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COPING STRATEGIES DURING HAZARDOUS SITUATIONS USING INDIGENOUS KNOWLEDGE IN THE CHANGING AGRICULTURAL SYSTEM OF TEESTA RIVER BASIN

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ABSTRACT
The Teesta River basin, spanning across regions of India and Bangladesh, faces increasing environmental hazards due to climate change, different types of natural and man-made hazards. In this context, indigenous knowledge systems are vital in helping local agricultural communities cope with and adapt to these challenges. This paper explores the traditional coping strategies farmers employ in the basin to sustain agricultural livelihoods amidst natural and man-made hazardous situations. Methods such as the use of flood and drought-tolerant crops, soil conservation, water and fertilizer management, crop diversification, intercropping, mixed cropping, community support etc., strategies are examined. The research highlights how these practices are not only shaped by generations of lived experience but are also undergoing change due to modern agricultural interventions and environmental pressures. Despite challenges, indigenous knowledge remains crucial for resilience, offering cost-effective and culturally appropriate strategies. During the last 10 years, approximately 394 and 110 acres of arable land in the study area have been affected by different types of natural and man-made hazards. In the past decade, 122 farmers' communities have migrated owing to various hazards, while 51 farmers have abandoned their traditional occupation and taken up new livelihoods as a result of changes in the agricultural system.

1.0 INTRODUCTION

Agriculture is intricately linked to the life and livelihood of the people of Bangladesh (Mahedi et al., 2025). Economic development in this country is not feasible without agriculture. Proper planning is essential for the overall development of the agricultural sector, in line with the country's growing population (Kabir et al., 2025). The agricultural land in the country is decreasing at a rate of about 1% every year, and soil quality is declining because of soil degradation, including nutrient imbalance, loss of fertility, and excessive application of chemical fertilizers (Lal, 2015). Furthermore, water resources are also diminishing. Increasing productivity, intensifying, and diversifying agriculture necessitates value addition to produce more food for growing populations on shrinking land and to supply raw materials for agro-based industries.

Various natural and man-made hazards are responsible for threatening agricultural systems and the

environment. The history of hazard is a history of human loss and devastation, because it resulted in numerous deaths, economic losses, and destroyed year-round development gains. This is why hazard has always been a great concern to human society. Every year, various hazards occur in the world. Each year, more than 600 hazards occur globally (Giudice et al., 2021). Since 1900, more than 9000 hazards have occurred over the last 30 years (Sun et al., 2022). Among the different regions of the world, Asia has received the hardest hit and is the most affected region by hazards (especially natural hazards). Statistics show that the impacts on humans were essentially concentrated in Asia, where 37% of the years reported hazards occurred, which accounted for 90% of all reported victims and 46% of the economic damage of the world (Shen et al., 2018). Among the Asian countries, India, China, and Bangladesh are the most affected (Yuan et al., 2022). Within the different natural and man-made hazards, flood, drought, river erosion, and some hazards which is occurred due to human activity, have always been a matter of great concern to the riverside people of Bangladesh. This scenario is common in the farmers' community of the surveyed areas in the Teesta River basin. Yet, the people cope with these hazards relentlessly. They devise different strategies and struggle to survive from these hazards. During hazardous situations, they cope with the situation in their ways, sometimes with external support, without which their existence would be threatened or extinct. Therefore, the farmers' community of the Teesta basin study area is applying various strategies leveraging traditional indigenous knowledge. Indigenous knowledge is the foremost strength of hazard management in Bangladesh (Lejano et al., 2021). Indigenous coping strategies reduce vulnerability and increase resilience (Pervez et al., 2015). It safeguards the agricultural system from natural and man-made hazards, adapts to the changing agricultural systems, and ensures survival.

Objective of the Study

1 To analyze the changing patterns of agricultural systems in the study area.
2 To evaluate the impact of indigenous knowledge on the farmers' community.
3 To explore farmers' coping strategies for protecting crops during hazardous situations and ensuring survival amid changing agricultural systems.

2.0 RESEARCH METHODOLOGY AND SAMPLING

The researcher has applied qualitative approaches with responses gathered from local participants for this paper. Due to the location in the Teesta River basin, the two villages of Kalpani Bozra and Satalaskar in Bozra union of Ulipur Upazila of Kurigram district, and the two villages of Jigabari and Taluk Belka in Belka union of Sundarganj Upazila of Gaibandha district have been considered as the research area purposively. The study area includes the researcher's locality and neighboring regions. Due to frequent travel, the researcher able to thorough understanding of the agricultural cultivation system, changing patterns of agriculture, traditions, adaptation, and coping techniques in these areas. Two hundred and forty (240) farmers' communities were selected purposively as respondents from the four villages, who are totally involved in agriculture since long period. The study was conducted using sixty (60) experienced farmers purposively from each area as respondents. As methods of collecting primary data, the researcher chose Questionnaire Survey, Key Informant Interviews (KII), FGD and In-depth Interview methods. The Auxiliary sources used in this study included books, journal articles, organizational reports, internet sources etc. Collected data has been presented in tabular form of presentation for a better understanding of the readers. The study period was January-March 2025.

3.0 RESULT AND DISCUSSION

Changing Patterns of Agriculture

Since ancient times, agriculture has been considered the main source of livelihood for Bengalis. The most important feature of the agricultural economy during the ancient, medieval, and British periods was the preponderance of crop production as a sub-sector. The other three sub-sectors of agriculture-livestock, fisheries, and forestry were relatively unimportant. But since the industrial revolution, many countries have transitioned to developed economies, and the proportion of people working in agriculture has steadily declined. According to the three-sector theory, the number of people engaged in agriculture and other primary activities can be more than 80% in the least developed countries and less than 2% in the most developed countries (Fan et al., 2023). After the liberation war, agriculture was given the most importance in the national budget of Bangladesh. But due to various natural hazards and modernization, the traditional agricultural system has been changing in Bangladesh for the past few decades. Earlier, the people of this region used the water of the Teesta River for agriculture. But currently, due to unplanned water flow and various hazards, there is a shortage of water in the river during the agricultural season, and untimely floods are causing huge damage to agriculture. Various man-made hazards are observed in the Teesta River basin. People are changing the course of the river by damming the river at will in the name of development. They are destroying arable land by filling the river and building houses and businesses.

Agriculture is the single most important economic sector in the basin, which employs more than 90% of its rural population. The average cropping intensity is high across the central and lower Teesta basin, ranging between 1.6 crops per year on the Indian side to almost 2 crops per year on the Bangladeshi side (Gupta et al., 2023). The Teesta River basin region, situated in South Asia, spans across India and Bangladesh. After flowing over Sikkim and West Bengal, the Teesta enters Bangladesh and joins the Brahmaputra River (Rahman et al., 2024). Changes in agricultural practices in this region are influenced by several factors, including climate, geography, socio-economic condition, natural hazards, man-made hazards, and government policy.

Table 1: Total amount of land area affected by natural and man-made hazards in last ten (10) years in the Teesta river basin study area.

Year	Amount of land affected by floods (in acres)	Amount of land affected by drought (in acres)	Amount of land affected by river erosion (in acres)	Amount of land affected by man-made hazards (in acres)
2014-2015	05	03	08	04
2015-2016	07	05	10	06
2016-2017	08	06	07	07
2017-2018	06	09	15	09
2018-2019	10	08	19	08
2019-2020	07	07	21	11
2020-2021	15	11	18	13

2021-2022	19	08	20	16
2022-2023	25	10	26	17
2023-2024	33	09	39	19
Total	135	76	183	110

Source of data: Field survey, 2025 & Union Parishad database report.

Table 2: Migration rates of farm households due to hazards in the last ten (10) years.

Year	Kalpani Bozra	Satalaskar	Jigabari	Taluk Belka	In Total	Percentage (%)
2014-2015	0	1	4	7	12	9.84
2015-2016	0	0	5	3	8	6.56
2016-2017	0	2	4	7	13	10.66
2017-2018	0	1	3	3	7	5.74
2018-2019	1	3	5	2	11	9.01
2019-2020	2	5	1	0	8	6.56
2020-2021	3	7	1	4	15	12.29
2021-2022	5	6	0	0	11	9.01
2022-2023	7	9	0	0	16	13.11
2023-2024	8	13	0	0	21	17.21
Total	26	47	23	26	122	100.00

Source of data: Field survey, 2025 & Union Parishad relief card report.

Impact of Indigenous Knowledge

In the surveyed areas of the Teesta basin, long-standing changes in agricultural practices due to various natural, man-made, and geopolitical factors have profoundly impacted the farmers' communities. For generations, the farmers in this region have relied on traditional indigenous knowledge in their farming practices. By applying indigenous knowledge in agriculture, they have contributed to economic prosperity, the preservation of traditional professions, eco-friendly farming, ecological conservation, and the timely planting and harvesting of crops, while also promoting local traditions globally. They willingly and enthusiastically applied indigenous knowledge to agriculture. However, various hazards and climate change have disrupted this stable state of agriculture. Uncontrolled population pressure is also a major factor in the changing agricultural practices. To recover from these hazards and meet the food demands of the growing population, farmers are gradually shifting away from traditional farming practices and adopting modern seeds, machinery, and methods. This has a significant impact on farmers, especially small and medium-sized ones, who bear the heaviest burden. They are unable to adapt fully to the changing agricultural practices, machinery, and methods, and cannot sustain farming or fully utilize indigenous knowledge to meet food demands and manage their livelihoods (Mahedi et al., 2024). As a result, many of these farmers are leaving agriculture to pursue other professions.

Table 3: Because of agricultural system changes, the rate of leaving agriculture and

taking other professions in last ten (10) years.

Year	Kalpani Bozra	Satalaskar	Jigabari	Taluk Belka	In Total	Percentage (%)
2014-2015	0	0	5	7	12	23.53
2015-2016	0	0	3	4	7	13.73
2016-2017	0	1	2	2	5	9.80
2017-2018	0	0	1	0	1	1.96
2018-2019	0	1	0	1	2	3.92
2019-2020	0	0	1	0	1	1.96
2020-2021	1	2	0	0	3	5.88
2021-2022	0	2	1	2	5	9.80
2022-2023	2	3	0	1	6	11.76
2023-2024	2	4	2	1	9	17.65
Total	5	13	15	18	51	100.00

Source of data: Field survey, 2025 & Union Parishad database report.

Many farmers are shifting away from agriculture by placing equal importance on other professions alongside it. Because they lack of will, capacity, and skills to manage modern farming within the changing agricultural practices. On the other hand, most large farmers can adapt easily to the changing agricultural system. But this number is negligible in the study area. However, most farmers' communities in the study area are using mixed farming systems to sustain their lives and livelihoods amid changing agricultural practices. At various stages of agricultural cultivation, they continue to produce crops by utilizing a combination of indigenous and modern knowledge. Thus, traditional indigenous knowledge continues to lay an undeniable and influential role in preserving the profession, economic prosperity, and livelihoods of farmers' communities in the study area amid changing agricultural practices. These farmers are the custodians and bearers of indigenous knowledge in agriculture. So amid changing agricultural practices, indigenous knowledge continues to significantly impact both the farmers' communities and the agricultural cultivation process even today.

Coping Strategies during Hazardous Situations Using Indigenous Knowledge

Every year, the farmers' community in the Teesta river basin study area is victimized by various natural and man-made hazards. Consequently, they incur significant losses. The individuals or a group can recover from a previous damage, and another hazard strikes again. Thus, they have to persist with the cultivation process despite the ups and downs. Farmers in the study area are unable to fully embrace modern farming practices due to a lack of skills and capacity. They engage in mixed-process farming, incorporating both modern methods and long-cherished traditional indigenous knowledge and techniques. As a result, they must exert more effort and demonstrate greater patience compared to farmers in other regions to cultivate crops amidst various hazards. Therefore, the farmers' community of the Teesta basin has sustained agricultural activities during natural and man-made hazards by adopting various techniques, integrating modern methods with traditional indigenous knowledge and methods. This part provides a comparative analysis of the indigenous knowledge and techniques,

alongside some modern knowledge and techniques, employed by the farmers' community. Although modern knowledge and techniques are limited and infrequently applied, they play a crucial role in helping farmers adapt to the changing agricultural systems. Despite the agricultural system in the study area reflecting elements of modernity, the farmers continue to preserve traditions and set an example by adapting to changing agricultural practices through the application of various techniques during hazardous situations resorting to the indigenous knowledge.

Early Warning System

Bangladesh is at the forefront among countries at risk of climate change and both natural and man-made hazards. In hazard-prone Bangladesh, it is crucial to convey information about weather and climate, the water status of rivers, and agro-meteorology to farmers during both hazard and normal conditions. Farmers in the Teesta River basin study area have long relied on traditional indigenous knowledge to predict hazards and provide timely warnings, often after the hazards have occurred. They have been giving warnings of hazards in this way for many ages, long before the invention of modern technology. They use traditional indicators such as animal behavior, type of cloud floating, the abundance or scarcity of stars in the sky, and direction of wind flow to predict impending danger. Additionally, they rely on modern technologies such as weather forecasts and mobile alerts for timely information. However, since many farmers in the study area do not have access to or are unable to use modern technology at home, they visit nearby markets to collect weather information. Many farmers still rely on indigenous knowledge to gather information about hazards and to continue farming. This alertness to hazard coping strategies benefits farmers economically amidst changing agricultural systems resulting from various hazards.

Planting Seeds and Seedlings

Often, many farmers in the Teesta River basin study area are unable to prepare paddy seedbeds due to early floods. In such cases, they create floating seedbeds in their backyard, on elevated areas. They spread banana leaves or polythene sheets on the seedbed and cover them with a thin layer of muddy. Then the seeds are soaked in water for 5-6 hours and thickly sprinkled. In this method, 2.5-3.0 kg of seeds can be sown per square meter of seedbed. Seedlings should be planted once the floodwaters have receded from the original land, within two (02) weeks. Additionally, farmers adopt another method for the rapid production of seedlings from seeds. After soaking the seeds in water for 24 hours, if they crack slightly, leaving them in sacks or earthen pots for 24-72 hours encourages rapid seedling growth. The seedlings produced in this manner are planted in the land as soon as the floodwaters recede.

Selection of Drought-Tolerant Crops

Farmers in the study area are encouraged to cultivate short-live or drought-tolerant varieties that can be harvested before the onset of drought. During the drought in the Amon season, varieties such as 'Bina Dhan-7' and 'Bina Dhan-21' are commonly planted. 'Bri Dhan-33' begins ripening a month before the season starts and is ready for harvesting. As a result, the crop can be safeguarded from the month of September-October drought. Similarly, 'Bri Dhan-56' and 'Bri Dhan-57' of the Amon season, being short-lived varieties, and these types of paddies can withstand drought for up to 21-30 days. Farmers are cultivating pulse crops such as chickpeas, lentils, peas, mustard, sesame, etc., after harvesting the early Aman paddy crop, to retain moisture in the soil, thereby achieving economic prosperity. Farmers in this region loosen the soil and cultivate slightly when moisture levels are low during land cultivation. After

cultivation, the soil is compacted using a ladder. It helps conserve water in the soil. They conserve moisture by covering the soil after planting seeds or seedlings with materials like straw, dry leaves, water hyacinth, jabra, and mulch. In this way, water cannot evaporate into steam due to the heat of the sun. As a result, weed infestation is also reduced.

Selection of Flood/Submergence-Tolerant Crops

Farmers in these regions protect crops by cultivating early varieties of Boro paddy. Since 'Bri Dhan-28' and 'Bri Dhan-36' ripen early and can be harvested earlier in the season, farmers cultivate these varieties in large quantities to mitigate the risk of hazards. Good yields are achieved by draining water from the land in January and planting 60-day-old seedlings. These paddy varieties mature and are harvested within 140-150 days. 'Bri Dhan-51' and 'Bri Dhan-52' are two flood-tolerant varieties approved for cultivation in this region. Both of these paddy varieties can survive underwater for 10-15 days. 'Bina Dhan-11' is another variety of submergence-tolerant paddy that protects against flash floods. It is a short-duration, high-yielding variety of Aman paddy. After 2-3 days of seedbed or seedling planting, the upper part of the seedling may be submerged by flash floods for 20-25 days. Although the upper part of the plant may rot, the root system regenerates, resulting in a normal yield. The lifespan of the 'Bina Dhan-11' variety is 110-115 days.

In addition to this, farmers have upheld the agricultural tradition by cultivating and preserving various flood-tolerant crops. For example, groundnut varieties such as 'China Badam 5, 6, 7, 8, 9, 10', 'Bina Til-2', and 'Bina Sarisa-9' are the flood-tolerant crops in the study area. In this way, the farmers' community has adapted and survived to the changing agricultural system by effectively managing and protecting crises during hazards.

Soil Conservation

Soil is the main component of agriculture. However, farmers have to adopt certain strategies to maintain soil fertility. By adopting these strategies, farmers in the Teesta basin can preserve soil quality and mitigate damage more effectively during hazards. Practices that can cause long-term soil damage include over-cultivation, leading to a loss of fertility. Moreover, applying irrigation without proper drainage can lead to soil salinization. Soil amendment involves using compost made from recycling (Bello et al., 2021). Available resources in the area are utilized by composting yard and kitchen waste. Avoiding soil tillage before seed and seedling planting and leaving plant residues after harvest reduces soil water evaporation; it also helps prevent soil erosion. To address increasing soil erosion and declining fertility caused by various hazards, farmers in the study area are minimizing tillage and adopting cropping practices that focus on surface rather than deep cultivation. Additionally, farmers are harvesting crops by cutting them from the top rather than uprooting them. By doing so, crop plant residues are helping to maintain soil quality. Moreover, crop residues left on the soil surface can reduce water evaporation, lower soil temperatures, and mitigate the effects of wind (Carvalho et al., 2024). Farmers in the study area utilize techniques such as mulching, contour plowing, and agroforestry to conserve soil fertility, prevent erosion, and enhance moisture retention. Because healthy soil enhances crop resilience and reduces the risk of hazards.

Water Management

Due to the fluctuating Teesta River water levels caused by various hazards, farmers employ techniques such as contour banding, terrace farming, and rainwater harvesting to conserve water and mitigate soil erosion during floods, drought, and river erosion. Efficient water management practices, such as the construction of small reservoirs, check dams, and irrigation channels, play a significant role in regulating water flow to farmers. Furthermore, efficient water management supports the sustainability of traditional agricultural practices by storing water during periods of abundance and distributing it during dry seasons. Farmers in the study area are showing interest in cultivating drought-tolerant crops as a strategy to cope with water scarcity. These crop varieties are genetically changed to adapt to the environment by requiring minimal water consumption. This is advantageous as it decreases the reliance on irrigation and contributes to water conservation. However, there is a limited availability of drought-tolerant crop varieties. Certain crops, such as paddy, have been successfully genetically changed to exhibit drought tolerance.

The majority of farmers in the study area utilize river water for irrigation. In such instances, they employ plastic pipes to transport water to distant cultivable land. However, currently, there is insufficient water flow in the Teesta River, prompting farmers to dig small ponds adjacent to their land. The ponds are replenished with river water during flood season and rainwater during monsoons, providing farmers with a vital resource for cultivating crops throughout the year, particularly during the dry season. It's an effective strategy for optimizing water resources in crop cultivation. In addition to this, there is a system of diesel-powered shallow machines and electricity-powered deep tubewells. Hence, farmers are preserving agricultural traditions by cultivating crops year-round, adapting and surviving to changing agricultural systems while maintaining continuity in their cultivation process.

Fertilizer Management

Farmers in the Teesta basin study area are partially contributing to environmental preservation and upholding agricultural traditions by utilizing both chemical and organic fertilizers on their land. However, the use of chemical fertilizers is increasing significantly day by day. Moreover, farmers collect crop residue along with household waste such as vegetable and fruit peels in designated pits, eventually utilizing them as compost fertilizer on the land after some time. This fertilizer significantly contributes to enhancing soil fertility and increasing crop yield (Shaili et al., 2025). After the floods, the floating water hyacinth gets stuck in various parts of the Teesta River (Ghosh et al., 2024). Farmers collect this water hyacinth, allowing it to dry on the land, and then utilize it as natural fertilizer in their arable lands to mitigate the crisis caused by the hazards. Additionally, another strategy used as fertilizer in the study area is aquaculture integration, which combines fish farming with agricultural practices. This strategy is applied to the waste from animals and crops and diverts them towards the fish farms to be used up instead of being leached into the environment. Mud from the fish ponds can also be used to fertilizer crops. Organic fertilizers, green manures, and fertilizers derived from various natural sources allows soil fertility to be improved and well-maintained, lead to reduced costs and increased yields, reduces the usage of non-renewable resources in industrial fertilizers (Nitrogen and Phosphorus), and reduces the environmental pressures that are posed by intensive agricultural systems. In this manner, the farmers' community in the study area has managed to cope with the crisis during the hazard period and has survived by preserving their agricultural traditions and adapting effectively to the changing agricultural system.

Crop Diversification

Every year, the study area is affected by various hazards. And struggle with these hazards, the farmers' community must cultivate and persevere to survive. They are not always able to cultivate the same crops in the same manner consistently. Therefore, they have to adopt various strategies to survive the crisis and make a living. Crop diversification is one of them. Crop diversification does not solely involve the production of a single crop on the same land or of a single crop in a specific area, but rather the cultivation of various types of crops on the same land or in a particular area (Paut et al., 2020). Thus, the increasing demand for food grains, pulses, oilseeds, etc., in that region must be met through the cultivation of diverse crops. By climate change and various natural and man-made hazards, it is not possible to consistently grow the same crop every year in the study area. Therefore, if farmers fail to grow one crop in a year, they sustain the farming process by cultivating another crop on that land (Mahedi et al., 2025). In this way, they adapt to the changing agricultural system by coping with crises during hazards, thereby ensuring economic development and survival.

Intercropping

Intercropping is one of the crisis coping strategies, which is utilized by the farmers' community in the Teesta River basin during hazardous events. When farmers' communities face disruptions owing to various hazards and is unable to cultivate a variety of food grains and cash crops because of limited land availability, intercropping provides a solution for the farmers. Intercropping is the practice of cultivating alternate crops such as garlic, tomato, coriander, and sesame side by side on the same land and nearby (Elouattassi et al., 2024). This method differs from the mixed farming approach in that all the crops are grown simultaneously, and each crop supports the health, growth, and yield of the others. Farmers in the Teesta basin typically cultivate groundnut alongside maize. Intercropping groundnut with maize aids in natural pest control and enhances the yield of groundnut. Apart from this, farmers cultivate onions as well as coriander, garlic as well as sesame, linseed as well as nigella.

Mixed Cropping/Polyculture

Farmers in the study area are emphasizing mixed cropping as a strategy to protect themselves from natural and man-made hazards. Mixed cropping/Polyculture is growing a diverse number of perennial crops in a single field, each of which would grow in separate seasons, so as not to compete with each other for natural resources (Hayes et al., 2024). This system enhances the disease resistance of the crop and enables the cultivation of multiple crops on the same land. Moreover, several farmers in the study area are overcoming the hazardous crisis by simultaneously cultivating rice and fish in the same land. On account of various hazards, the amount of land owned by people is decreasing day by day. So, farmers in the study area are sustaining agricultural cultivation on small plots of land by adopting various strategies and achieving economic development. Owing to insufficient water flow in the Teesta River, the fish quantity is continuously declining. Hence, farmers are cultivating both paddy and fish on the same land to fulfill their food requirements and offset losses during hazards. Weeds from paddy plants are being used as fish feed, while fish waste serves as fertilizer for the paddy fields. The rice-fish farming system practiced by farmers has increased freshwater fish production alongside rice farming on the same land, resulting in an additional product and reducing eutrophication of nearby rivers. Just as farmers cope with hazardous crises by catching and selling fish after harvesting paddy, they also adapt to the changing agricultural system and thrive by preserving long-standing traditional farming methods.

Livestock Management

Cows, goats, ducks, chickens, horses, and buffaloes in the study area face a shortage of fodder during hazards caused by various natural and man-made factors (Hall, 2004). During this period, there is a shortage of grass, and the animals suffer from various diseases because of malnutrition. Consequently, these animals need to be cared for as much as possible. Meanwhile, farmers cope with the crisis during hazards by selling marketable animals and relocating unsold ones to higher ground or elsewhere. Subsequently, when the crisis is over, the animals are brought back home and cared for. During hazards, when grass is scarce, leaves of various plants are used as an alternative feed for animals. During this time, rice flour, husk, paddy flour, and rice are considered as feed alternatives. Various crops in the study area are damaged during the hazard period. Therefore, farmers in this region diversify their income sources through livestock rearing. In addition to crop production, these income sources provide an additional buffer against crop failure and contribute to keeping the economy stable. Moreover, farmers also utilize animal waste to produce organic and compost fertilizers.

Market Diversification

When farmers in the study area are unable to keep the crops produced and stored at home due to various natural and man-made hazards, they explore alternative markets outside the traditional channels to sell their produce . In this regard, they reduce reliance on single buyers and mitigate income loss during interruptions caused by hazards. Thus, they safeguard their hard-earned crops from opportunistic buyers by selling them at fair prices, thereby ensuring economic prosperity.

Government Assistance

The farmers in the Teesta River basin receive assistance from various government agencies, upazila representatives, and local administration during hazards. These supports include pre-hazard preparedness and recovery, access to subsidized crop insurance, and emergency relief measures during crises. Each Union has a Disaster Management Committee (UDMC) to deal with hazard risks. This committee conducts meetings once a month except during hazardous periods; in hazardous periods, they meet once a day as required, and at least once a week. During these meetings, they discuss the hazards in the area, offer guidance to the farmers, and provide all-out cooperation. Additionally, a board related to hazards and agriculture is displayed in the Union Parishad. Through the board, farmers can continue the farming process by acquiring knowledge about what to do during hazards and accessing agricultural weather forecasts.

Non-Government Assistance

Numerous domestic and international non-governmental organizations in Bangladesh assist people in various ways during disasters. Farmers in the Teesta basin survey area receive various financial supports from these non-government institutions, including hazard training, hazard response, and recovery assistance. These institutions distribute seeds of various crops and provide training in farming techniques to the farmers to mitigate losses during hazards. At this critical moment in the study area, the support of non-governmental institutions provides relief to the farmers and empowers them to contribute to and sustain agricultural cultivation despite facing hazardous periods in the changing agricultural system.

Community Support

Collaborative efforts among the farmers' community in the Teesta River basin, including sharing resources, labor, and knowledge during hazards, help strengthen resilience against hazards. Collective action enables farmers in the study area to respond and recover quickly in the face of adversity. For this purpose, various volunteer organizations have been established in the survey area. These organizations play a vital role in pre-hazard preparation, hazardous response, and post-hazard recovery. During hazardous situations, the members of the organization, along with other capable community members, also fully cooperate in protecting lives and property. Especially that time, the farmers' community strives to protect the crops and sustain the farming process by coping with the crisis and mitigating losses. Thus, the farmers in the study area become self-reliant through the application of indigenous knowledge and the selfless cooperation of the community.

4.0 CONCLUSION

A hazard refers to a serious disruption in the normal functioning of society, posing a major threat to human life, health, property, and the environment. Undoubtedly, Bangladesh is one of the most hazard-prone countries in the world. Effective coordination is an essential element in hazard management. In recent times, Bangladesh has gained credibility and a reputation worldwide in hazard management. All relevant ministries, departments, agencies, local government bodies, and the people have ensured the effectiveness of the institutions responsible for maintaining proper coordination and reducing the suffering of the hazard-affected people, from the national to the grassroots level.

The people living in the Teesta River basin region depend on the river for agriculture, transportation, trade, and commerce. But hazards are a constant companion for the people of this region. Before one hazard can be addressed and resolved, another one knocks at the door. Therefore, farmers focus on adapting to hazards rather than simply dealing with them. To achieve this, they are adopting various strategies to sustain their way of life, livelihoods, and promote economic development. In this scenario, they sometimes succeed and sometimes fail. If they fail, they strive to turn around with renewed enthusiasm and fresh strategies. Various voluntary organizations, including government agencies, non-government entities, and individuals, have extended their cooperation in these efforts. These institutions provide various trainings, motivation to adapt to new challenges, and, along with financial support for subsistence farming, help farmers to withstand crises during hazards.

In this study, the strategies adopted by the farmers' community to cope with crises during hazards through the application of indigenous knowledge are truly commendable. Through these strategies, they are continuously striving for survival and economic development by adapting to the changing agricultural system. Finally, it can be mentioned that coping strategies during hazards are vital for resilience and recovery. Through these strategies, the farmers' community can enhance capabilities through training, foster community support, apply various cultivation methods, implement effective communication channels, and prioritize mental health resources. Thus, the farmers' community can navigate hazards with greater resilience and adaptability, ultimately paving the way for a safer and more prepared future.

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