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Flooding Hazards and Mental Perception: A Theoretical Framework

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Authors' contributions

This work was carried out in collaboration between all authors. Author MAR designed the study, wrote the protocol, and wrote the first draft of the manuscript. Authors MSA, MBH and MAR managed the literature searches and took part in the statistical analysis and MAHB prepared the final version of the manuscript. All authors read and approved the final manuscript.

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ABSTRACT

This study was focused on flooding hazards and its negative consequences at the Bandaler char area in Bangladesh. It was performed to make out the local views, long term experiences and health impact perspective to regional feature. It was observed that, people perception and observational data indicate to latent hit in the community. People views are revealed that, concept on environment and climatic variables were varied from person to person owing to educational qualification and age. Results showed that, flood frequency and its damage rate negatively

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impacted on mental health. In addition, a theoretical outline is drawn which could be effective to control the situational flood risk in a society. It may implies to integrated flood risk management approach whereas it is included both upcoming stage to recovery stage.

Keywords: Flooding hazard; mental justification; bandaler char area (Bangladesh); social crisis and theoretical outline.

1. INTRODUCTION

Flooding vulnerability and its negative consequences is a critical issue at the present world. The changing pattern of natural climate mostly has been made by human induced causes. This imbalance condition is negatively attributed to socioeconomic status and livelihood pattern. However, several communities are trying to develop adaptive capacity against with environmental crisis through applying indigenous technique. Economical and social aspects along with disaster frequency have been identified as potential factors to evaluate adaptation capacity in the hazard prone area [1]. A natural hazard is considered to be more dangerous compared to any other hazards for the human being [2]. Furthermore, many affected individuals cannot manage environmental conditions with the social aspects.

In the developing countries, most of the people have been victimized owing to natural hazards but it is not possible to cope with in a short term measure and support. In addition, develop country already made some efforts to control the situational case for the environmental hazards. Consecutively, Bangladesh is highly affected and flood prone country in the developing world. In Bangladesh, one-third area has been identified as a vulnerable part to flooding but it may varies from temporally and spatially [3]. Hydrological cycle is significantly affected by climate change. The Ganges-Brahmaputra river basin has been identified as a highly risky (vulnerable) point in the world due to considering some issues and its combined effect of excessive monsoon rainfall, glacier melt and sea level rise [4]. Immerzeel [5] reported that, average stream flow of the Brahmaputra River is around 20,000 m^3s^{-1}. It is stated that, study area is located belongs to the Ganges- Brahmaputra floodplain area. A number of authors [6,7] mentioned that, the Ganges-Brahmaputra River basin is more critical point which is influenced by heavy monsoon precipitation and flooding. However, it is identified as a great warning for the food security approximately 26 million people [8]. Nevertheless, a major part of the country is categorized into flood risk zone whereas it is superlatively treated as potential area for the flooding hazards. Every year, the major elements of sustainable development goal are threatened and/or inhibit socioeconomic condition to achieve sustainability in a society. In the long term measure, social people try to make out the indigenous technique to ensure their existence but in some cases vulnerability has been increased owing to drastically change of climatic variables in the local and global scale.

Now-a-days flood measure is an important factor, to know the situation, social parameter and local perception along with "*how can build up adaptive capacity?*" Climate change vulnerability and adaptation capacity is extensively cited in social aspects for the last few years [9]. People perception measurement and belief helps to develop a new measurement criterion for the adaption using long term pragmatic experience. In addition, the negative impacts of flooding hazards disseminate in a community as a sporadic calamity. An inductive approach was suggested for including adaptive capacity and flexible governance structure owing to vulnerability assessment [10,11]. Nevertheless, it would be apparent as an environmental and health hazards in the affected area. The aim of the study is to investigate the local perception and adaptive capacity measure in a "CHAR" land community in the long term measure. This study would be led to clarify the individual judgment and local capacity against with adverse environmental flooding hazards. A theoretical framework has been done as a recommended outline to promote functional advancement to achieve sustainable development.

2. RESEARCH METHODS

The study was carried out in the Chilmari Upazila[1] (Under Kurigram District) at Bandaler Char area. It is located in between 25°26´ and 25°40´ N latitudes and 89°38´ and 89°48´ E longitudes (Fig. 1).

[1]*Small administrative unit (e.g. Police station) which consist of several union*

This area (5.8 Sq km) is bounded by the Brahmaputra River. Total people of the study area were recorded around 2500-3000. Many communities livelihood depends on contemporary agricultural activities in char land and fishing activities.

Research was performed using structural feedback form (Questionnaire). It was randomly distributed [12] among the local respondents to get clear perceptional views and flooding hazards. It was divided into four parts; part-1 was contained demographic information along with preliminary concept on environmental and climatic stress, part-2 was consisted with personal feelings and concurrent flooding hazards at the study area, part-3 was enclosed with mental stress and social views on flooding hazards, part-4 was consisted with overall perceptional view among the respondents in case of indigenous coping mechanism and its justification.

Interview was taken among the local respondents. This technique was considered those respondents who were directly concerned with natural hazards. A total number of 153 questionnaires were survived from the study area. They were willingly agreed to give the information about the natural hazards and impacts on their mental stress, livelihood pattern, social crisis, problematic site and perceptional view in relation to their pragmatic experience. Respondents were selected randomly among both male and female in the community. The structural question was placed face to face and tried to find out the real scenario and long term climate change. Their thematic answer and local condition was being highlighted on socioeconomic status and social hazards. The RRA (rapid rural appraisal) approaches of qualitative research were used to perform focus group discussion (FGD) to get clear concept on socioeconomic status and vulnerability [13]. FGD was performed in the study area, divided into three groups among the total respondents (teacher, shopkeeper and other service holders) and performed according to the selective study and to serve the aims of the study. A total number of 60 participants were taken part at FGD in group, 19 for group one, 21 for group two and 20 for group three. Their visual expression and information was more clear and congruent with the relevance discussion question. Most of the "question" was contained thematic view of the research work....."How environmental hazards affect their life style?" "What sorts of flooding factor influence their socioeconomic and health condition?" "What are the major problem arise due to long term flooding hazards?" The informal dialogue was performed among the rural people. It was performed on the way to survey in different location and places like as stall, local shop and on the street.

A number of questions were contained in the structural question whereas likert-scale formatted question got emphasized for getting clear concept on "climatic hazards" "Mental Stress on negative consequences of flooding hazards" and "conceptual evaluation for the damage function". It was more significant to seek out realistic fillings with respect to local scale. It is the significant way to make out the better understanding feedback in the social aspect and realizing phenomena. Flooding hazards and its negative impacts was defined using sub-categorical (*"Climate change" "Climatic variable" "Natural hazards" "Environmental pollution" "Flood pre-consequences" "Flood post-consequences" "Hygienic" "Awareness" "Mental strongest to stay homeland" "Thinking and future perception" "Home sickness and property loss stress" "Upcoming hazards and attitude" and "Concurrent problematic realization"*) question depending on situational and regional factor (Table 1). Likert-scale analysis was performed considering with positively and negatively scoring methods following reverse order like as "know" for 5, "well known" for 4, "either known nor unknown" for 3, "unknown" for 2 and "completely unknown" for 1.

However, the adaptation indicator to flood vulnerability was performed using "Conversation linkup technique" it was recorded a sequential conversation tracking point instantly in order to find out thematic views on "mental stability" "Mental stress to forthcoming flood" "Confident level" "Adaptive strength" Adaptive capacity" "Experience level" "Knowledge shearing attitude" "Predictability" "Coping experience" "Anxiety to property loss" and "Risk realization ability" (Table 1). Adaptation is to be made of long term pragmatic experience against with any adverse natural and human induced environmental stress. These characteristics emphasized on mental, physical and surrounding environment around the residence or in the community. Nature teaches to….. "How to survive in the adverse environmental condition?" which is implies to social, situational and conditional factor.

Statistical analysis was performed using different statistical tools and technique. The data coding system was used to accumulate the required data gathering and arrangement [14]. Statistical analysis was applied due to evaluating the co-factor relationship among the asked question answer. The statistical package for windows software like as SPSS version 11.5, MS excel 2007 and Sigmaplot version 7. Statistical analysis has been performed following proper system and technique.

3. RESULTS AND DISCUSSION

3.1 Probable Indicator of Primary Judgment

A number of factors in a society act as a key indicator to investigate the real circumstances at the right time and place. The International Strategy for Disaster Reduction (ISDR) recognizes that, Social context (people perception and experience) consideration is a very important factor for getting clear concept of underlying cause [19]. The situational and social factor may influence to the conceptual realization and individual attitude in a locality. The literacy rate and better socioeconomic status directly attributed to personal view in case of betterment and welfare. It is an important issue to make out the realistic output through proper scrutinizing factor influencing parameter. However, most of the people of the study area were lived from hand to mouth. Economical crisis has been stated, the knowledge empowerment is a long term problem which is gone over the decades in the study area. Consequently, a series of natural hazards expedite to existing worse livelihood pattern and financial stress.

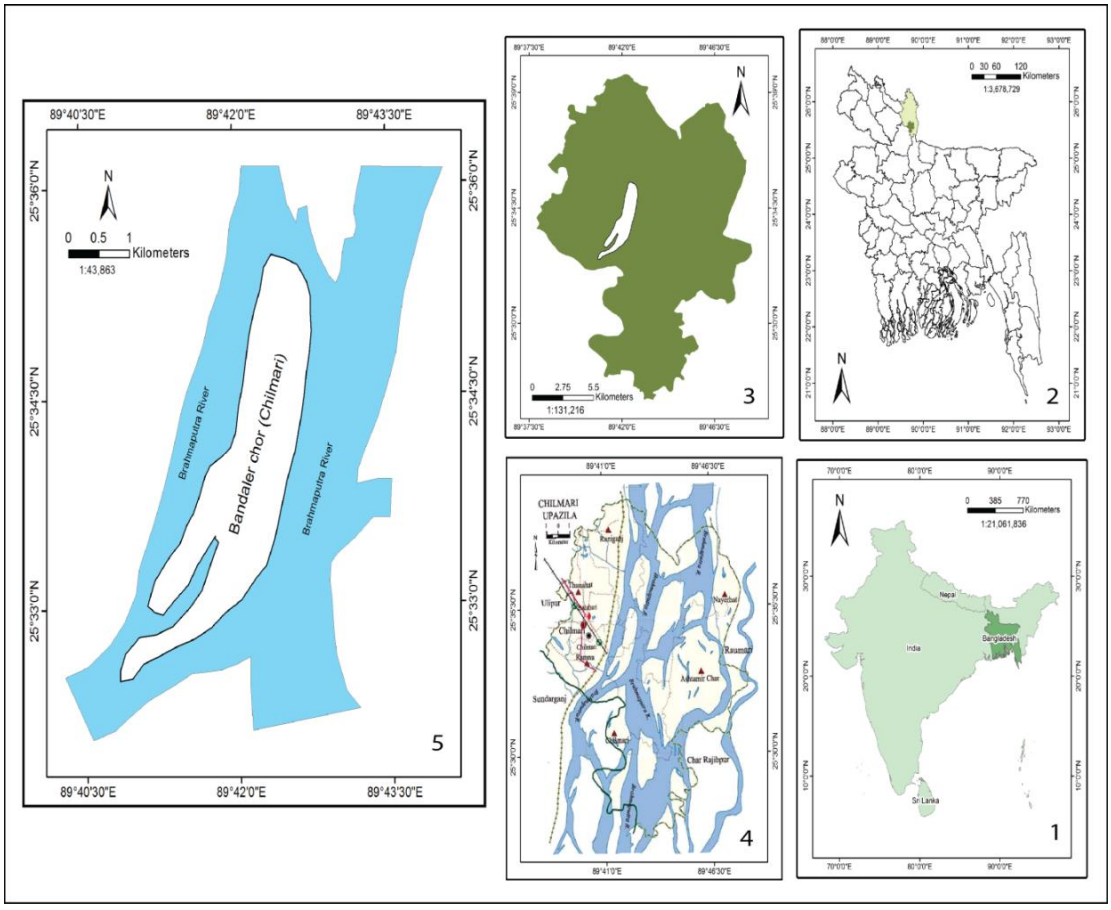

Fig. 1. Location of the study area [1. Position of Bangladesh in Map, 2. Position of the study area under the Kurigram District, 3. Study area in a broad aspect (just white portion), 4. Chilmari Upazila (Under the Kurigram District), 5. Only study area] in Bangladesh

Table 1. Interview conducting guide

Questionnaires	Thematic feature	Question set and aspects
Part-1	A number of fundamental question has been done to make out the realization and conceptual knowledge on environmental and climatic stress. It was embodied on local views and existing capacity to cope with natural calamity.	➢ Have any idea about climate change? [15,12] ➢ Do you know, what is climatic variable? ➢ What are natural hazards? [16] ➢ Have any idea about environmental pollution? [12] ➢ Clarify your knowledge about flood pre-consequences ➢ Clarify your knowledge flood post consequences ➢ Have any idea on Hygienic condition? ➢ Do you know what is awareness and preparedness?
Part- 2	This section has been highlighted on respondents outlook and concurrent flooding hazard. It was observed through applying inter-personal knowledge variation and its future prospect along with resilience pattern.	➢ Are you mentally determine to stay homeland at the time of flooding hazard? ➢ What are you thinking to future perceptional view on local flood? ➢ Have any opinion about home sickness, property and economic loss? ➢ How can you take action to upcoming hazards, and on time individual attitude? ➢ What about the concurrent problematic realization on this issue?
Part-3	A number of problems have been identified among the respondents through informal and formal dialogue on flood and social aspects.	➢ Mental stress [17,18] ➢ Psychiatric problem [18] ➢ Property loss and economical hazards ➢ Social hazards and sustainability failure ➢ Livelihood Pattern and food crisis [3] ➢ Body physiological disease evolved and health risk ➢ Post-hazards crisis and social crime
Part-4	The following interviewing parameter has been considered to observe the situational case and overall perceptional view on indigenous coping mechanism and its justification using “Conversation Linkup Method”.	➢ Mental stability ➢ Mental stress to forthcoming flood ➢ Individual confident level ➢ Adaptive capacity [3,18] ➢ Adaptive strength [3,18] ➢ Experience level ➢ Knowledge shearing attitude [12] ➢ Predictability ➢ Coping experience ➢ Anxiety to property loss [17] ➢ Risk realization ability

The perception analysis is a reflection of existing cause of problematic sufferings and damage function. Natural hazards and its degree of frequency and magnitude indicate to economical stress and food crisis in a community [3]. The contemporary climatic risk and devastating information helps to avoid catastrophe at the specific region. In addition, people realization power relies on education, age, sex, economical wellbeing, community empowerment and existing facility to facilitate personal development. It was observed that, 16%, 26%, 22%, 13%, 26%, 31%, 20%, and 23% people were well known about climate change, climatic hazards, natural hazards, environmental pollution, flood pre-consequence, flood post-consequence, hygienic and hazard awareness respectively but some people (14%, 10%, 1%, 18%, 2%, 3% and 9%) were unware completely about the climatic parameters and its negative consequences in a longterm measure (Fig. 2). It may be indicated to the lack of environmental education and ignorance. Most of the respondents were observed not so conscious about environmental threats and its future impact. However, education might be enlightened to one's present, past and future realization power along with it may upgrade thinking level with considering attitude. Environmental education could be effective for getting sustainability in all parts of human life cycle, whereas it may wake up to natural justice and build up managerial power against with worsen environmental condition. So, it may play a vital role to reduce environmental risk and impacts.

3.2 Mental Settings and Personal Justification

Mental setup is a critical parameter to maintain suddenly evolved social, cultural and family crisis which is firstly highlighted to one's growing environment, social status, adaptive capacity, socioeconomic condition, educational qualification and socialization factor. The reverse situation and its negative result imply to make vulnerable in a position [20]. The local people believe that, "worst condition" is a continuous process and/or pathway in a life. Moreover, ending point of previous dilemma, another stage will be started from that point. Sometimes, the perceptive view and thematic concept of the local people lay down to upcoming hazards, when life at risk to death. However, Regarding with respondents perception, 32%, 19%, 39%, 37% and 25% local peoples were found to be strongly agreed to stay at their parents residence with respect to mental determine to stay homeland, thinking and future perception, home sickness and property loss stress, upcoming hazards and attitude and concurrent problematic realization respectively (Fig. 3). A minor part of the total respondents did not support to stay against with natural hazards and environmental stress.

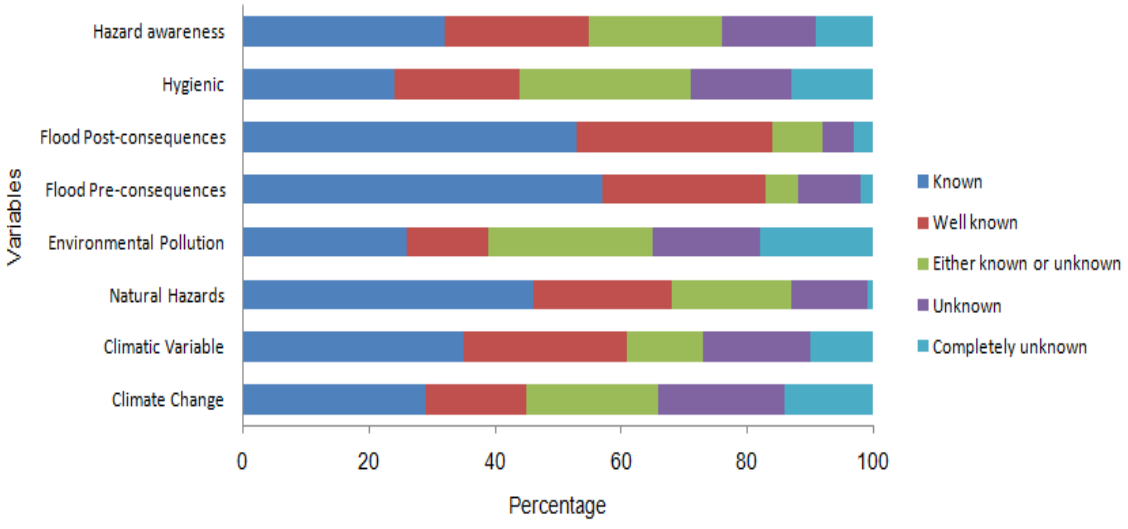

Fig. 2. The general concept on environment

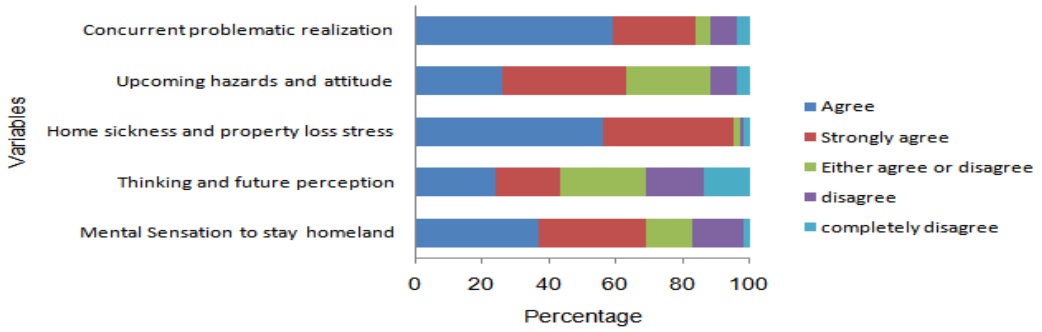

Fig. 3. The mental setting and personal judgment

3.3 Existing Mental Stress and Development Impairment

The positional factor and existing inferior condition directly make linkage with mental and psychological stress. The long term climatic hazards and its negative feedback force to family and social crisis in a community. Consecutively, it is attributed to change livelihood pattern and daily life style and food chain sustainability. The post disaster and economic slowdown act as a future predictability or reliable factor to occur health risk, social crime, food crisis and social instability in the community. Multidimensional approach is very important to identify the social disaster along with mental crisis. The United Nations Development Programme (UNDP) recognizes that, hazard is a potential factor to occur physical and mental damage of human being that may helps damage property, lose of life or injury, environmental degradation, social and economic disruption and property damage [21]. The information of nonfatal flood injuries is very little but most of author normally reported as flood related [17]. According to WHO (World Health Organization), flood hazards and its consequences on mental health have not clearly addressed in the field of disaster preparedness [22]. Flooding hazard impact on human health varies, and it depends on flood types and people vulnerability [23,24,25].

3.3.1 Mental stress

A number of people observed who were victimized with mental pressure due to long term climate change and its negative impact on socioeconomic condition. People suffering and daily life style not congruent with sustainable way to lead better management. Moreover, it may be turned into to psychological hazards.

3.3.2 Psychiatric problem

The psychological problem has been identified among the respondents of the study area. According to the field observation, a number of respondents expression were found to be anomalies and inharmonious to the respective question. It may be the eventual consequences of natural hazards and basic needs crisis.

3.3.3 Property loss and economical hazards

Natural hazards and its harmful impact on sustainability openly attributed to resilience pattern in the community. Most of the people's livelihood and their life style pattern were governed by the agro-economy and its derivative. The local people reported that, *"flooding hazards and its pessimistic effects is the main cause of our economic crisis and food crisis"*.

3.3.4 Social hazards and sustainability failure

The ultimate consequences of economic crisis have been coincided with the social instability and respective vulnerability in the community. Regarding with the respondents perception, social development and its negative aspects made a linkage with natural damage function along with its frequency per year. Whereas, sustainable development is a very important issue to ensure basic needs in the whole population of a society. However, a number of people were not being coped with natural calamity in the long term hazards.

3.3.5 Livelihood pattern and food crisis

Agricultural impacts and economic crisis is evolved due to long term hindrance of natural and anthropogenic calamity [26]. A major part of

the social people in the community stated that, livelihood pattern has been shifted and gone to the worse condition. Their pragmatic experience predicted to the long term food shortage owing to climatic hazards.

3.3.6 Body physiological diseases evolved and health risk

Now climatic hazards are an unexpected threat to the human being due to long term variation of climatic variables and newly evolved diseases. The possibility of infectious diseases depends on factor influencing hazards like as flooding hazards. It would be spread out as a fatigue exposure in the locality.

3.3.7 Post-hazard crisis and social crime

Post-hazards crisis is a common issue when it is converted into catastrophically accepted. Then people suffer from economical crisis, mental stress and food crisis. Whereas, the considering factor has been emphasized on social vulnerability and leading future instability in the community.

Ahern et al. [17] reported that, a number of evidence related to natural hazards and health impacts like as posttraumatic stress syndrome, mental disorder and suicide. A significant number of studies has performed on mental health disorder owing to flooding hazards in develop or middle-income countries like as the United Kingdom [27], the United States [28], Australia [29], Poland [30] and also Bangladesh [31].

3.4 Local Perception, Disaster Coping Technique

Local views and disaster (natural and anthropogenic) is a reflection of failure to adapt against with adverse environmental condition. The pragmatic experience and long term upward and down trends of natural hazards helps to their affirm mind setup for the coping capacity build up that “IT IS A NATURAL PROCESS”. They believe that, it would be pacify by the natural way after a certain period of time but its magnitude and frequency has been increased than previous scenario. However, a few people reported that frequency and magnitude of natural hazards has been changed to aggressive than before era. It is a critical parameter where local perception on natural disaster and its aggressive mode coincided with climatic stress and long term atmospheric change in the world. Local perception and adaptation capacity to flooding hazards varies from place to place and time. It may depend on geographical position, culture, educational and age classes (Table 2). Factor depending adaptation capacity helps to reduce life loss and unexpected social crisis.

The coping technique is an aggregate of thematic and/or traditional view which is applied to cope with any adverse condition in a situational case. The long term observation and practical feedback indicate to better understanding to face any difficulties. The traditional natural hazards (like as flood) has been helps to built up capacity to survive in any occurrence and magnitude. The fighting process and technique was showed some variation from technological evolved adaptive technique and institutional approach to disaster management. The practical approach for hazards documenting is guided to surveillance from present to future predication at a glance. A number of respondents reported that, *“our evolving technique was enough to manage natural hazards before 15-20 years ago but we could not realize what would be the flood frequency and magnitude in the upcoming days”*. In addition, global environmental changes have been turned into reverse and/or disorder the natural balance condition whereas some time local experience fails to read out the natural attitude and expression.

3.5 Capacity Building and Thematic Outline

Survival capacity is positively influenced by mental setup whereas it implies to adaptive measure in a worst situation. In some cases, situational factor, socioeconomic factor and social condition act as a coexisting parameter to sustain in an adverse environmental condition. Nature and its positive or negative consequences help to teach human being “*how to play with natural calamity?*” However, it may differ among different victimized area in order to rank and frequency. Frequently hazards occurring area and its resident easily being coped with environmental stress and local impacts. Actually, it depends on frequency and magnitude when it may overlap with their perceptive view and forthcoming hazards intensity. White [32] reported that first flood hazard research work, along with geographic research and natural hazards adjustment of human. Whereas, this adaptation capacity builds up through long term experience and hazards occurring. In addition, a

number of natural hit may drive a huge loss by the breaking people (experienced) perceptional trends and anticipated power. It may be attributed to global environmental imbalance condition. According to respondents, "*now we did not realize the actual phenomena of natural hazards, damage function and its intensity because, in some cases we observed the discontinuation pattern, time, place of flooding hazards*".

"The RAKIB®FHAM (RAKIB®Flood Hazards Management) theoretical model (Fig. 4) illustrated the realistic point of actual scenario and respective mitigation technique for the future research. It is contained five-steps and explained in itself from primary stage to recovery stage. However, its prospective measure in a whole approach given emphasize on coping technique with a holistic approach in the social aspects. It may describe itself as a guide to social or regional crisis and its prospective solution in order to 1) thematic and prospective outline of natural hazards with special reference to flooding hazards, 2) Social aspects and its driving force lead to life style system analysis, 3) Probable damage with respect to natural hazards without taking any action, 4) Recommended outline perspective to flooding hazards mitigation and adaptation approach, 5) Expected outcome using recommended outline. However, it is more interesting and potential research points that, people perception and indigenous coping technique. In addition, human psychology and pragmatic experience act as critical parameter to build up adaptive capacity step by step including 1) Tension growing, 2) Mental setup and coping mechanism, 3) Adaptive capacity build up, 4) Food crisis and diseases, 5) Recovery stage. It is drawn to recommended economic loss with respective hazards from upcoming to recovery stage. Future research will be helpful to project implementation and policy making."

The Proper management and direction approach helps to reduce damage rate in any hazard prone area. Flood risk management has been categorized in two types whereas existing flood risk management and another including planning system. It may decrease flood risk [33]. The early warning system, emergency planning and public education facilitate to reduce health impacts [34]. It is clear that the health risk associated with flood hazards depends on number of people that it affects [17]. However, in some cases "RAKIB®FHAM" theoretical guideline would be very much effective to save life and properties. This outline implies to integrated flood management approach whereas it indicated to upcoming stage to recovery stage (Fig. 4). The multi-approach management strategy is divided into several steps including extreme condition along with recommended outline depending on situational status. The Bangladesh government has been taken some initiatives to change flood risk management strategy from structural to both structural and non-structural. It would be significant to flood risk management in the country [3]. Government and Non-government organization has been made some valuable efforts to control the situational cause of pre and post disaster in the community. If any cases, government should take some steps to revise the governance strategy and policy on the priority basis emergency management. It may include root cause and damage function evaluation, access to local people and their views in the managerial body whereas it would be strengthen along with the institutional capacity.

Table 2. Adaptation indicator to flood vulnerability in relation to age classes

Adaptation indicator to flood vulnerability (%)	15-30 (Age)	30-45 (Age)	45-60 (Age)	> 60 (Age)
Mental stability	16	21	26	37
Mental stress to forthcoming flood	14	18	32	36
Confident level	13	20	28	39
Adaptive strength	13	18	41	28
Adaptive capacity	17	24	43	16
Experience level	8	19	28	45
Knowledge shearing attitude	11	20	25	44
Predictability	12	15	32	41
Coping experience	9	16	33	42
Anxiety to property loss	10	19	35	36
Risk realization ability	11	23	32	34

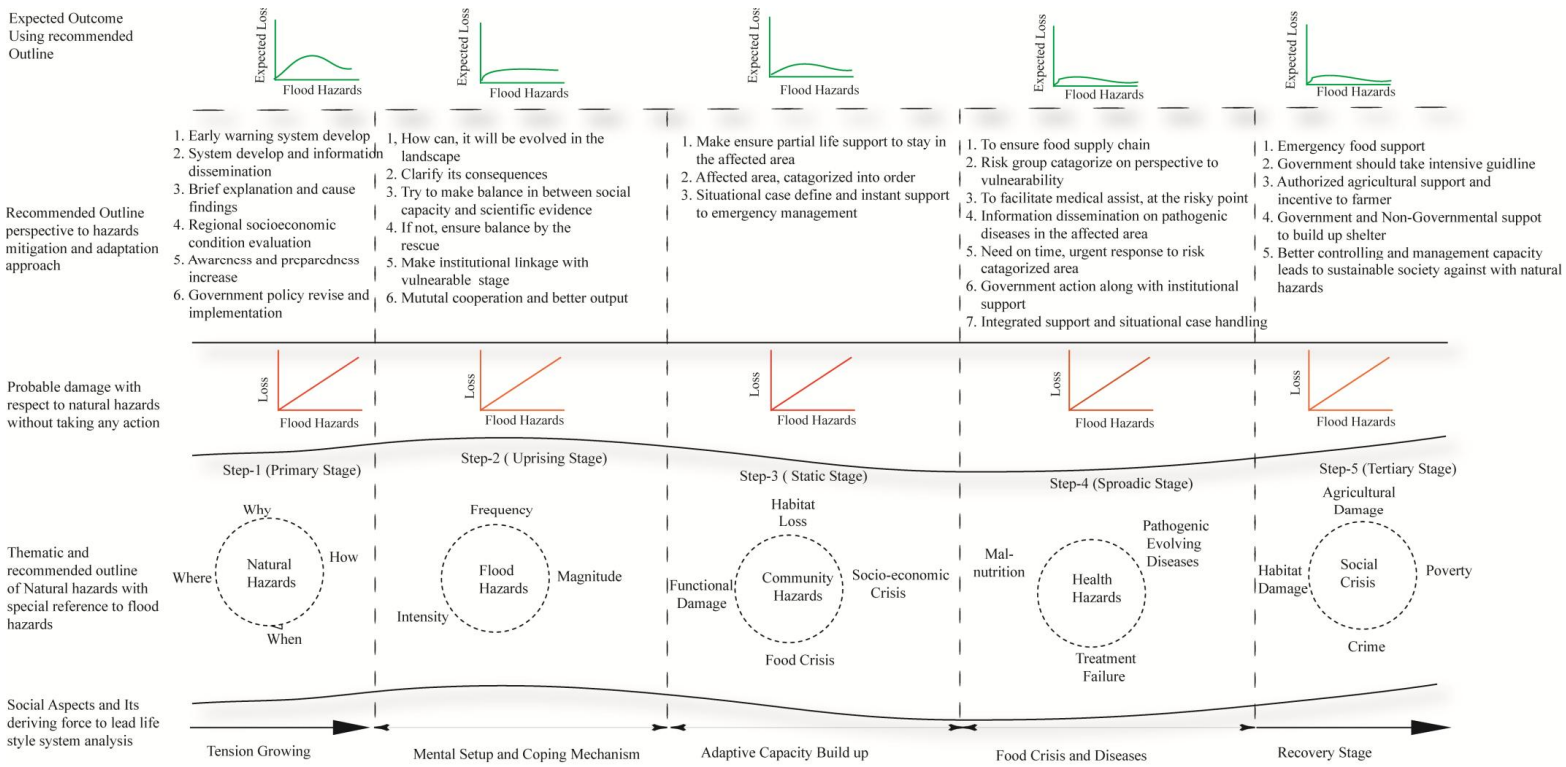

Fig. 4. Thematic guideline (RAKIB®FHAM theoretical model) of mitigation and adaption approach to flooding hazards. [step-1 (tension growing): it is indicated to the upcoming stage of natural hazards whereas denoted the primary cause of natural hazards along with recommended outline; step-2(mental set up and coping mechanism): denoted the uprising stage, it is pointed out flood frequency, magnitude and intensity along with recommended outline to coping capacity build up at the local scale; step-3 (adaptive capacity build up): it signify the community hazards, it is indicated to the habitation problem, functional damage, socioeconomic and food crisis along with its future recommendation to adaptive capacity build up in society; step-4 (food crisis and diseases): it is indicated to health hazards, it specify the malnutrition, pathogenic evolving diseases and treatment failure along with its recommended outline to reduce unexpected death; step-5 (recovery stage): it is indicated to social crisis, be a sign of agricultural damage, poverty, crime and habitat loss and along with its suggested guideline to recovery social crisis

4. CONCLUSION

Flooding hazards and its long term negative consequences implies to social component on the way to rural development. Most of the peoples were observed who are victimized in the aspect of social, economical and cultural due to unexpected natural events. However, the long term climatic hazards feedback force to family and social crisis in a community. Consecutively, it may attribute to change normal livelihood pattern and daily life style along with food chain sustainability. Local views are revealed that, concept on environment and climatic variables were varied from person to person owing to educational qualification and age. Results showed that, flood frequency and its damage rate negatively impacted on mental health. In addition, a theoretical outline is drawn which could be effective to control the situational flood risk in a society. However, it would be helpful to find out the several causes associated with flood risk from upcoming to recovery stage. On the emergency and priority basis, theoretical guideline may assist to policy making against with adverse environmental crisis. It may implies to integrated flood risk management approach whereas it is included both primary to recovery stage.

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COMPETING INTERESTS

All authors have declared that no competing interest exist

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