migrated.

4.3.5 Wellbeing

The survey asked women in migrant households to agree or disagree to several wellbeing statements, as shown in Figure 14.

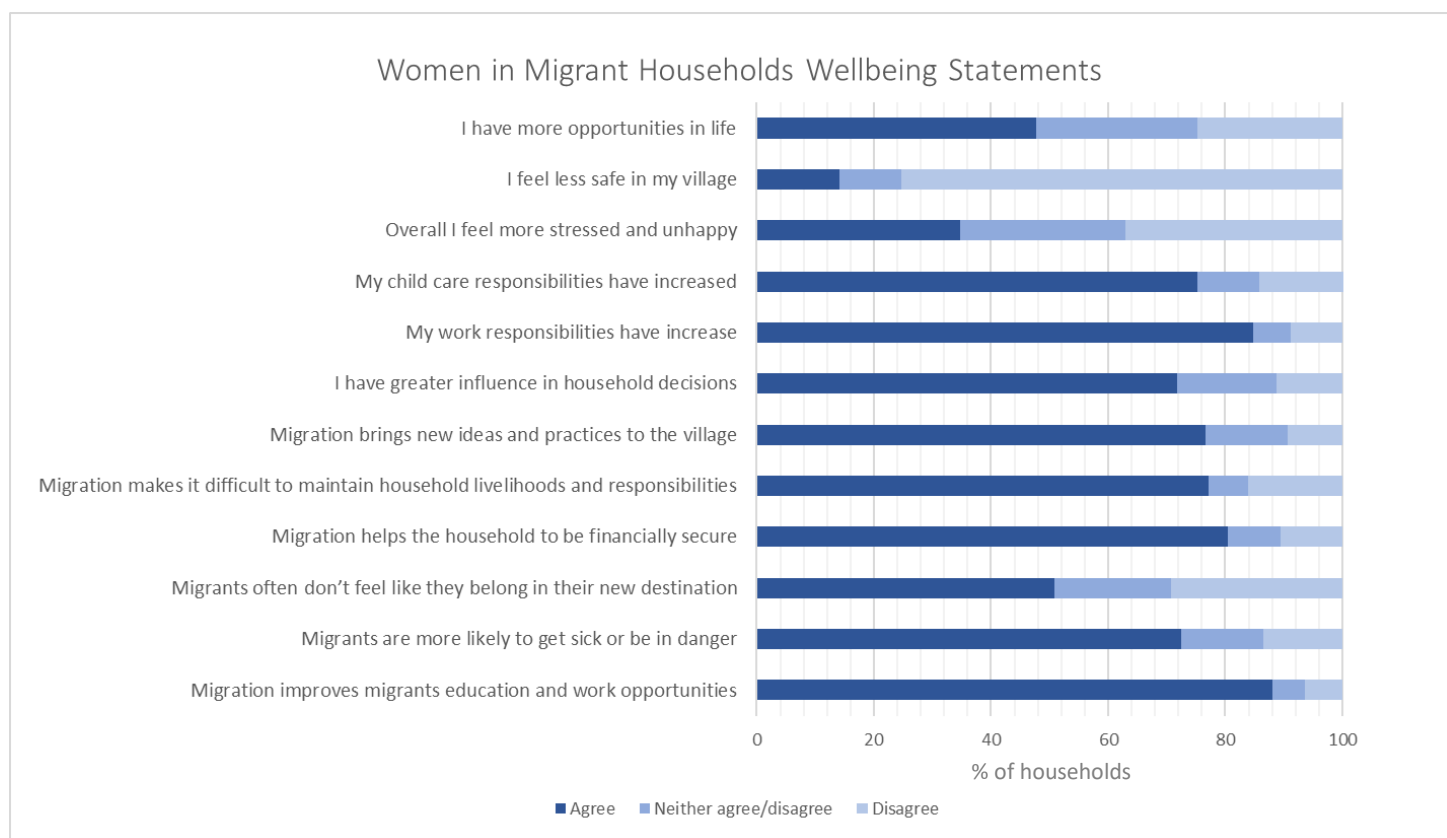


FIGURE 17: WOMEN'S WELLBEING STATEMENTS (SEE APPENDIX 14)

There are interesting aspects to discuss with relation to the wellbeing statement; 'overall I feel more stressed and unhappy' in relation to out-migration, which can be explored within the other wellbeing statements. Whilst, 35% of women agreed with this statement, 38% of women disagreed with it. There seemed to be influencing factors that affect the responses.

One significant finding from the interviewee responses was the worry women had for the migrating member and its impact on womens wellbeing. They were significantly affected by emotional worry about where and how the migrant was. It was observed from the survey data that 50% of women felt that migrants do not feel like they belong in their new destination and 74% of women felt that migrants are more likely to get sick or be in danger. Emotional worry, combined with social isolation, affected the adpative strategies women undertook. The little support they received from family or friends led them to be more vulnerable, with some experiencing emotional stress. The increasing social interaction and social activities led women to undertake adaptive strategies and improve their wellbeing. Women stated that they felt more empowered and supported to undertake livelihood and household decisions. Furthemore, it is interesting that 90% of women agreed that

migration improved a migrants education and work opportunities. Within all interviewee responses, women wanted their children to gain a good education and wanted migrants to have good work opportunities. Primarily, migration is presented as a positive livelihood decision by women. Additionally, the survey data illustrates that 48% of women agreed that migration gave them more opportunities in life and 75% of women believed that they had greater influence in household decision making. These statements demonstrate that migration can have positive outcomes on womens lives. Women had the choice to undertake livelihoods, such as tailoring (Figure 19) and growing chillies (Figure 18). The interviewee responses can provide examples of this with women attributing more freedom during out-migration:

'I have my own fishing net now and I support the income from fishing occassionally' (Partcipant 11)



FIGURE 18: CHILLIES DRYING IN THE SUN (AUTHORS OWN PHOTO)



FIGURE 19: WOMEN'S TAILORING (AUTHORS OWN PHOTO)

Adaptive strategies are further implicated by these opportunities and greater influence in decision making, with women observed to be re-organising their time, diversifying livelihood choices and accessing SHG's. SHG were praised by interviewees for the economic support and security they

provided during out-migration of family members. This was seen to increase women's access to economic resources and allowed women to make decisions over their livelihoods and households. To prepare for rapid-onset weather hazards, accessing SHG positively contributed to the adaptive strategies they could undertake. For example, it allowed them to stop working outside the home or to undertake a different livelihood during times of vulnerability or stress. It also allowed women to save money and preserve rations. This was especially evident when remittances were not sent by the migrant.

Within the wellbeing statements 85% of women agreed that their childhood responsibilities had increased and 85% of women agreed their work responsibilities had increased. These were noted by interviewees as potential negative during out-migration, during flooding, cyclones and storm surges. The added pressures often led women to struggle with life and the ability to implement adaptive strategies.

4.3.6 Observed Barriers to Adaptations

There were several barriers to adaptation, which emerged from the data, experienced by women in migrant households, shown in Figure 15. These have been categorised and documented within three categories; Human and Informational, Natural and Social (**Jones and Boyd, 2011**).

Human and Informational	Natural	Social
Inexperience in decision making	Lack of resources	Isolation
Livelihood pressures		Lack of access to SHG
Increase in household roles and activities		
Access to remittances		Lack of family members
Ability to forecast weather		
Time constraints		

FIGURE 20: BARRIERS TO ADAPTATION EXPERIENCED BY WOMEN IN MIGRANT HOUSEHOLDS

Higher responsibilities in decision making powers often led women unable to implement adaptations. Socially isolated women with increased household roles and livelihood activities often

struggled to prepare for and respond to weather hazards, with time and economic constraints reported. Women with supportive family and friends would help the women to forecast weather, provide emotional and economic support, which leads into the Social and Natural barriers to adaptation.

A lack of resources was associated with a lack of access to remittances, SHG's and social isolation. Access to additional livelihoods and assets to allow women to prepare for and respond to hazards was particularly observed, for example, women could not obtain resources from the market, cover their houses in plastic and build bamboo fences. Social barriers were noted to have the highest impact on the ability of women to undertake adaptive strategies. Isolation and a lack of family members to support women were significant allowing women to respond to weather hazards. They placed huge strain and stress on women, both mentally and physically. Furthermore, SHG's were extremely important for women's agency and to support livelihood activities when migrants were away or remittances were not sent regularly. Access to these SHG was vital for women in rural areas. A lack of access to these SHG's, from age and means of finance, was identified as a primary social barrier experienced by women.

4.4 Summary of Results and Analysis

The Results and Analysis section presented the qualitative and quantitative data to address the main research objectives. The summary will further be informed by the research objectives and will address the related research questions.

Primarily men are observed as the migrating members of the household, with unmarried children, married children and partner of the household head the main migrants. The primary livelihoods of migrant families are crop farmers, which can reflect the prevalence of seasonal and cyclical migrants.

The perception of the impacts of rapid-onset weather hazards on households found that migrant households appear to be impacted by cyclones, storm surges and flooding more than non-migrant households. Whilst affecting households within all time frames, hazards primarily affect households once every decade. Adaptive strategies were undertaken by migrant and non-migrant households differently, as shown within the fifteen adaptation responses from the survey data. Primarily, household adaptations in the forms of taking out a loan, modifying the house, planting trees and using hired labour are being undertaken in the IBD. The adaptive strategies migrant households undertake, is reflected within the adaptive strategies undertaken by women in migrant households.

There are many adaptive strategies employed by women. Adaptive strategies categorised as Proactive adaptations, including increasing social interaction and activities, accessing female-only SHG's and storing rations, were undertaken to prepare for rapid-onset weather hazards. Whereas, the adaptive strategies categorised as Reactive adaptations, including increased awareness of household and livelihood activities for decision making purposes and re-organisation of day, were undertaken to respond to rapid-onset weather hazards.

The impacts of out-migration documented within this research study were primarily identified as reason and type of out-migration, remittances, household structure, physical and emotional impacts and decision making. The impacts of out-migration are by affect linked to the adaptive strategies women undertake. Out-migration has shown to positively impact a woman's wellbeing and their ability to prepare for and respond to weather hazards, though remittances and greater influence on household and livelihood decision making. These impacts are linked to the following adaptive strategies: stopping working outside the home and increasing social interaction. The role of remittances, social factors, including social interaction and the support provided by family were discussed as the primary influencing factors of how women experience out-migration.

On the other hand, out-migration has shown to negatively impact a woman's wellbeing and their ability to prepare and respond to weather hazards, from loss of household members, not receiving remittances and physical impacts. The negative impacts of out-migration causes women to undertake the following adaptive strategies: covering themselves in plastic to continue farming and accessing female-only SHG's. There were several barriers to adaptation, including social isolation, lack of access to SHG's and time constraints, which have shown to be experienced by women in migrant households. The impacts of out-migration, their inter-relations and the interactions between adaptive strategies are open-ended and do not have a definite correlation.

Chapter 5

Discussion

5.0 Introduction

Chapter 6 will provide a discussion on the results and analysis in relation to the current literature. It will synthesise the impacts of out-migration on the adaptive strategies women undertaken to respond to and prepare for rapid-onset weather hazards specifically. It will reflect on the research study limitations and positionality in data interpretation.

5.1 Synthesis: Out-migration, Women and Adaptive Strategies

The adaptive strategies identified and categorised within this research contributes to the current literature in relation to rapid-onset weather hazards, adding to adaptive strategies identified by Raha et al, 2013, Mondal, 2014 and Mazumdar et al, 2014. The documentation of gender dimensions of these adaptive strategies is further important for representation of women within research. The way migrant households perceive and experience rapid onset weather hazards and the reasons for out-migration within migrant households have significant implications for the adaptive strategies women undertake. This is an important aspect to highlight and has rarely been documented within the current literature.

Several studies exploring out-migration often question or attempt to conclude the reasons for why some women experience out-migration positively and others inherently negatively (Gulati, 1993). Desai and Banerji's (2008), upon reflection of studies who document women's perception of out-migration, raise the interesting question of 'Why do some women find freedom and responsibility in their husband's absence while others do not?' This research study can offer several inferences, upon presentation of the results and conclusions of this research study, in relation to impacts of out-migration and can further be discussed within women's choices of adaptive strategies. The findings to this research study have identified several impacts of out-migration that constrain women and in contrast, find women's agency and autonomy significantly enhanced.

The role of loans have been identified as a reason for out-migration, an adaptive strategy to cope with natural hazards and in turn, has demonstrated several impacts on women. When a household takes out a loan a woman often has to manage both the household and livelihood activities alone, when the migrant leaves the household, because the remittances are used to repay the loan and do not contribute a household livelihood. Whilst within the same deltaic region, but not within India, Paul and Routray (2011) identified that households took out loans to cope with the impacts of cyclones and induced surges in coastal Bangladesh. It was identified that households often entered a vicious cycle of taking out loans after a natural disaster as a way of coping. Borrowing money, whether formal or informal, was seen by a high number of households in the IBD. The pressure on women from this act can have an extremely detrimental impact, with impacts affecting women's physical and emotional wellbeing.

With the characteristics of out-migration reflecting mainly male migrants, it was shown in this study and anticipated that women become de facto household head and in turn the responsibility of the household head decision making (Nabikolo et al, 2012). Findings of this study show that decision making powers often transferred to the women when men migrate, which can have implications for the adaptive strategies they undertake. Whilst limited literature documenting this in the IBD, similarities can be drawn from Nabikolo et al's (2012) study in the context of rural communities in Uganda, which explored differences in adaptive strategies undertaken by men and women. This study found that men and women were observed undertaking adaptive strategies differently, with men prioritising adaptations with land use and women prioritising assets and house modifications. The increase in decision making powers often had positive impacts on women, but social isolation and inexperience in decision making led women to be affected and not undertake adaptive strategies, especially within livelihood activities and outside of the household.

Desai and Banerji (2008) stated the household structure forms the key mediating factor through which a husband's absence affects women. This has been inherently reflected in the findings, and can be highlighted particularly in relation to weather hazards and the main influencing factor in the adaptive strategies undertaken by women. Women's autonomy is critical for empowerment and it has been attributed and identified as a crucial aspect, both within literature and the findings of this study, to allow them the freedom to undertake adaptive strategies (Osamor and Grady, 2016). Whilst further drawing on the conclusion presented by Desai and Banerji (2008), the findings of this research study found that the key mediating factor the household structure, but can redefine this

to incorporate the stark implications of social aspects discussed, redefining this mediating factor to include 'family' and 'community.' A woman's social network, of extended family, neighbours and friends, is often increased and strengthened during out-migration.

Within the migration left-behind nexus literature, Toyota et al highlights the multidimensional nature of out-migration, arguing that there is not a sole outcome or conclusion, but instead it is more productive to identify 'lines of influence and their relations' (2007). Toyota et al's (2007) interpretation of the impacts of out-migration can be used to conclude the research studies findings. There are many lines of influence that affect the choices women make in preparing for or responding to rapid onset weather hazards in the IBD outlined in this study. The open-ended nature of out-migration and their influence on the adaptive strategies women undertake are broad and identifying the lines of influence that highlight the issues impacting women, households and communities, represented in Figure 12. Documentation of these lines of influence are inherently important for policy and decision makers.

5.2 Limitations and Interpretation

Whilst the household survey provided huge insight, its implementation and execution however, was costly, time consuming and far beyond a masters student's realistic study design. The use of the data was invaluable and added significant depth and insight into the wider context of out-migration in the IBD specifically. It should be noted that the qualitative research was undertaken in significantly planned circumstances. The climatic conditions, safety aspects and travel in the IBD are near impossible without help from locals and understanding of the local area. A research team from Jadavpur University, as well as visiting researchers, provided help and assistance during fieldwork, from safety aspects to undertaking the purposive sampling. Risk assessments were carried out to ensure we knew what to do in an emergency and consider all potential risks involved in fieldwork (Appendix 9).

The limitations of the survey design appear to lie within language and the meanings of words cross-culturally. These limitations were experienced but overcome and mitigated during the in-depth interviews. The meanings of words, the structure of the sentences and the delivery by the translator all impacted how the question was answered. For example, the question: 'What was the reason the migrant left the household?' was asked within the in-depth interviews to obtain context to the migration within a household. Most respondents reported the migrant left to 'find employment' but

the need for this employment was identified as the actual reasons for migration. Whilst in the household survey, researcher training was put in place to overcome these language issues, it appears evident that this is one limitation which comes with the implementation of surveys. It allowed for further insight and provided a holistic view for the reasons of out-migration, whilst the survey showed that the primary reason was to seek employment, there was rarely one motivating factor for out-migration.

In recent years, researchers have acknowledged the importance of not just ethical practice within research but have put a greater emphasis and attention on reflexivity, positionality and power relations, to contribute to the ethical considerations (Canagarajah and Stanley, 2015; Vanner, 2015; Nathan et al, 2016). This was noted as particularly important by Sultana (2007) in relation to conducting international research. During transcription and after conducting interviews, many topics were discussed with the translator, to situate the findings within the social and cultural context. This was which was invaluable for highlighting the researcher positionality within interpretation of the data. As a British woman and the researcher, the way I interpret the data will be from my current understanding of social and cultural contexts. A field diary was kept to understand the phenomena and prevent bias within data interpretation.

The need for in-depth interviews can be further justified in relation to the exploration into differences undertaken by women in migrant households, primarily to ensure that they were represented. Whilst the household survey was undertaken by women, this was only if they were the household head, and the adaptation specific-questions were reportedly undertaken by very few women. Therefore, to explore the aim, the findings were solely drawn from the interview data. Whilst this mitigates the limitations highlighted from the survey implementation, limitations can still be reflected on in relation to case study. The generalisation and applicability of case studies are very limited, however, the contextual relevance and broader understanding was provided by quantitative research (Flyvbjerg, 2006). Real life context is an important addition, however, there is a possibility that the quantitative and qualitative research does not correlate. The quantitative variables may not represent what is interpreted and there may be cross-cultural misunderstanding. Every effort was made during the survey implementation by the DECCMA team and during the qualitative research to ensure simple and unambiguous questions.

Chapter 6

Conclusion

The main aim of this research was to advance an understanding and to explore the impact of out-migration on the choices women make in preparing for or responding to rapid onset weather hazards in the IBD. The aim and research objectives were explored in the six previous Chapters. Chapter 1 presented introduced the research topic and study area and outlined the importance and significance of the research. Chapter 2, this synthesised, explored and reviewed the current literature surrounding deltas, adaptation and out-migration, with reference to women in the IBD. Chapter 3 outlined the justification and implementation of the mixed methods research study design. Chapter 4 presented the results and analysis of the qualitative and quantitative findings in relation to the research objectives. Chapter 5 synthesised the current literature with the results and analysis of this research. This research study can be concluded within regards to the specific research objectives to address the main aim.

The documentation of the characteristics of the IBD provided a foundation and context, contributing to a deeper understanding of how out-migration impacts the adaptive strategies women undertake to prepare for and respond to rapid-onset weather hazards. The findings conclude, with support from current literature, that rapid onset weather hazards and their impacts are perceived and experienced differently by non-migrant and migrant household and in turn, adaptive strategies are undertaken. These differences in adaptive strategies, combined with characteristics of out-migration such as reasons and remittances, impact the choices women make in preparing for or responding to rapid onset weather hazards.

Out-migration poses significant impacts on women in the IBD, with an interplay of aspects affecting how women experience this phenomena. These implications have been shown to influence the choices women make in preparing for and responding to rapid onset weather hazards. It has been documented on an IBD scale that migrant households perceive and are affected by rapid onset weather hazards. Within the parameters of the case study data, the gendered dimensions within the adaptive strategies documented are implicated by the way migrant and non-migration households perceive and undertake adaptations. This study reinforces the open-ended and multi-dimensional nature of relations between out-migration and adaptive strategies undertaken by women. There are

many 'lines of influence' which can contribute and be attributed to the adaptive strategies women undertake. It is evident that migration will continue to be a viable and increasingly undertaken sustainable livelihood within the IBD and it has been observed that it has great positive impacts on women. The greater influence on decision making, gifted from out-migration by men, is a significant factor that affects the choices women make in preparing for rapid onset weather hazards. Remittances and SHG are additional significant impacts of out-migration which empower women to make choices over their own lives and in turn the adaptive strategies they undertake. Whilst the negative impacts of out-migration are inherently evident, social factors, such as strengthening social networks, can reduce these impacts. Literature discusses that out-migration has re-defined the social and cultural roles and dimensions within the IBD, which positively attributes decision making through empowerment, this has been demonstrated within this research study and has important implications for policy and to highlight areas of future research.

6.0 Implications for policy

The Indian government has been slow to recognise the importance of adaptation implementation in policy, particularly within gender development. Women are still unrepresented within both policy and research. The Delta Alliance, which publishes reports to inform policy, may find the conclusions of this research study important for assisting in the development of policy (Delta Alliance, 2018). Social support is often lacking in policy, but has been concluded as the primary reason for undertaking adaptive strategies, as well as the primary barrier. Therefore, policy makers should develop these into policy for supporting women in rural communities.

SHG's have been shown to have positive implications for women in rural communities which this research study reinforces. Therefore, the support of these groups should be important additions into policy. The findings of this study would contribute significantly to Disaster Risk Reduction policy for reducing vulnerability and impacts of weather hazards.

The findings could be valuable for NGO's which often play an important role in assisting and supporting these rural communities after natural hazards. One NGO, the Sundarban Social Development Centre (SSDC), with a mission to support society and improve equality in relation to natural disasters, would be informed by the study's findings in the best uses of their funds and support for women in the IBD (SSDC, 2018).

6.1 Future Research

The focus of this research study was solely the impact of out-migration on women's adaptive strategies in relation to rapid-onset weather hazards, it would be valuable to replicate the study in relation to slow-onset weather hazards to explore the potential implications of these. Furthermore, whilst this study documented adaptive strategies in the context of out-migration the IBD, migration is inherently dynamic. It would be academically important to repeat the study in to further document how women experience out-migration over time. The study provided and contributed to the literature on adaptive strategies undertaken within the IBD but future studies should attempt to build on this further. It has been important to document the impact of out-migration on women and the adaptive strategies they undertake, however, the study found several barriers to adaptation. A study exploring barriers to adaptation further would be an important area to be explored in the future. Finally, future research should aim to develop a framework for identifying the impacts of out-migration on adaptive strategies women undertake in relation to weather hazards. Whilst many studies have attempted to do this within the 'migration left-behind nexus' literature, they do not have applicability universally.

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