

Role of Self-Help Groups in Coping with Natural Disaster: A Study from Sundarban Region in West Bengal¹

by

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Abstract:

This paper undertakes an economic analysis of the adaptation and coping strategies of households and the role of supporting institutions in a heavily cyclone affected area of the Sundarban. Climate change, incidence of recurrent cyclones, poverty and different response patterns are empirically verified with the primary data collected for this study. The results highlight the role of self-help groups and microfinance institutions in building resilience among affected households during natural disaster episodes.

1. Introduction

Sundarban means ‘beautiful forests’, lies on the delta of the Ganges, Brahmaputra and Meghna rivers on the Bay of Bengal and is spread across India and Bangladesh. The place is intersected by a complex network of tidal waterways, mudflats, and small islands of salt-tolerant mangrove forests. The diverse biological resource and the ecological importance of the region is well recognised and well documented. The mangrove ecosystems of the Sundarban are the world’s largest mangrove forest and has great ecological significance for being the most efficient carbon sequestration. These forests also protect the coastal regions from heavy wind, tidal waves, coastal erosion, and sea water intrusion, generate substantial quantities of fishery resources and provide many useful forestry products. The region was declared as World Heritage Site in 1987.

The changing climatic condition along with deforestation of the mangrove forests coupled with the changing lifestyle is increasing the level of degradation as well as climate change and temperature. Being as estuarine delta, the changes in the temperature of the sea, which

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has severe implications on aquatic life, is greatly impacting the ecosystem of the region. The sea level, in the last 25 years, has been rising at a rate which is double the global average and the salinity level of water in the region has also increased substantially, again impacting the agricultural productivity (Bairagya, 2019). An important characteristic of the Sundarban region is that it is a cyclone-prone area. The occurrence and intensity of cyclone storm hitting the Sundarban have increased substantially during the last century (Singh, 2007).

In May of 2009, the Alia Cyclone which hit the region created havoc and destroyed the livelihood of over 2 million people of the region. The changes in the level of salinity of the agricultural land have made agricultural activity more difficult, and consequently, a large section of the male population have returned to skilled and unskilled seasonal labour in nearby urban location, namely Kolkata. The female members were compelled to take up various other kind of economic activities, which included integrated farming, handicraft, micro-food processing activities, livestock rearing, etc with the help of various Self-Help Groups (SHG).

The objective of integrated farming was to use the natural behaviour of animals and insects in a zero-wastage system to bring the saline soil close to its natural state. The SHGs provided the necessary support to help train these household in integrated farming techniques apart from maintaining their own grain-bank of indigenous seeds to ensure security during rainy days and relief from running into debts. Besides agriculture, these SHGs have also got involved in fishing in land ponds bottom covered by polymer and operating biogas plants.

Sundarban has its own unique characteristics that exacerbate welfare risks in the face of shocks. Widely exposed to the whims of nature, owing in part to the global pattern of climate change and the increased risks posed to life and livelihoods in low-lying, coastal regions, the Sundarban's development connotations are precarious. Frequent natural calamities such as floods and cyclonic storms, even on a much smaller scale, may weaken household adaptive capacities; disasters and other extreme climatic events hasten the breakdown of all coping mechanisms and push households deeper into chronic poverty traps. Therefore, in the geo-climatically challenged areas of Sundarban, continuous series of shocks often shapes a household's welfare outcomes and explains the dynamics of coping mechanisms (Kanjilal et. al, 2010).

At the backdrop of the recent episodes of cyclones in the region (Cyclone Bulbul in Nov 2019 and Cyclone Amphan in 2020), this study tries to evaluate whether SHGs constitute appropriate interventions to empower households to meet their challenges of climate change shocks. The focus of this study is exploring the efficacy of adaptation as against mitigation

measures. The structure of the paper is as follows. Section 2 presents literature review. Section 3 explains the objective of the study, field survey and methodology. The results of the survey, analysis and discussions are provided in Section 4 while Section 5 concludes along with the policy implication.

2. Literature Review:

The initial international response to climate change has focused more on mitigation as it tries to address the problem from its source (Fussel, 2007). However, as Nordhuas and Yang (1996, p189) points out, "mitigate at we might; adopt we must". There is also lot of scepticism about the efficacy of mitigation efforts, and these has led practitioners and researchers to recognise that both mitigation and adaptation should go hand in hand (Pielke, 1998). Adaptation is a process of adjustment to new or modified circumstances, and in the context of climate change, adaptation is understood as the actions people take in response to, or in anticipation of changing climate conditions to reduce adverse impacts or take advantage of any opportunities that may arise (Tompkins and Adger 2003). Adaptation research lies at the intersection of multiple disciplines in both natural and social science. Therefore, several approaches to understanding adaptation have emerged over the last few decades including the hazards, vulnerability, and resilience (Funfgeld and McEvoy, 2011). The hazard approach, which stems from the disaster and risk management literature tends to focus on the short-term coping capacities of communities (Funfgeld and McEvoy, 2011). The vulnerabilities approach draws from the poverty and development literature and highlights the differential impact of climate events on social groups (Adger, 1996, 2006; Eakin and Lauers, 2006; Funfgeld and McEvoy, 2011; Hweitt, 1983, 1995; Wilkinson, 2012). The resilience approach aims to achieve a more integrated understanding of the natural and social world, with a special focus on the role of human agency and ingenuity in the face of ecological changes (Adger, 2000; Berkes, et al. 2003; Gunderson, 2003; Brown and Westway, 2011; Gallopin, 2006, Nelson, 2011). Adaptation is also relatively easier to implement because mitigation strategies require cooperation at global level and the outcome of such efforts are often non recognisable in the short term. There is also an increased recognition of the fact that climate change policies need to be integrated with social and sustainable development agendas (Adger et al., 2003; Robinson and Herbert, 2001; van Asselt et al., 2005), primarily because of the profound impact that it has on the poor population across the globe.

There are multiple ways in which communities and societies try to cope. However, it is a fact that poor and marginalised segment are more vulnerable to climate variability and shocks. Literature in this area suggest that livelihood diversification and migration are two common widely used mechanism. Livelihood diversification - at household level, it is viewed as an outcome of dynamic livelihood adaptation to various constraints and opportunities faced by householders. It refers to income strategies of rural individuals or households in which they increase their number of activities, regardless of the sector or location. Livelihood diversification is an active social process, involving the maintenance and continuous adaptation of a highly diverse portfolio of activities over time to secure survival and improve standards of living (Ellis, 2000). Migration, particularly the temporary seasonal migration, has long been used as an important risk-coping strategy of poorer households facing uncertain income flows, resulting from adverse weather conditions and other external shocks – a mechanism for household level income smoothing (Ellis, 2000; Laczko & Aghazarm, 2009; Marchiori, Maystadt, & Schumacher, 2013; Wisner, Blaikie, Cannon, & Davis, 2004). While citizens in developed countries depend little on weather-contingent production activities and have more resources at their disposal to protect themselves against the direct effects of adverse weather conditions (Fankhauser & McDermott, 2014) but it does not obtain for the poor. The marginalisation of poor population along various dimensions such as gender, ethnic, political and geographic discrimination put them at a disadvantage compared to other population segments of any society.

In this context, Microfinance Institutions (MFIs) have been part of the development toolbox used to irradicate poverty across the globe for almost 30 years. Microfinance institutions provide small loans particularly to the weaker sections of the population to help them improve their livelihood. Using the concept of joint liability and group lending through SHGs, these have been able to reach a base clientele of literally hundreds of thousands of poor families, through distribution channels that serve concentrated slums in urban areas as well as remote rural communities. (Helms, 2006). Over the years, microfinance programmes have emerged as an important factor in reducing poverty and bringing about social change (Ray, Mahapatra and Nath, 2019). As per the Microfinance Barometer 2019 report, over 139.9 million borrowers benefited from the services of MFIs in 2018.

The logic behind microfinance's role in climate change adaptation is simple and straight forward - as individuals and households manage to accumulate more assets and capabilities, they are likely to be less vulnerable (Swift, 1989; Moser, 1998; Ellis, 2000). SHGs and microfinance facilitate adaptation by (1) improving ex-post risk recovery by enhancing

coping capacity (Heltberg, Siegel, & Jorgensen, 2009); and (2) improving ex-ante risk reduction by enhancing adaptive capacity (Agrawala & Carraro, 2010; Hammill, Matthew, & McCarter, 2008). The types of services such as microcredit, microinsurance and micro savings, have considerable linkage to asset accumulation needed to undertake livelihood strategies in the pursuit of desired livelihood outcomes (Scoones 1998; Hammill, Matthew and McCarter, 2008). The ability of microfinance institutions to help the poor population in accumulating and managing the assets and capabilities needed to become less susceptible to shocks and stresses and/or cope with their impacts is well documented. Therefore, it has been argued that microfinance can play a big role in helping poor, vulnerable population to cope with climate change impacts and shocks as more assets and capabilities people have, the less vulnerable they are (Swift 1989; Moser 1998; Ellis 2000). All these microfinance services can enhance the livelihood asset base through direct income effects, indirect income effects (from education and training), and non-pecuniary effects (i.e., stronger social networks and increased confidence) (Galab et al. 2006; de Aghion and Morduch, 2001). Thereby, microfinance provides the poor and vulnerable populations can adapt to climate change by accumulating and managing the assets and capabilities needed to become less susceptible to shocks and stresses and/or cope with their impacts. Of course, some assets and capabilities would be better suited to promoting climate change adaptation than others, and the optimal mix needs to be determined at the community or household level and can even result in maladaptation (Hammill et al., 2008). Therefore, there is a need to obtain empirical evidence to substantiate that SHGs and microfinance help in coping with climate change shocks.

Studies from the region in the post-Aila period suggest that social capital formation has a significant role in risk reduction (Sanyal and Routray, 2016). Because of the settlement's common historical background, isolation, similar culture, and the presence of institutions such as youth clubs that served as de facto community centres, bonding social capital was abundant in the study area. There was a lot of reliance and trust among the community members because of these ties and institutions. As a result, social capital and adversity experience are critical for this remote community, particularly because disaster management institutions and essential infrastructures are lacking. Many of the community members' problems are solved internally with each other's help and cooperation, even in times of emergencies such as a small-scale disaster, because the community members are well connected to one another. In the event of a large-scale disaster, social capital assists the community in surviving until assistance from the government and other aid agencies arrives. Similarly, the NGOs operating in the region have also played an important role in livelihood

diversification and disaster response through the introduction of alternative livelihood activities in the Sundarban, which has the capacity to improve community resilience and mitigated risks (Jain, Rawat, and Patil, 2016).

Indian Sundarban is home to 4.5 million people as well as 85 percent of India's mangrove habitat and 1434 species of fauna. Their primary sources of income are agriculture, fishing, and non-timber forest products from mangroves. Due to land loss caused by shoreline changes, residents of this climatically vulnerable region are at risk of becoming environmental refugees. Furthermore, storm surges caused by cyclones such as Aila are becoming more common, causing a sudden influx of saline water into the freshwater supply. Salt accumulation in soil and water has a significant impact on agricultural and aquaculture production. As a result, climate risks have had a significant impact on livelihoods as well as this unique ecosystem. Man-Mangrove interactions in Indian Sundarban are also hampered by unsustainable exploitation of forest products, mud-flat embankments that cause propagule failure, and other factors. Food insecurity, health hazards and the likelihood of material and human losses due to climatic calamities acts as a serious threat to the population's economic viability, as it slows down the human capital generation and other developmental options in the face of climate change (Majumder et. al, 2014; Roy and Guha, 2017; Hajra et. al; 2017). Majumder et al (2014)'s study shows that in comparison to their counterparts who have only experienced the health shock, households who have experienced multiple shocks have a significantly greater difficulty financing expenses arising from health shocks. Furthermore, these households are more likely to borrow money from friends or moneylenders to cover their expenses. The empirical evidence provided by the authors suggest that natural and health shocks reinforce each other's effects and as a result coping becomes more difficult, posing significant risks of welfare loss, with short-term and long-term development implications. Hajra et. al., (2017) study highlights the positive relationship between economic poverty and material loss following natural disasters. Salinization, tidal surge, erosion, and household location are significant drivers of economic and human losses.

The region, therefore, needs geo-smart systems which help in addressing three aspects of adoption, i.e., anticipate, absorb, and reshape (Ghosh, et. al., 2018). In this context, Ghosh et. al. (2018) also argues that the SHGs can be a significant catalyst in helping the region and the households mitigate and adopt to climate change impacts. The possible ways in which SHGs can contribute range from creating of climate risk map to identifying vulnerable areas, formation of local disaster response teams, coordination with various governmental and non-governmental agencies in creation of environmental assets such as germplasm conservation

and seed banks, and co-ordinating linkages with financial institutions. This study is an effort to provide empirical evidence related to the adaptation and coping strategies for households in the Sundarban region and the role of SHGs as a facilitator.

3. Objectives, Field Survey and Methodology

The present study is conducted with two principal objectives. First is to assess the impact of these disaster episodes, i.e., the cyclones on the livelihood of the households in the region. The second is to document the coping strategies by households to rebuild the income generating sources. As extended part of the second exercise, an attempt is made to (i) compare and contrast the efficacy of Self-Help Groups in conjunction with affected household labour and the help emanating from external sources such as government intervention, rural banking and micro finance institutions; (ii) assess the efficacy of integrated farming as an instrument of sustainable development. That is, rebuilding the income generating agricultural practices by using the inputs available locally, generated during the disaster. The feasibility of integrated farming is analysed by employing a comparative analysis among those who practised the same with others who were not involved in such activities.

Furthermore, this study was designed to understand the adaptation strategies of the affected households and to evaluate the role of SHGs in helping the population to recover from the livelihood loss caused by Cyclone Alia. The study tries to evaluate the long-term adoptive strategy used by households in the region. Only a few studies have attempted to evaluate the real picture of coping strategies after about a decade of the occurrence of a natural calamity. Moreover, given the fact that the Sundarban region witnessed a severe cyclone Bulbul in November 2019 and a super cyclone Amphan in 2020, this study helps us to evaluate the role of the SHGs in bringing about a sustainable longer-term socioeconomic transformation among poor households.

When the survey was conducted (Oct 2020 to Feb 2021), the region and the households had witnessed two more cyclones, i.e., Cyclone Bulbul in November 2019 and Cyclone Amphan in May 2020. Therefore, the setting of the study resembles a natural experiment setup. Natural experiment is observational study in which an event or a situation that allows for the random or seemingly random assignment of study subjects to different groups is exploited to answer a particular question. Situations that may create appropriate circumstances for a natural experiment include policy changes, weather events, and natural disasters (Dunning,

2008; Phan & Airoidi, 2015). Therefore, we use this natural experiment setting of the occurrence of cyclones in Sundarban to evaluate the coping strategies of households associated with SHGs in comparison with the households which are not associated with any SHGs. The SHGs related households act as the treatment group while the Non-SHG related household act as the control group. The analysis is therefore, done using the two-sample t-test for numerical variable and z-test for proportional variable. The results and discussion are provided in the next section.

The Sundarban region of the Indian side is spread over two administrative districts of West Bengal, which includes six blocks from the North 24 Parganas district and thirteen blocks from the South 24 Parganas district. Since the survey was carried out during the Covid 19 pandemic, we had to select the villages / location where the spread of Covid was relatively less and accessing the households were possible. We selected a total of 21 villages from four administrative blocks of South 24 Parganas district which were among the most affected blocks during Cyclone Aila South, i.e., Basabti, Gosaba, Kultali and Sandeshkhali. Since the objective was to compare the SHG associated households with the non SHG associated households, we tried to have a similar set of households being selected from all village belonging to both the groups. The participation in the survey was voluntary. Finally, we had a total of 585 households covered in the survey in a span of about 5 months. The survey had to be stopped by February 2021, on account of the state assembly election which was scheduled in April 2021. The distribution of the households is provided in table 1.

Table 1: Sample Household Details

Location (Blocks)	No of Villages Covered	SHGs Related Households	Non-SHG Related Households	Number of Households Surveyed
Basanti	2	22	50	72
Gosaba	4	108	37	145
Kultuli	11	240	75	315
Sandeshkhali	4	31	22	53
TOTAL	21	401	184	585

Source: Household Survey 2020-21

Out of the 585 households covered, 401 households had at least one member associated with a Self-Help Group and was classified as SHG associated group. Therefore, the total sample

constitute of about 68.54% SHG-related households and 31.45% non SHG-related households. The distribution of these SHGs across the blocks is given in Table 2. Members of about 92 SHGs were covered in the survey. The membership type of the SHGs members includes leadership role such as Secretary and Team Leader; functional Role such as Cashier and Treasurer; and normal member. Majority of the SHG related respondent, i.e., 86.53% have been associated as normal member. The average span of membership for the 401 SHG-related respondent is 6.77 years. This average membership period was highest, i.e., 13.48 years for Sandeshkhali block and lowest for Kultuli block, i.e., 5.07 years.

Table 2: Distribution of SHGs covered in the Study and SHG membership details

	Basanti	Gosaba	Kultuli	Sandeshkhali
No of SHGs Covered	8	17	55	12
Average Membership Period (Years)	7.36	8.51	5.07	13.48
Normal Members	22	71	225	29
Functional Role	0	12	6	0
Leadership Role	0	25	9	2

Source: Household Survey 2020-21

Table 3 provides the details about the demographics of the households covered in the survey. Majority of the households have semi-pucca (semi-concrete) houses, while only about 6.50% has pucca (full concrete) houses. The major source of drinking water in the region is deep tube well. In terms of fuel consumption, only about of the households have and use cooking gas. Usage of forest wood and cow dung is very much prevalent in the region, particularly among the weaker sections of the households. Interestingly, there is a marked difference in the availability of toilet among the households. Overall, about 80% of the households have toilet. The percentage of households among those associated with SHGs is comparatively much higher than the other group of households. Average size of the households is about 4 and the mean number of children (below the age of 18 years) is 1. About 9% of the households do not have any children below the age of 18 years. As far as occupation is concerned, majority of the households (65%) is associated with agriculture, either directly or indirectly.

Table 3: Demographic profile and Amenities of the Households

	SHG-Related Household	Non SHS- Related Households	All Households
Amenities			
Housing type (% of respondent)			
Pucca	6.48	6.52	6.50
Semi- Pucca	34.91	43.48	37.61
Tilled roof	30.17	24.46	26.32
Thatched roof	28.43	25.54	29.57
Source of Drinking Water (% of respondent)			
Tubewell	100	100	100
Source of Cooking Fuel (% of respondent)			
Gas	37.41	71.20	48.03
Availability of Electricity	92.02	95.11	92.99
Availability of Toilet	87.78	60.87	79.32
Education - Household Head			
No formal Schooling	13.72	14.67	14.02
Elementary	54.61	51.63	53.68
Secondary	22.19	28.26	24.10
Graduate & above	9.48	5.43	8.21
Family Composition			
Mean Household Size	3.845	3.821	3.838
Mean No. of Male Adult	1.46	1.59	1.497
Mean No. of Female Adult	1.31	1.39	1.338
Mean No. of Children (Below 18)	1.07	0.84	1
Occupation (%)			
Cultivators	46.63	69.61	53.50
Agricultural Labour	17.71	1.66	12.65
Unskilled workers	17.21	13.26	15.90
Skilled workers	3.24	3.31	3.25
Animal Rearing & Fishery	3.49	4.97	3.93
Business	5.49	3.31	4.79
Salaried	3.24	2.21	2.91
Migrant Worker	2.99	3.31	3.08

Source: Household Survey 2020-21

4. Results, Analysis and Discussion

In this section we present the results emanating from the survey data. The analysis revolves around following aspect; viz. the extent of loss and recovery, integrated farming, and its impact of livelihood restoration; livelihood diversification; migration and financial inclusion of the households.

Table 4 provides a summary of information related to the level of impact and recovery, along with various modes and mechanism used to coping with the calamities for the households surveyed in the study. All the 585 households survey were impacted by the cyclone and had suffered loss of income. The level of loss per household stood at 70.93%. The non-SHG household incurred more loss compared to the households associated with SHGs; but they have also been able to recover losses to a much higher extent vis-à-vis the SHG associated households. The households associated with SHGs are those who are at the lower part of the strata in the region and have severe resource constraints as evident from the relatively much lower level of recovery. As part of the recovery and coping mechanism, the survey provides details of households engaging in similar economic activity, migrating outside Sundarban and engaging in integrated farming. Details of the number of households receiving financial and non-financial assistance from government agencies was also procured. The data related to this suggest that only a marginal section of the households received such assistance in an adequate manner. Family members of around 29% of households migrated to locations within the state (mostly to Kolkata), while about 22% household member migrated to locations outside the state. The proportion of household with migrating family member is slightly higher for SHG related households. This is one of the prime reasons for women member of these families getting engaged with SHGs for some productive activity. The participation among SHG related households for integrated farming, in terms of proportion, is however, much lower compared to the non-SHG associated households. Lack of understanding, training and more importantly the uncertainty and resource constraints continue to be the major factors resisting households from taking up such initiatives. The above-mentioned fact is evident from the information about the impact of integrated farming shown in Table 5.

Table 4: Level of Impact and Recovery Mechanism

	Non SHS- Related Households	SHG- Related Households	All Households
Impacted by Cyclone	100	100	100
Household income impacted negatively	100	100	100
Level of Loss Incurred per household (mean)	84.05	64.91	70.93
RECOVERY & COPING MECHANISM			
Extent of Recovery per household (mean)	76.48	56.98	63.11
Started same activity fresh with self-fund	44.59	49.04	46.83
Started same activity fresh with borrowing	45.95	14.42	32.94
Migrate within State	25.68	32.69	28.57
Migrate to Other State	21.62	24.04	22.62
Financial Assistance from Government	12.16	15.38	13.49
Non - Financial Assistance from Government	15.54	22.12	18.25
Engaged in Integrated Farming	91.16	68.08	74.87

Source: Survey data; All data in percentage.

The incremental returns generated from integrated farming for the non-SHG associated households is almost twice that of the SHG associated households. The results provided in table 5, provides a clear indication that integrated farming does have the potential of helping households in reviving their livelihood. Almost all household among the non-SHG associated group witnessed improvement in the soil condition and about 34% of the household feel that this mechanism of farming has the potential of reversing migration in the region. As mentioned above the lack of proper training and uncertainty in marketing the products have been a major hinderance in reaping the benefits from integrated farming for the other group of households. Many of the households in the SHG associated group are also constraints because of non-availability of adequate farming land and therefore their efforts do not provide noticeable gain in income level.

Table 5: Details about Integrated Farming and its impact

	Non SHS- Related Households	SHG- Related Households	All Households
Incremental Return per household (mean)	160.81	86	114.2
No incremental return	20	38.46	31.51
Potential to reverse migration	33.94	19.41	24.89
Soil Condition Improvement	99.39	65.57	78.31

Source: Survey data; All data in percentage.

Table 6 provides the results of livelihood diversification index and situation of financial inclusion among the households. Ability of diversify into various form of economic activity is a major coping mechanism among rural communities. We use the Simpson Index of Diversity (SID) using the level of income from various source for the households. The definition of the index is as follows:

$$SID = 1 - \sum_{i=1}^n p_i^2 \quad \dots\dots (i)$$

where p_i is the proportion of income source i in the total household income, and n is the sources of income. The value of SID ranges between 0 and 1. With this index, 1 represents infinite diversity and 0, no diversity (or infinite specialization). The result of the index shows a fair amount of diversification among all the households, where the value stands at 0.384. In fact, the households associated with SHGs have a slight edge. The details about financial access provide some interesting information about the households. About 91% of the households have bank account, however, when it comes to financial savings an investment, the percentage is only 7.69%. This is a clear indication that households in this region struggle to generate and accumulate surplus fund because of the regular events of natural disaster and climatic shocks. The amount of funds getting diverted just to restore and repair their dwelling units is an indicating about the struggle to generate and accumulate savings. diversion of fund However, the households associated with the SHGs seems to have slightly better financial discipline. This group have better proportion of household involved in saving activity, life insurance penetration is almost comparable and most importantly, there is a marked difference in term of non-life insurance penetration, particularly health insurance. The information about investment in precious metals, is a clear indication that household prefer to use such investment for meeting emergency requirements as against investment in insurance products.

Table 6: Details of Livelihood diversification Index, Financial Access, and Fund diversion for recovery.

	Non SHS- Related Households	SHG- Related Household	All Households
Simpson Index of Household Livelihood diversification	0.371	0.389	0.384
Financial Access			
Bank Account	95.65	88.52	90.77
Financial Savings/Investment	6.52	8.22	7.69
Life Insurance	14.46	13.04	14.01
Non-life Insurance	2.71	14.46	10.76
Investment in Jewellery	39.1	34.2	35.76
Diversion of funds for rebuilding dwelling units per household (mean in Rs)	63767.39	64523.69	64285.81

Source: Survey data; All data in percentage.

One of the major objectives of the study is to evaluate the role of the SHGs in assisting household cope with the natural calamities in the region. This exercise is carried out by comparing the outcome of various indicators of the control group, i.e., the households not associated with any SHGs, with that of the experiment group, i.e., households associated with the SHGs. Table 7 which provides the result of the t-test and z-test. The results provide a mixed observation. The households reveal mixed behaviour. As far as the coping mechanism of integrated farming is concerned, the outcome of control group is statistically better compared to the experiment group. However, this does not undermine the effort and the usefulness of SHGs, because the households with which the SHGs are engaged with have significantly lower resources and capabilities. The effectiveness of preparing such households with lower capabilities is evident in the results related with financial access as well as livelihood diversification.

The findings of the study are in line with other studies such as Ghosh et. al, (2018), Roy & Guha (2017), Wodon (2015), virtually all households in the area have been affected negatively and substantially by cyclones in terms of destruction of dwellings, with the poor and the disadvantage typically suffering the most. The ability of households to cope with cyclones and manage the losses they imply is limited. However, unlike previous observation as only few households tend to engage in medium term and long-term adaptation strategies,

we find that a good number of households are engaged in livelihood diversification through various ways including the practice of integrated farming. Support received from government programs may seem to be less effective in reaching out to the neediest segment of the households and therefore, migration continues to be an easy sought-after alternative.

Table 7: Results of t-test and z-test

		Non-SGH Households			SHG Households			
	Units	N	Mean	SD	N	Mean	SD	t-test
Extent of Impact & Loss	Percentage	184	84.05	15.73	401	65.91	24.83	9.61***
Extent of Recovery	Percentage	184	76.48	1.118	401	56.98	0.99	11.76***
Start Afresh same activity	Proportion	184	0.842	0.0268	401	0.574	0.024	6.365***
Migrated for livelihood	Proportion	184	0.462	0.0368	401	0.404	0.024	1.318*
Engaged in Integrated Farming	Proportion	184	0.897	0.074	401	0.681	0.05	2.425***
Incremental Return	Proportion	165	160.81	0.078	273	86.036	0.06	758.296***
Improvement in Soil Condition	Proportion	165	0.994	0.078	273	0.656	0.6	3.43***
Encourage Others for Integrated Farming	Proportion	165	0.891	0.078	273	0.476	0.06	4.206***
Potential to reverse migration	Proportion	165	0.339	0.078	273	0.194	0.06	1.473
Integrated farming supported by Self fund	Proportion	165	0.533	0.78	273	0.853	0.06	-3.247***
Integrated farming supported by Formal Loans	Proportion	165	0.285	0.78	273	0.169	0.06	1.18
Simpson Index of Household Livelihood diversification	Number	184	0.372	0.157	401	0.39	0.011	-0.91
Bank Account Access	Proportion	184	0.956	0.015	401	0.885	0.016	2.764***
Availability of Financial Savings/Investment	Proportion	184	0.065	0.018	401	0.082	0.014	-0.72
Life Insurance Coverage	Proportion	184	0.13	0.0248	401	0.145	0.017	-0.46
Non-life Insurance Coverage	Proportion	184	0.027	0.12	401	0.145	0.017	-4.26***
Investment in Jewellery	Proportion	184	0.391	0.359	401	0.342	0.023	1.164
Diversion of funds for rebuilding dwelling units (mean in Rs)	Amount in Rupees	184	63767.39	6680.08	401	64523.69	4579.07	-0.093

Source: Computed

5. Policy Implication & Conclusion

Cyclones and associated surge in sea level and floods have had massive impact on household in Sundarban region, The increase in salinity of the land has been a major reason for the lower agricultural yield in the region. Agriculture being the backbone of the region, any deterioration of productivity only results in higher poverty (Hazra et al. 2002). Moreover, the fragile tidally influenced ecosystem provides limited scope for livelihood expansion (Raha et al. 2012). Our analysis unveils that households have come up with diverse set of coping and adaptation strategies, which includes seeking better employment opportunities, migrating, and selling various assets as well as taking other emergency measures. Expectation about the involvement of government programmes also ranges high but such opportunities are very limited. While households clearly suffer from cyclones, there is no substantial permanent migration among the affected households.

The finding of the study does not rule out the capability of SHGs in building the resilience and social, human capital which can be used to cope with such natural shocks as witnessed in the region. Continuous training and capacity building programmes through the SHGs will help reduce the poverty level through income generation. Economic poverty can also be minimized by engaging the women members of the household in productive activity and better decision making about health, hygiene, and children education. The involvement of the SHGs can go a long way in helping the region at large in adopting to the climate change and recurring natural hazards.

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