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Community Initiated and Practiced Climate Resilient Technology and its Effectiveness in Disaster Risk Reduction at Barisal, Bangladesh

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Abstract: Bangladesh is a low-lying deltaic plain country in which three-quarters of the population lives in rural areas, and they are the primary victim of climate invented worst situation (Siddiqui, 2009). As rural area's people were deprived from the modern technology to mitigate the disaster, so that rural area's people created y own initiated climate resilient technology to protect themselves. The purpose of this study was to identify indigenous disaster mitigation measures that the community had implemented in order to reduce the negative effects of disaster. The study area was Bakerganj upazila, Barisal which is also a rural based disaster-prone area. In this research, two types of data collection techniques were used, such as as primary and secondary data collection methods, afterwards the collected data were analyzed through Microsoft Excel. The major findings of this study were that, due to climate change the most drastic change was in temperature, which is responsible for occurring different kinds of disaster. Among those in the study area flood was the most prior disaster which may fallen impact on house and agriculture of study area. It was mainly influenced by poverty and lack of community awareness. So that the mostly used climate resilient technology of this area was raising of house platform above flood level (95.87%), plantation of disaster resilient tree around the house (76.29%), raising platform for cultivation (73.20%), using homemade fertilizer for enhance productivity (62.89%) and tying of house to minimize the possibility of destroying (61.86%). Among those raising house platform and cultivable land platform was more sustainable and resilient indigenous technology of this area. Beside more the study area's people also got support from different GO and NGOs. And also, this area had strong social bonding with each other and local authorities, so that they got advantages from them and they consider this support as their capacity to fight against any kind of disaster. As indigenous technologies are very important for disaster risk reduction so that those should be linked up with local level adaptation plans for increasing the efficiency and resiliency of those locally invented technology, so that those will be easily accepted by the vulnerable community and implemented successfully against disaster.

Keywords: Climate; Disaster; Risk; Climate resilient techniques; Sustainability.

INTRODUCTION

Climate change is not only a regional or national problem; it is also a global one, particularly in light of the international forums' calls for swift, coordinated action to address the problems brought on by climate change's adverse effects. (IPCC, 2007). In today's life disaster is a very common phenomenon for all over the earth. Basically, the disaster risk means a destructive condition when intensity or frequency level of hazard and level of vulnerable condition

is very severe and the level of coping capacity is low (Bahauddin and Uddin, 2012). Bangladesh is a low-lying deltaic country located in the active delta of three major rivers in the world: the Ganges, the Brahmaputra, and the Meghna. (Guna, 2009). Bangladesh is frequently affected by a disaster due to its unfavourable weather conditions and its geo-graphical condition (Nawaz and Shah, 2011). Most probably all types of disaster hits first the rural level of Bangladesh which is still now flat, low lying, covered by many rivers and exposed to coastline along. The self-thinkable modernized people are also responsible for this, because they developed their urban area without take into consideration the vulnerability of rural people. On the other side people of the rural area is very poor, illiterate and deprived from all social justice. So that the local area's people had to develop some own coping mechanism against the worst climatic situation for their self-protection in emergency-situation (Wisner, 2009). Natural disasters like cyclones, tornadoes, and tidal bores will continue to affect Bangladesh and that there is no way to stop them. But damages might be significantly minimized with appropriate management techniques (Haque, 2019).

After the 2004 Asian Tsunami, when the Moken communities of Surin island in Thailand, the Simeulueans in Indonesia, and many island populations of Nadaman and Nicobar successfully predicted the Tsunami and employed their traditional strategies to effectively survive it, indigenous peoples' capacity to deal with disasters came to light. (Lambert and Scott, 2019; Rumbach and Foley, 2014). Since then, many academics have pushed the theory that local communities have evolved time-tested skills, coping mechanisms, and adaptation tactics to help them anticipate, lessen the effects of, respond to, and recover from catastrophes as a result of their embeddedness in their environment (Balay-As, Marlowe and Gaillard, 2018). Community based disaster management was aims to 1) lessen human suffering, 2) reduce vulnerabilities, and 3) speed up recovery for vulnerable populations and communities. (Islam, 2013). Native wisdom and scientific disaster risk reduction methods collaborate to make indigenous people more resilient to natural disasters (Pottier et al. 2003; Shaw et al. 2009). Indigenous knowledge refers to the ways and practices created by a group of people based on an advanced awareness of the local environment that has grown over many generations of occupation (Jennifer, 2008). According to development studies, the viability and longevity of community-level interventions are dependent on local culture, knowledge, and indigenous practices (Shaw, 2011). The relationship between the indigenous technology and natural disaster is a very important to reducing risk. The transition from reactive emergency management to disaster risk reduction led to the emergence of community-based disaster risk reduction (Shaw, 2016). So, we should support the community people to reinforcing their most specific indigenous practice to insert those in disaster management policy and model for avoiding disaster risk and understanding the value of indigenous technology against vulnerability (Jennifer, 2008). Many of Bangladesh's rich history of indigenous knowledge and customs have been lost as a result of their lack of recording. It is important to record the coping mechanisms used by those who live in disaster-stricken areas so that they may be used elsewhere in the nation. It is important to inform decision-makers and technocrats about the variety of non-structural responses to these catastrophes that have been used by locals for decades (Haque, 2019).

The objective of this study was found out major climatic effects of this area and for those effect what kind of indigenous technologies the study area's people were adopted to controlling the situation.

MATERIALS AND METHODS

Study Area: The study was conducted in the Bakerhanj upazila of Barisal district of Bangladesh, which is geographically located at 22033'0" North, 90021'0" East. The Bakerganj is the second largest upazila of Barisal district, of Bangladesh. Its total area is 417.2km, including household area is 4640 ha, water land is 3823 ha, road area is 640 ha and cultivable land area is 35030 ha (Banglapedia, 2016) (Figure 1). The study areas are located near to the proximity coastal belt and coastal zone is characterized by a vast network of rivers and tidal channels; erosion and accretion processes continue, siltation takes place on water courses and river-beds; and the area is prone to cyclone, storm surges and salinity intrusion.

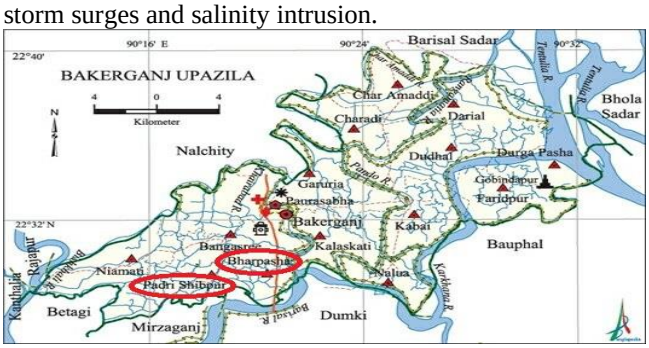

Figure 1. Location of study area in the map of Bakerganj upazila (source: Banglapedia)

Hazard Assessment: In this research the frequency and intensity of hazards parameter was catagorized in four sets-No-0, High-01, Medium-0.75, Low-0.50, then calculating the frequency and intensity of each parameter through computing the expert and local people opinion with different catagories of score and dividing by total frequency. And after caculating hazard frequency and intesity priority index then find out the severity of each parameter through multipling frequency and intensity.

Vulnerability Assessment: The priority level of vulnerable condition was divided in four category those are-No=0, High=1, Medium=0.75, Low=0.50. After getting opinion from expert and community people through questionnaire survey then computing those with catagory value and dividing by total frequency and at last find out the priority index of each vulnerability.

Capacity Assessment: Each of capacity has own priority level and the level is divided into four category those are-No=0, High=1, Medium=0.75, Low=0.50. The calculation

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of priority index for each capacity was done through computing the expert and local people opinion with category value and then dividing by total frequency.

Risk Analysis: After gaining hazard, vulnerability and capacity score it is computed following the equation (1) to find out the risk score.

R= (H&V)/C…… (1)

Here, R= Risk; H= hazard; V= Vulnerability and C= capacity (DDM, 2012).

Data Collection and Analysis: For completing the research both type of data collection methods like primary data collection method and secondary data collection method are used separately. In primary data collection method included- field observation, focus group discussion, questionnaire survey and key informant interview.

Additional information as secondary data was pertaining to the study was attained by accessing the relevant information from media such as journal articles, books, other research thesis and the use of recorded data, through Union Parishad (Local Government administrative office), Upazila Parishad (Sub-district Government administrative office), study areas and from various organizations working in this sector. The collected data was analyzed though Microsoft Excel sheet to form statistical chart and then doing descriptive analysis in Microsoft Office Ward for the better understanding about the overall condition of study area related to the research title.

Results and Discussion

Demographic Profile of the People: Total number of the household survey was 97 among them 45% was male and 55% was female. Males were working in different sectors and females were mainly housewife and some of them also working with their male partner in agriculture field and homestead gardening. In the study area most of the people were very poor (73%) and they have no permanent livelihood option. In the secondary livelihood of Bakerganj upazila was included- day labor (33%) fishing (17%), cottage industry (2%), handicraft (17%), made servant and nursery (5%), agriculture (9%). tailoring and small business (0%) and poultry raring (6%). Age, gender and education are a major factor for collecting data (Hakim, 2012). This research was conducted in a diversified aged and educated group of people in where the highest number of respondents 79 % was covered 20-60 years which influenced the risk perception, understanding, experience and knowledge regarding disaster risk and indigenous coping mechanisms and 71% covered illiterate upto class five, so that their scientific knowledge about disaster risk reduction is very limited but they have indigenous knowledge to resist the disaster. On the other hand from class six to class eleven or more cover 29% respondent population and they have little bit knowledge about disaster risk signal and mitigating method.

Climatic Effect: Climate change is becoming a major danger to sustainable development, wreaking havoc on agriculture, water resources, ecosystems, and human health. (Siddiqui, 2009). Climate change is mostly harming the poor by destroying infrastructure, affecting coastal communities, and lowering crop yields, as well as transforming our seas, compromising fish populations, and endangering species. (Nawaz and Shah, 2011).

According to respondents' perceptions, the change in temperature in the research region was the most severe climatic consequence, followed by changes in rainfall and natural disasters. (Figure2). On the other side, the wind pattern, water level, and drought had the least climatic impact. According to respondents' perceptions, seasonal diversity was of medium severity in Bakergonj upazila

The climate change effect mainly reduce the physical stability of vulnerable people through natural disaster (river erosion, land slide, flash flood etc) and increase the risk of those people. The impact also severe for the agriculture production, human health, food security and so on. Day by

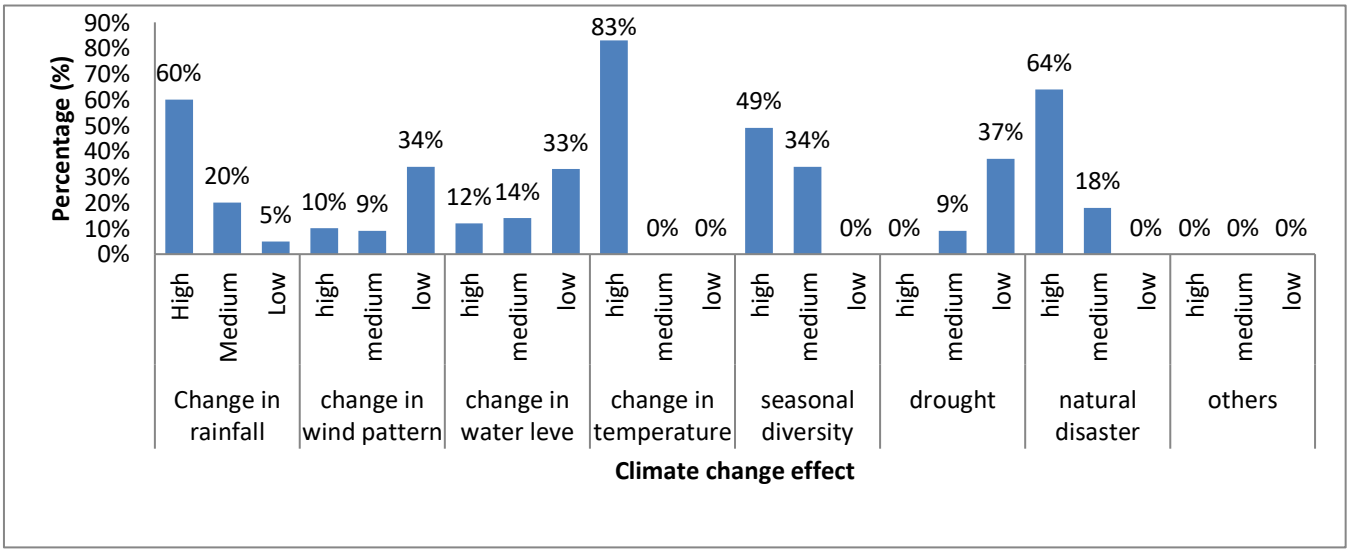

Figure 2. Climate change effect in Bakergonj upazila

day this situation is getting worst and leading towards the destruction of overall national economy.

Hazards Assessment: A hazard is a phenomena or condition that has the potential to disrupt or damage people, their property, their services, or the environment (Shaw, 2007). The study area Bakergonj upazila was very close to coastal area Patuakhali. So naturally this area was faced different types of disaster per year. It is mainly occurred for high frequency of vulnerability and less coping capacity. In this research the frequency and intensity of hazards was catagorized in four sets-No-0, High-01, Medium-0.75, Low-0.50, then calculating the frequency and intensity of each hazard through computing the expert and local people opinion with different catagories of score and dividing by total frequency that is shown in Table-02. And after caculating frequency and intesity for each hazard then find out the severity of each through multipling frequency and intensity. The result is shown in the Table-01:

Table1. Assessing Hazard of Bakerganj Upazila with Priority Index

Hazards	Hazards Priority Index												
	Intensity				Frequency				Total frequency	Priority index of intensity	Priority index of frequency	Severity of hazard	Ranking
	No (0)	High (1)	Medium (0.75)	Low (0.50)	No (0)	High (1)	Medium (0.75)	Low (0.50)					
Flood	0	78	19	0	0	61	32	4	97	0.95	0.9	0.86	01
Cyclone	2	45	41	9	2	9	21	65	97	0.83	0.59	0.4897	02
Tornado	41	0	7	49	41	0	4	52	97	0.31	0.3	0.093	07
Heavy rani	0	24	63	10	0	25	35	37	97	0.54	0.72	0.39	03
River ero	44	2	15	36	44	3	9	41	97	0.32	0.31	0.099	06
Pest attack	22	17	28	30	22	6	26	43	97	0.55	0.49	0.27	04
Salinity	87	0	0	10	87	0	0	10	97	0.052	0.052	0.0027	09
Epidemic	33	13	39	12	33	10	25	29	97	0.5	0.45	0.23	05
Others	87	0	10	0	87	0	0	10	97	0.077	0.052	0.004	08
									Average severity of hazard=			**0.27**	

As the flood, cyclone and heavy rainfall were first in ranking and all are water related hazard, so the safety measures for those were nearly same and they should try to rainforcing their coping capacity against those hazards as early as possible for precautinary and aftermath measures.

Vulnerability Assessment: The state or set of conditions that lowers people's ability to prepare for, tolerate, or respond to a hazard is referred to as vulnerability (ISDR, 2008). In the study area the set of vulnerable conditions are-poverty,level of education, lack of natural resources, por communication system, lack of awareness on climate change effect, lack of man power, insufficient weather forecasting system etc and then dividing the priority level of those vulnerable conditions in four category those are-No=0, High=1, Medium=0.75, Low=0.50. After getting opinion from expert and community people through questionnaire survey then computing those with catagory value and dividing by total frequency and at last find out the priority index of each vulnerability. In table-02 representing the calculation for vulnerability assessment:

Table 2. Assessing Vulnerability of Bakerganj Upazila with Priority Index

Vulnerability	Vulnerability Priority Index						
	No (0)	High (1)	Medium (0.75)	Low (0.50)	Total frequency	Priority index	Ranking
Poverty	0	74	19	4	97	0.93	01
Level of education	1	0	28	68	97	0.57	07
Lack of natural resources	1	36	46	4	97	0.81	06
Poor communication	0	42	51	4	97	0.85	05
Lack of awareness	1	67	27	2	97	0.91	02
Lack of man power	0	51	41	5	97	0.87	04
Insufficient EW system	4	69	21	3	97	0.89	03
			Average priority of vunerability=			**0.73**	

According to the Table2 can see that in the priority index first priority was poverty, second was lack of awareness and third was insufficient early warning system. So they should try to strong their financial structure and physical structure adversly to develop their condition for better living and coping of disaster.

Capacity Assessment:

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Capacity is a positive state or set of abilities that improves a community's capacity to deal with dangers. It is a sustained endeavor to improve or preserve a community's social and economic well-being. (UN/ISDR, 2005). The capacity of communities is regarded as a critical first step in creating resilience. Six indices (physical, structural, non-structural, social, financial, and natural capacity) were used to measure community capacity. Each of this capacity has own priority level and level is divided into four category those are-No=0, High=1, Medium=0.75, Low=0.50. In table-04 is shown the calculation of priority index for each capacity through computing the expert and local people opinion with category value and then dividing by total frequency. The calculation for capacity assessment is given below in Table-3.

Table 3. Assessing Capacity of Bakerganj Upazila with Priority

Capacity	Capacity Priority Index						
	No(0)	High (1)	Medium (0.75)	Low (0.50)	Total frequency	Priority index	Ranking
Physical	0	0	41	56	97	0.61	04
Structural	0	3	47	47	97	0.64	03
Non-structural	0	0	5	92	97	0.512	05
Social	0	2	80	15	97	0.72	01
Natural	1	0	65	31	97	0.66	02
Financial	0	2	4	91	97	0.510	06
				Average priority index of capacity=		**0.61**	

From this above calculation in Table-03 can see that the social bonding and relationship was first in ranking for capacity development, the natural resource was second, so they should use this capacity positive purpose and tried to work hard to raise their economic condition for defending themselves from natural and manmade disaster.

Risk Analysis: Risk is the likelihood that a community's structure or geographic region may be harmed or disturbed as a result of the effect of a specific hazard, due to its nature, construction, and proximity to a hazardous location (R). After calculation of Hazard, Vulnerability and Capacity, all the results were computed in equation R= (H&V)/C and final risk value are obtained.

Risk = (Hazard X Vulnerability) / Capacity (DDM, 2012)

= (0.27x0.73)/0.61

= 0.32.

So the risk score of this area is 0.32 which is low according to severe=1, moderate=0.75, minor=0.50, low=0.25 and no=0.

Affected Sector Through Hazard: In this research some sector was selected by the study area's people perception, those were - agriculture, homestead, sanitation, food security, human health, fisheries, livestock, communication, biodiversity etc. The impact of disaster was severe in agricultural sector (41.81%), high in homestead (30.24%), moderate in food security (23.37%), communication (22.79%) and fisheries (19.47%), low in drinking water (17.53%), flora (17.18%), fauna (16.50%) and livestock (16.27%) and very low in sanitation (12.72%).

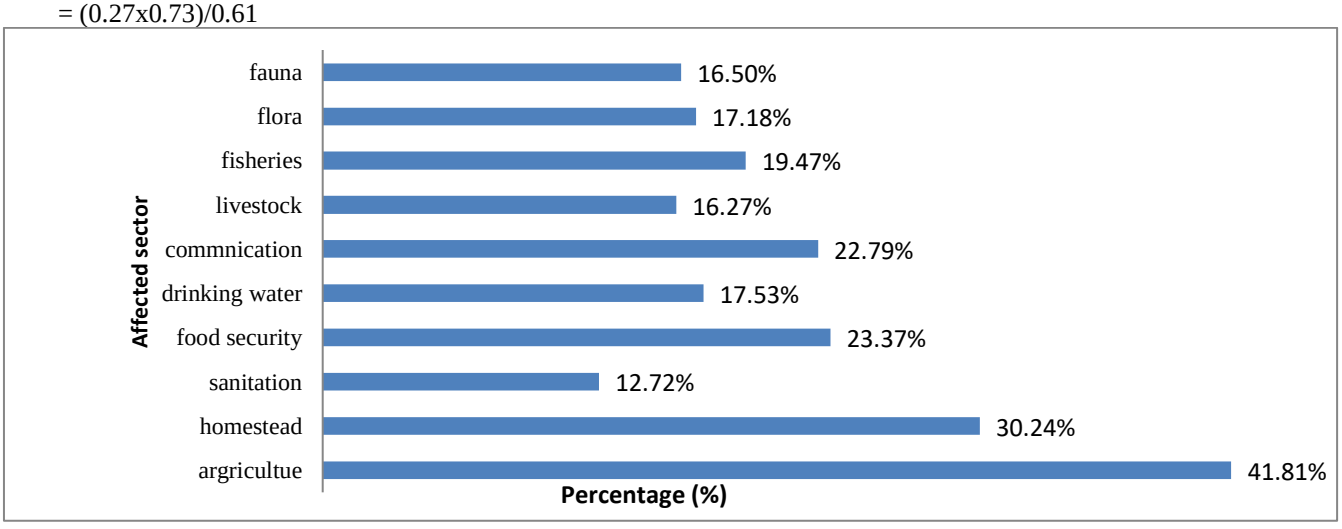

Figure 3. Affected sector through hazards

In Bangladesh rural communities are continuing to cultivate in accordance with historical patterns. The lack of contemporary climate change adaptation strategy in the cropping field, making agriculture most disaster-prone sector. On the other side, the homestead region has suffered severe harm due to its low cultivation techniques as well as structural and non-structural disaster mitigation methods.

Loss and Damage by Hazard: The day-to-day climate is quickly changing, and the resulting global warming and

greenhouse gas effect is causing a very destructive mood worldwide. (IPCC, 2007). Hazards were once just a natural phenomena; but, due to human destructive activities, hazards are now both natural and anthropogenic. As the harm caused by those hazards were increasing and spreading negatively throughout the physical, structural, environmental, and economic sectors, and most violently human health sector. The estimation of loss and damage by different hazard according to local people perception is shown below:

Table 4. Loss and damage assessment of Bakerganj Upazila

Hazard	Loss and damage priority								
	No (0)	Highly severe (1)	Severe (0.8)	Moderate (0.6)	Minor (0.4)	Low (0.2)	Total frequency	Priority index	Ranking
Flood	1	33	50	13	0	0	97	0.83	01
Cyclone	6	24	36	31	0	0	97	0.73	02
Tornado	45	6	25	12	8	1	97	0.38	05
Heavy rainfall	0	0	3	56	38	0	97	0.53	03
Pest attack	25	0	4	41	27	0	97	0.4	04
River erosion	52	0	7	18	19	1	97	0.25	06
Salinity	86	0	0	1	5	5	97	0.037	09
Epidemic	32	0	0	2	40	23	97	0.22	07
Others	90	0	0	5	2	0	97	0.039	08

According to this estimate, flood loss and damages were extremely severe, cyclone loss and damages were moderately severe, destruction by heavy rainfall was less severe, pest attack and tornado loss and damages were moderate, river erosion and epidemic were minor, salinity and hailstorm were extremely low. So, they should give priority for flood resiliency than other types of hazards for their better safety in future.

Climate Resilient Indigenous Technology:

Indigenous knowledge refers to the ways and practices created by a group of people based on a deep awareness of the local environment that has grown through many generations of occupation. (Jennifer, 2008).

Table 5. The identified community-initiated technologies were:

Indigenous technology	Merits	Demerits
1. Raising of house platform	a. The measure is cost effective and protective against tidal surge and cyclonic wind. c. This helps them to take primary shelter until signal was announced and volunteer team was coming. d. The study area's people could do this without external help. e. It created shelter for livestock and cattle. f. It secured them from infectious debris that came with flood water and cyclonic wind.	a. This project did not require external funding, however it may require external assistance for ultra-poor or female-headed households. b. For the absences deep rooted pillar sometimes it faced destruction in time of severe disastrous situation.
2. Tying of house:	a. The measure was cost effective. c. It was effective against heavy cyclonic wind. e. On the other hand the key requirement for this measure was rope and it could be also made by local people by paddy fiber or jute fiber.	a. Sometimes the tree can spill out with its root from soil for heavy weight of house. b. It's sustainability period against disaster was very low.
3. Raising of platform for cultivation	a. It was a cost effective measure. c. Sloping side of the platform allowed get rid of excessive water from land.	b. The longevity of bamboo based platform was short.

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	d. The sloping sides of the platform could be used for leafy vegetable production. e. The primary elevated ground platform appropriate for the production of numerous seasonal crops. f. For bamboo based platform don't require extra land, it could be built on house pond/puddle. g. It was effective for flash flood and rain feed flood. h. This was not only a strategy to convert a single crop into multiple crop production, but it also helps to provide food and financial security for agro-based households..	
4. Plantation of disaster resilient tree around the house	a. It was a cost effective way for saving of house against disaster. b. They could also use these trees for other purpose like-fire wood, boat construction etc. c. It was helped them to refuge in time of emergency. d. It was supported them in time of crisis to earn money. e. It's sustainability period was long lasting.	a. It was a time consuming process. b. However, they needed external assistance as the trees were not naturally available in their areas.
5. Raising of pond bank	a. This measure contributed to strengthening community cohesion. b. The measure was very effective against tidal surge. c. It was a very flood resistance technology. d. The large height bank could be used for vegetable cultivation.	a. This measure was only relevant if the local people are prepared to collaborate to overcome their issues rather than relying on outsiders.
6. Floating vegetable gardening	a. It was helped in cultivation and earning money in time of rain and flood. b. It was needed no extra cost for cultivation and it was a very flood effective technology. c. In crisis time it was helped own to meet their own nutritional requirement and food security.	Sometimes the rafts got putrefaction for remaining in water for a long time and effect on plantation
7. Using of vegetable waste, cow dung as a fertilizer	a. It was a cost-effective way of more production and reducing cost of fertilizer. b. Gave them healthy food and for making this not required any type of external help and advice.	a. Bad odor and sometimes people could affect by diseases for direct use of hand for processing the cow dung to convert it into fertilizer.
8. Using of boat or tree raft/hull for transportation during water logging	a. It was helped to transport goods and people in time of flood/heavy rainfall. b. It was reduced spreading water related diseases by avoiding direct foot walking in water logging. c. It was helped to earn money in time livelihood vacancy.	a. In time of urgency it created collation between passengers.

Percentage of Using Indigenous Technology: In the study area found that most of the people of this area practice raising house platform (95.87%) for climate resiliency and then sequentially plantation of disaster resilient tree (76.29%), raising platform for cultivation (73.20%), using of homemade fertilizer (62.89%), tying of house (61.86%), raising pond bank (50.52%), using of boat or tree raft (45.36%), floating vegetable gardening (24.74%) and finally others techniques (8.25%) including-using of banana tree leaf as umbrella, using fit-kari for water safety, building of machon for storing materials.

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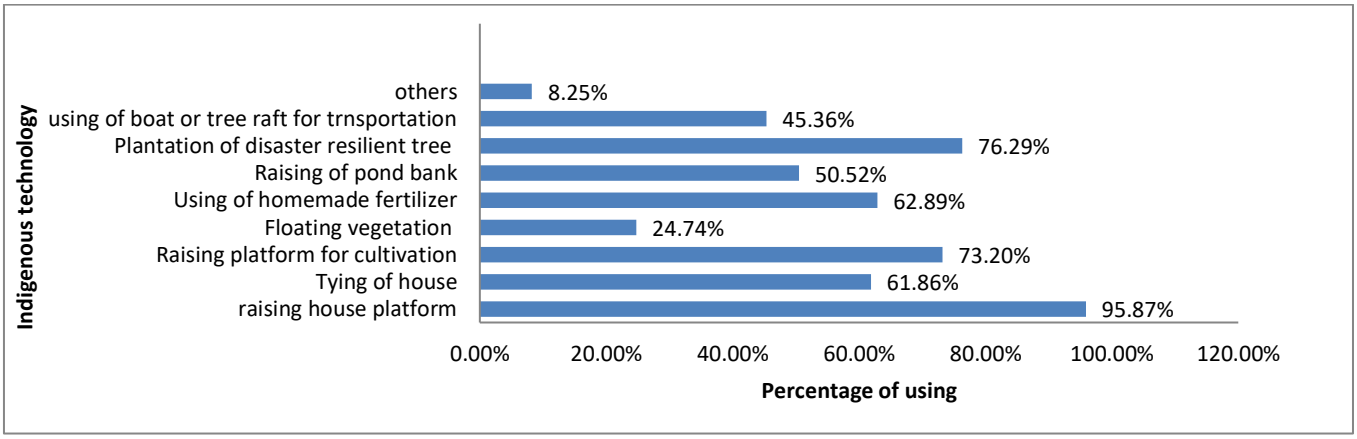

Figure 4. Percentage of using indigenous technology by respondent

Sustainability of Indigenous Technology:
For climate resiliency sustainability is a major part. If we can grow sustainably, the negative and quick impact of disasters will be reduced. Economic growth, environmental protection, and social equity are the three pillars of sustainable development.

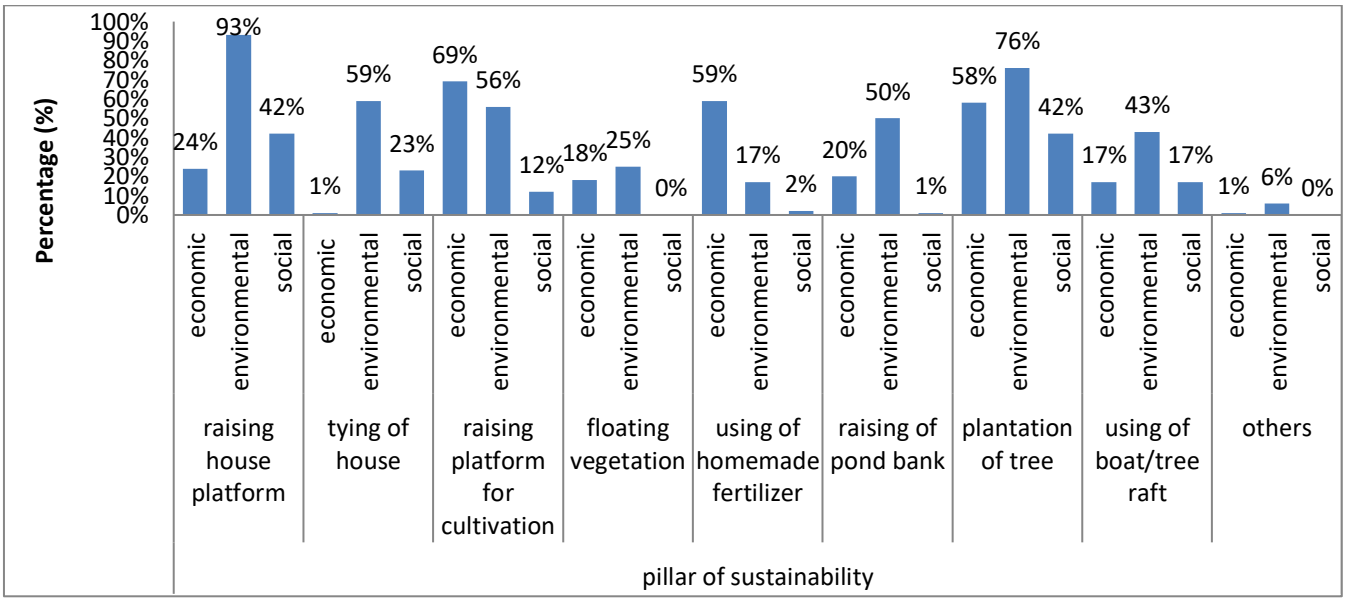

Figure 5. Sustainability Status of Indigenous Technology.

In figure-5 shown that the sustainability of different climate resilient technology through 3 pillar of sustainability.
According to people perception the raising house platform was highly sustainable and the floating vegetation was rarely sustainable to disaster .
Resiliency of Community used Indigenus Technology **Through 4R Approach:** There are a 4R approach for determining the climte resiliency of those indigenous technology that were used in this area. In the 4R approach may include-

Robustness—The inherent strength or resistance in a system that allows it to withstand external demands without degradation or loss of functionality.
Redundancy—System properties that allow for alternate options, choices, and substitutions under stress.
Resourcefulness—The capacity to mobilize needed resources and services in emergency.
Rapidity— The speed with which disruption can be overcome and safety, services, and financial stability restore (Bruneau, 2008).

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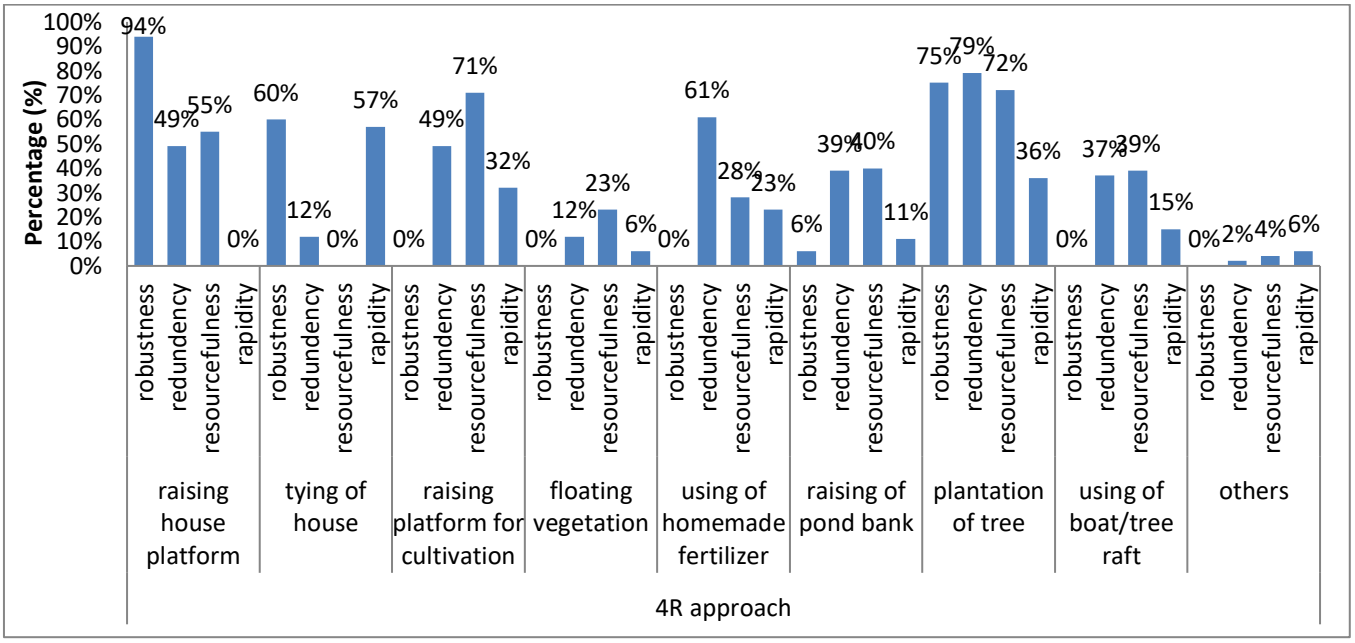

Figure 6. Resilient status of indigenous technology

According to respondent perception it was found that plantation of tree aroun the homestead area was most disaster resilient approach of the study area. Besidely as the area was mostly flood prone area so the raising house plateform also got second prioprity in resiliency score. Because when the study area people built their house they gave more attention in this issue.

Table 6. SOWT Analysis of Climate Resilient Indigenous Technology:

Strengths	**Weakness**
Increase people's participation, decrease dependency on external aid and local knowledge and Practices can assist in determining what is required and what is acceptable locally.	The technologies are transmitted orally, absences of documentation and inadequate knowledge about the value of indigenous technology
Opportunities	**Threats**
Natural resources will be mobilized; It will foster mutual trust, understanding, and a feeling of communal ownership.	Standard forecasting and early warning systems are insufficient because they may be inaccurate owing to ongoing climate change; traditional coping mechanisms are also insufficient for disasters that occur abruptly and on a large scale.

After this research, we may conclude that everything has a bad and good aspect. As Bangladesh is a disaster-prone country, and the demand for indigenous technology is great, we should endeavor to maximize the positivity of those technologies while decreasing the negativity.

Support from External Source:

In time of survey found that the Bakerganj Upazila's people was work with different NGOs like- BRAC, KARITAS, ASHA and UTTARAN for developing their vulnerable condition through loan, different types of development training and support. On the other side, the people of this area also received government help during Sidr and Aila. The government has 43% of the ability to provide external services, NGOs have 53%, the private sector has 1%, and corporations have 0% that is shown in figure 7:

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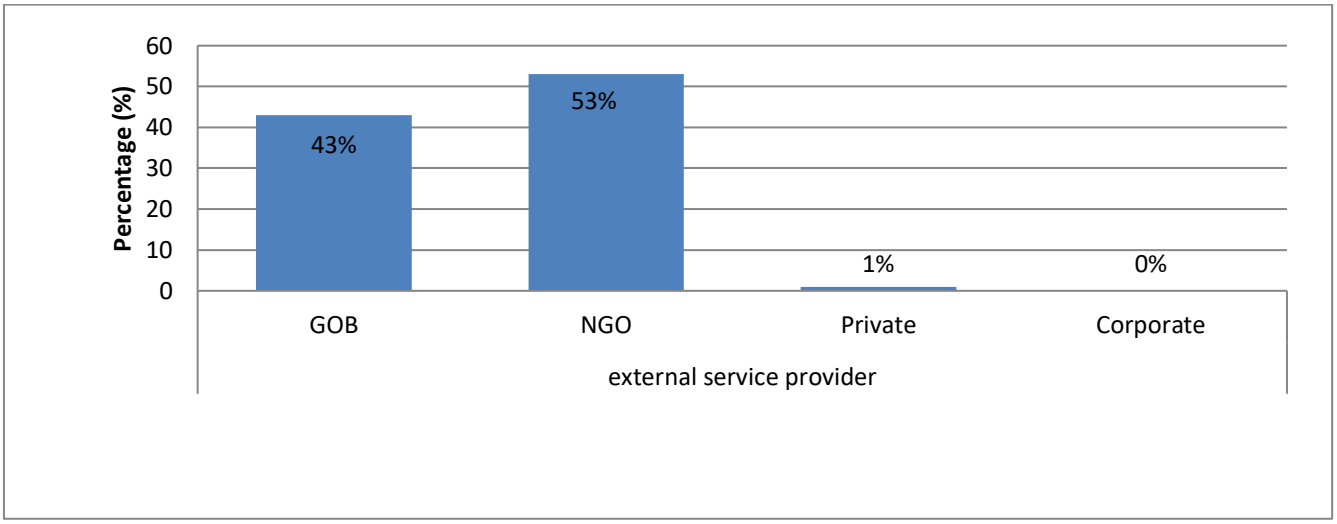

Figure 7. Statistical Status Of External Support

CONCLUSION

From above mentioned discussion it is turned that the Bakerganj upazila was very rural based area and they have very little knowledge about outer world mechanisms. In the analyzing session found that the change in rainfall and temperature is highly severe climate change impact and for this the flood was hitting in this area very frequently. The paper also emphasized the abundance of indigenous technologies accessibility in the study region for efficient disaster mitigation of the negative impact of disaster. From the people perception of Bakerganj upazila it was clear that here rain feed flood and riverine flood is occurred most and for this they raise their house platform at a greater height as an adaption technology, they also practiced different method like- plantation of disaster resilient tree, raising pond bank, rainwater harvesting, raising platform for cultivation, floating vegetation etc. These technologies are practiced regularly, occasionally and seasonally but they can't understand the ultimate value of those technology, they think they practice those as a tradition. On the other side poverty and lack of awareness increase the possibility of occurring those disaster. But their main capacity was to fight against those disaster was social bonding. Because this social bonding helped them to make raising house platform, plantation of trees around the house and other indigenous technology more sustainable and resilient. Beside the study area people also got support from different GO and Ngo so the severity of risk in this area was low. As the indigenous and local level practiced technologies are highly affordable and strong to manage disaster or climate change than scientific method. So, all higher level scientist and researcher should come forward to analyze the value and effectiveness of indigenous technology for CCA and integrate those with modern technology for getting a most effective climate resilient adaption measures and should be disseminated those adaptive method top to grass root level for wellbeing of earth and human being.

Conflict of Interest

There are no conflicts of interest declared by the authors.

REFERENCES

Bahaudding, K. M. and Uddin, M. H. 2012. Community Based Risk Assessment and Adaptation to Climate Change in Dharam Wetland under Sunamganj District. Journal of Environmental Science and Natural Resource, 5(2): 161-166.

Balay, M., Marlowe, J. and Gaillard, J.C. 2018. Deconstructing the binary between indigenous and scientific knowledge in disaster risk reduction: approaches to high impact weather hazards. International Journal of Disaster Risk Reduction, 30: 18-24 https://doi.org/10.1016/j.ijdrr.2018.03.013

Banglapedia, 2006. http://enbanglapedia.org/index.php?tittle=BakerganjUpazila.

Battiste, M. 2002. Indigenous knowledge and pedagogy in first nations' education: A literature review with recommendations. Ottawa: National Working Group on Education and Indian and Northern Affairs Canada.

BBS 2014. Bangladesh Bureau of Statistics (BBS) (2014) Statistical Yearbook of Bangladesh. Bangladesh Bureau of Statistics, Ministry of Planning, Dhaka.

Berkes, F. 1999. Sacred Ecology: Traditional Ecological Knowledge and Resource Management, Boca Raton (USA): Taylor and Francis.

Brunea, M. 2008. Multidisciplinary Center for Earthquake Engineering, University of Buffalo.

Folke, C. 2006. "Resilience: The emergence of a perspective for social-ecological systems analyses." Journal of Global Environmental Change, 16:253–267.

Guna, N.P. 2002. Forecasting and Warning of Water-Related Disasters in a Complex Hydraulic Setting—The Case of Bangladesh, Hydrological Sciences Journal, 47(S1):S5-S18.

Hakim, S. 2012. Reduction of flood risk by indigenous knowledge at Alekdlar char of Shibalaya upazila in Manikganj district, BRAC University, Dhaka, Bangladesh.

Hasan, M. 2012. The Cost of Adapting Extreme Weather Events in a Changing Climate, Minister for Environmental and Forest, Bangladesh.

Haque, M. 2019. Indigenous Knowledge and Practices in Disaster Management: Experiences of the Coastal People of Bangladesh. 10.1007/978-981-10-8845-2_4.

IPCC. 2007. Summary for Policymakers, in Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the

Intergovernmental Panel on Climate Change, M.L. Parry, et al., Editors. 2007, Cambridge University Press: Cambridge.

ISDR. 2008. Indigenous knowledge for Disaster Risk Reduction: Good practices and lessons learned from experiences in the Asia-Pacific region, Bangkok, July 2008.

Islam, K.F. 2013. Community Based Disaster Management in Bangladesh, https://www.researchgate.net/publication/333972153

Jennifer, B. 2008. The value of Indigenous Knowledge for Disaster Risk Reduction: A Unique Assessment Tool for Reducing Community Vulnerability to Natural Disasters, Journal of Political Science, Bangkok, UN/ISDR.

Langill, S. 1999. Indigenous Knowledge: A Resource Kit for Sustainable Development Researchers in Dry Land Africa. London: IDRC.

Lambert, S.J. and Scott, J.C. 2019. International disaster risk reduction strategies and Indigenous Peoples. International Indigenous Policy Journal, 10 (2), 10.18584/iipj.2019.10.2.2

Pottier, J., Sillitoe, P. and Bicker, A., 2003. Negotiating local knowledge: Identity and power in development. Pluto.

Mishra, V. 1994. Guidelines and Principles for Social Impact Assessment, Prepared by the Inter-organizational Committee on Guidelines and Principles for Social Impact Assessment.

MoSTE. 2015. Indigenous and Local Knowledge and Practices for Climate Resilience in Nepal, Mainstreaming Climate Change Risk Management in Development, Ministry of Science, Technology and Environment (MoSTE), Kathmandu, Nepal, GOP.

Moser, C. and Stein, A. 2010. Pro-Poor Adaptation to Climate Change in Urban Centers: Case Studies of Vulnerability and Resilience in Kenya and Nicaragua. World Bank.

Nawaz, F. and Shah, N.N. 2011. Mechanisms and challenges for managing disaster in Bangladesh, African Journal of History and Culture 3(7):104-112.

Nelson, D.R. and Brown, K. 2007. Adaptation to Environmental Change: Contributions of a Resilience Framework, Annual Review of Environment and Resources, 32:395–419, http://eprints.icrisat.ac.in/4245/1/AnnualReviewofEnvResources,32,395-419,2007.pdf.

Richard, A. and Krueger. 2002. Designing and Conducting Focus Group Interviews, University of Minnesota.

Rumbach, D.F. 2014. Indigenous institutions and their role in disaster risk reduction and resilience. Evidence from the 2009 Tsunami in American Samoa, Journal of Ecological Science, 19 (1), 10.5751/ES-06189-190119.

Shaw, R. et al. 2009. Indigenous Knowledge and Disaster Risk Reduction: From Practice to Policy.

Shaw, R., Takeuchi, Y., Ru Gwee, Q. and Shiwaku, K 2011. Disaster education: An introduction. in R Shaw, K Shiwaku & Y Takeuchi (eds), Disaster Education. Community, Environment and Disaster Risk Management, 7:1-22. https://doi.org/10.1108/S2040-7262(2011)0000007007.

Shaw, R. 2016. Community Based Disaster Risk Reduction, Journal of Natural Hazard Science, https://doi.org/10.1093/acrefore/9780199389407.013.47

Siddiqui, T. 2009. Climate changes and Population Movement: the Bangladesh case RMMRU, University of Dhaka

Sillitoe. 2005. Indigenous Knowledge Enquiries; methodologies, Manual for development programs and projects. Rugby: ITDG Publishing.

Smit, Barry and Wandel, J. 2006. Adaptation, adaptive capacity and vulnerability, Journal of Global environmental change 16(3): 282-292.

Thapaman, B. 2002. Linking Disaster to Development: The Case of Community-led disaster Management in Nepal, Regional Workshop on total disaster risk management, 7-9 August, 2002, Nepal.

United Nation International Strategy for Disaster Reduction (UNISDR). 2005. Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters, http://www.unisdr.org/eng/hfa/docs/Hyogoframework-for-action-english.pdf.

Wisner, B. 2009. Local Knowledge and Disaster Risk Reduction. Unpublished talk at the Side Meeting on Indigenous Knowledge, Global Platform for Disaster Reduction, Geneva.