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Factors and actors for enhancing community flood resilience: An experience from a river-side settlement in Bangladesh

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Abstract

Purpose – Enhancing community flood resilience is a critical aspect of flood risk management that requires a systematic process of capacity building through incorporating mitigation measures. The inhabitants of South Rishipara, a riverside settlement of Bangladesh, are accommodating themselves in a flood-prone location through modifying their built environment. The purpose of this study is to conduct a detailed investigation regarding the built environment development and find out roles of different actors and contributing factors for enhancing community flood resilience.

Design/methodology/approach – This case study-based post-positivist research uses multiple lines of inquiries, which include focus group discussions, transect walks, in-depth semi-structured interviews, pair-wise comparisons and a questionnaire survey, mostly in a participatory appraisal manner to obtain data about community experiences and perceptions.

Findings – About 66.7 per cent of respondents identified themselves as severely affected by flood before the recent development with increased elevation of land, flood protection walls, reclaimed land from the river, underground drainage system, a new layout of plots and houses of better quality. In the post-development situation, not a single respondent identified him/ her in that condition. "Coordination and cooperation among GOs, NGOs and donor agency" (GO: governmental organization; NGO: nongovernmental organization) and "awareness about the flood vulnerability" were identified as key factors and the NGO was identified as the key actor for enhancing community flood resilience by the survey participants.

Originality/value – This research, through exploring the nuanced relationship between built environment development and community resilience, will contribute to address uncertainties associated with community capacities to respond to risks.

Keywords Resilience, NGO, Capacity, Flooding, Disaster mitigation, Built environment

Paper type Research paper

Background

"Resilience", more specifically "community flood resilience", is the key theme of this research. In general, resilience is identified as a system's capacity to adapt or respond to singular, unique and most often radically surprising events (Kuhlicke, 2013). Resilience for a community as a social unit is the ability to take collective actions to remedy the impacts of any kind of problem or adverse condition, including the ability to interpret the environment, intervene and move on (Pfefferbaum *et al.*, 2005).

Many scholars, including Schelfaut *et al.* (2011), Coles and Buckle (2004) and Godschalk (2003), define natural hazards or disasters as problems or adverse conditions for which the

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community needs to enhance resilience. Coles and Buckle (2004) argue community resilience as the combination of a community's capacities, skills and knowledge that allows it to participate fully in recovery from disasters. Godschalk (2003) identifies it as a sustainable network of physical systems and human communities that is capable of managing extreme events such as disasters in an urban system, and because of having community resilience, during any disaster, both physical systems and human communities must be able to survive and function. This physical system includes built environment, which is the human-made space for accommodating every daily activity (Roof and Oleru, 2008). In this built environment, human beings develop ecological relationship with the surroundings, and they must live with a variety of natural hazards which threaten their lives and properties (Alam, 2000).

The term "hazard" captures the notion that, to some extent, people co-exist with powerful natural and man-made processes; there is a probability that the variation in these processes will produce extreme events which have very negative consequences (Burton *et al.*, 1993; Cutter, 2001). A hazard turns into a disaster when a vulnerable community is severely affected by it and cannot recover without external assistance (Shaw *et al.*, 2013). Community resilience and community vulnerability are inversely related. Geis (2000) ideally defines a disaster-resilient or disaster-resistant community as the safest possible community that we have knowledge to design and build in a natural hazard context through minimizing its vulnerabilities. A flood-resilient built environment mainly involves reducing exposure of buildings and infrastructures to floods and minimizing their vulnerabilities through incorporating proper structural and non-structural mitigation measures. Schelfaunt and colleagues (2011) indicate that for enhancing resilience, it is necessary to know communities' risk perception, which implies how individuals perceive any risk. A community, living with a condition of experiencing disasters, obviously perceives risks and develops a sense of resilience through practicing some ways to deal with disasters according to its capacities. Along with evaluating the functional aspects of resilience (i.e. actors and capacities) (Kuhlicke, 2013), the mentality/outlook of a community and individual community members' behavior and mindset (Kuhlicke, 2013; Luthar and Cicchetti, 2000) are needed to be considered to discover community perceptions of resilience. The lived experiences of people in a place provide an embodied context for perceptions of change in and of the environment (Casey, 2009). Flood, as an unpredicted incident, and any kind of development for mitigating adversities provide a context to a community to construct perceptions of future flood risks and resilience.

Adaptation, a common term in disaster-based literature, is considered as an effective strategy for reducing disaster risks. UNISDR (2009) provides a more elaborated definition where adaptation is identified as an adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects and helps to lessen the adverse impacts of that climatic stimuli. In short, adaptation is the process of achieving community resilience, which can be enhanced in various ways. The spontaneous adjustment in everyday practice conducted by local people using their local knowledge is termed as responsive adaptation, and the planned intervention that aims to improve people's lives is termed as anticipated adaptation (Tanner and Mitchell, 2008). The usual distinction between responsive and anticipated adaptation lacks the idea of incorporating adaptation into development, as the popular discourses of development always round about economic growth, which is focused toward poverty reduction, not enhancing community resilience in a disaster context. But, the "development"' as an external actor's intervention possess possibilities to make adaptation for achieving resilience. Nongovernmental organizations (NGOs), governmental organizations (GOs) and donors, as a part of their development policies, conduct development activities (as planned interventions) that might contribute to develop adaptive capacities (or community

resilience) among vulnerable communities. As the consequences of any planned intervention are not always easy to predict accurately, these interventions might introduce several risks of new kinds (Cannon and Muller-Mahn, 2010). Planned interventions usually come as a form of anticipated adaptation for enhancing community resilience, and it is very rational to discover the community perception about impacts of adaptation process (both anticipated and responsive) and roles of different actors for enhancing community resilience. Here, "role" is identified as designated duties, responsibilities and activities of each contributing actor.

River-side settlements in Bangladesh are always at risk of flood, and the risk is increasing because of climate change impacts (Huong and Pathirana, 2011; Krysanova *et al.*, 2008). Because of economic constraints, the poor population is usually forced to find their accommodations in underserved, vulnerable and hazardous locations of urban areas, and low-lying river edges usually fall in such category of land. Securing shelters is a major challenge for the urban poor in Bangladesh, and they often end up in illegal or legal settlements on precarious lands with major environmental concerns (World Bank, 2007). It is primarily reflected on neighborhood with poor housing and poor infrastructural supports. In the same way, river-side urban poor settlements hold a high chance of experiencing floods as disasters. This research focuses on a river-side urban poor settlement in Bangladesh, which is known as South Rishipara slum. The settlement went through a process of modification of its built environment because of a development project, managed by an NGO.

South Rishipara slum belongs to Bhairab Municipality of Kishoreganj district in Bangladesh (Figure 1). The most identifiable feature of South Rishipara slum is its power distribution tower, as it is settled around that tower (Figure 2). Geographically, the area is almost surrounded by natural water channels on its four sides. It accommodates 205 homesteads in its 1.15 acres of land area (Field survey, 2016; Figure 3).

This research will identify the impacts of development activities (built environment modification) on community flood resilience and factors for enhancing community flood resilience with a focus on discovering roles of different actors involved in development activities. Boon (2014) conducted similar kind of studies in the context of rural Australia, where community perceptions were explored to identify factors which support to enhance community flood resilience, and Brilly and Polic (2005) studied a Slovenian town to explore public perceptions of flood risks, forecasting and mitigation measures.

Through exploring a slum in Bangladesh, the current research will contribute to the concept that explains vulnerability as the exposure to hazards and the "sensitivity to multiple drivers of change, as well as the capacity to adapt to change" (Nelson *et al.*, 2010, p. 14). It will improve decision-makers' understanding about roles of different actors for enhancing community resilience, enabling the creation of local plans which address uncertainties associated with community capacities to respond to risks. The knowledge will be applicable to any geographical location where marginalized communities are suffering from natural hazards, as well as socio-economic constrains, and seeking external supports from organizations like NGOs.

Research methodology

This post-positivist research used multiple lines of inquiries, which include focus group discussions, transect walks, in-depth semi-structured group interviews, pair-wise comparison and a questionnaire survey, mostly in a participatory appraisal manner to obtain data about community experiences and perceptions. During the first phase of data collection in 2013, through an introductory meeting, research participants were recruited to form well-represented four groups of 12-15 adults from the community to conduct focus group discussion and interview sessions. The pair-wise comparison[1] and questionnaire survey were conducted in 2016. With a target of getting at least 50 participants for the comparison session, this research managed to get

Figure 1.
Map of Bangladesh showing location of Bhairab (© Google Maps)

Figure 2.
A view of South Rishipara slum (field survey, 2013)

53 participants. The sample size and selecting samples for the questionnaire survey is explained later. Qualitative data were analyzed using content analysis method, and quantitative data were analyzed using Microsoft Excel. The detail research design, along with intended outcome from each level, is shown in Table I.

Figure 3.
Plan of the existing condition of the settlement, prepared by the first author using AutoCADD, based on physical survey data (field survey, 2016)

Historical development of South Rishipara

The exercise of historical timeline preparation, resulting from the focus group discussion and transact walk sessions (Table I), conveyed the information that first settlers of South Rishipara used to live on the site of the current office building of Bhairab Municipality. In 1962, when it was decided to build the municipality building on its present location, the settlers were evicted without providing any kind of rehabilitation. The evicted families found the current location as a neglected waste-dumping ground of the Bhairab Bazar market area and started to live there. The area was nothing but a *char* (island) of the river Meghna, and its original owner eventually donated the land to four members of the settlers with a condition that maximum 28 families can reside there. Since then, 28 *Rishi*[2] families started to live at the current location of South Rishipara slum. As all of them belong to *Rishi* clan, and the area is to the south of existing North Rishipara, the new settlement area started to be recognized as South Rishipara. In addition, 58 *Rishi* families of the settlement legally own about 40 per cent of the total settlement area. Another 20 per cent of land area belongs to the Power Distribution Board, and this area is enclosed with a high wall. But some *Rishi* families live within that boundary wall. Rest of the land is owned by the Bangladesh Inland Water Transport Authority (BIWTA), and this land was leased for 99 years to the settlers at a rate of US$0.09 per square feet per year in 1984 (Field survey, 2013) as a part of their regular program.

The participants conveyed the information that a major development project had been conducted here from 2006 to 2009, which resulted in several modifications in the built environment. The project was primarily run by CARE Bangladesh[3], an international NGO (INGO) under their SHOUHARDO (strengthening household ability to respond to development opportunities) Program[4]. CARE ran its SHOUHARDO Program with a strategic objective of disaster preparedness along with other three objectives (CARE, 2015). The SHOUHARDO Program was funded through USAID's Food for Peace Title II program, operating from October 2004 to May 2010. In 2006, the CARE Bangladesh chose South Rishipara for implementing their project on disaster preparedness after identifying it as vulnerable to flood. The local authority was informed about it, and as they were sympathetic to the issue, they allowed CARE to run their program in the slum. Under the SHOUHARDO

Step	Tools	Group/ individual household	No. of conduction	No. of participants (adult)	Task and outcomes
1	Introductory meeting	Group	1	Open	Explaining research aim and objectives Recruiting research participants
2	Focus group discussion and transact walk	Group	4	12-15 participants each time	Preparing historical timeline of the settlement, considering major changes in the built environment Identifying flood risks and reasons for risks Identifying attempts for reducing flood risks
3	In-depth semi-structured group interviews	Group	4	12-15 participants each time	Preparing list of actors and their roles for site and house modification (Tables II and III) Identifying various levels of resilience
4	Pair-wise comparison	Group	1	53	Comparing actors based on significance of their contributions Comparing factors of enhancing community flood resilience based on their significance
5	Questionnaire survey	Individual household	1	65	Identifying resilience level before and after the major development

Table I.
List of data collected tools with intended outcomes

Program, in the 2006-2007 financial year, CARE Bangladesh took a project of building a protection wall or embankment along the river-side, along with other relevant infrastructures. The project was named as "Homestead Protection Wall Building Project". This project was jointly financed by USAID[5] and Bhairab Municipality. The major features of this site modification projects were as follows:

- *Increased elevation of land*: At first, the elevation of land was increased to make the land permanently free from riverine flood. The whole site was raised up to 14 ft (4.27 m) from its original level through dumping sand and wastes.
- *Protection wall*: A 2-ft-thick (60.96 cm) reinforced concrete wall was built as a protection wall around the land area, which protects the settlement from riverine flood and bank erosion. This wall contains outlets to drain out rainwater and wastewater through an underground drainage system.
- *Reclaimed land from river*: More than 20 per cent of current land area was reclaimed from the river-bed while building the protection wall. This additional land helped to provide spaces for access lanes and community facilities.
- *Underground drainage system*: Except the area within the protection wall of power distribution tower, an underground drainage network was laid out to drain out the waste water and rainwater.
- *New layout of plots*: Except the area within the protection wall of power distribution tower, the whole area was realigned with plots, accessed by internal lanes.

Development for reducing flood risks

Because of the natural water channels on four sides of the slum, increased monsoon water and rain-fall, river bank erosion and low land elevation, the area was naturally prone to flood. The participants conveyed the idea that the community is aware of their problems and challenges related to flood incidents, which is mainly associated with the flood water level. At the extreme condition, they had to evacuate and seek shelters in somewhere else. It was also required to repair or rebuild their damaged houses, knowing that the houses might be damaged again in next year. Their whole life and livelihood used to disrupt regularly. The participants identified four reasons for their flood vulnerability, i.e. natural causes, organizational failure, infrastructural limitations and household's limitations (Figure 4). The organizational failure was identified as the unawareness and negligence of GOs and NGOs, which did not let them to initiate any project for mitigating flood adversities of this settlement. The area was even deprived of all services, such as drainage, sanitation, water supply, power supply and roads and lanes. Poor quality of houses due to financial constraints of individual household is also a prime issue for infrastructural limitation. The participants identified two types of modifications that contributed to reduce the flood risk: site modification and individual house modification.

Site modifications

The major site modification, which was conducted under the project, has been described in the previous section.

Individual house modification

Individual houses are very important components of a built environment. Building materials, construction technologies and designs of houses can be altered to make individual houses resilient to any natural hazard. A house which can be used during and after a flood condition is considered as a flood-resilient house. Floodwater can submerge buildings and cause various degree of damage from staining of walls or structural collapse depending on flood water depth and/or flood duration and type of structure (Ahmed, 2005). The local people of South Rishipara slum used to experience severe damage of their houses because of floods (Field survey, 2013). Since 2009, the area had not been inundated because of riverine flood, and after having the protection wall and new plot arrangement, aligned with access lanes, everyone started to improve the quality of their houses (Field survey, 2013). The assurance of not being damaged by floods encouraged individual households to invest in

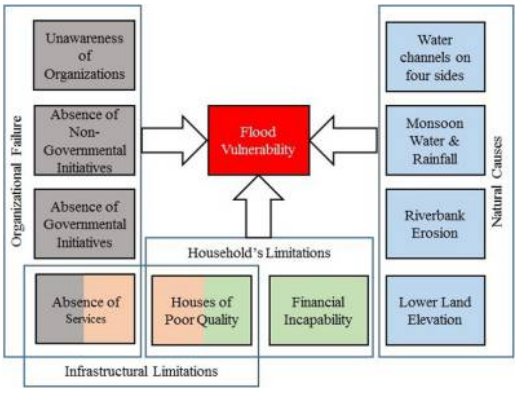

Figure 4.
Reasons for flood vulnerability (field survey, 2013)

building houses of better quality. Moreover, a parallel micro-credit program, run by the municipality by using funds from the Asian Development Bank (ADB), contributed to strengthen their financial capacity and made them able to invest.

Roles of actors for site and house modification

Along with local people, other organizations were, directly and indirectly, involved in the built environment development of South Rishipara slum. Among various kinds of organizations, there were GOs, NGOs, INGOs and donor agencies. Land for development, protection wall, increased elevation of land, underground drainage system and better houses were identified as main contributing factors for developing the built environment. Based on information collected during the in-depth semi-structured interview, Table II is prepared to categorize roles of different actors for the factors of built environment development. As the local people identified micro-credit as another contributing factor, it was considered along with other five factors of built environment development.

Besides the local people, the municipality as the GO, CARE Bangladesh as the INGO and USAID and ABD as donors or funding agencies contributed to develop the built environment. Table III shows the specific roles of different actors for different development activities. For each development activity, four types of roles were identified:

(1) decision-making;
(2) technological and professional contribution;
(3) financial contribution; and
(4) physical labor.

The roles of different actors are collected against these types. The nature of actors is also mentioned in the last column of Table III.

A pair-wise comparison (Table IV) was conducted to rank actors based on the significance level of their contributions. There are five actors:

(1) Bhairab Municipality (GO)
(2) CARE Bangladesh (INGO)
(3) USAID (Donor Agency)
(4) ADB (Funding Agency)
(5) Local people

The participants identified the CARE Bangladesh as the most contributed actor. The second was Bhairab Municipality. USAID and local people equally shared the third position. It means that CARE is the most and ADB is the least contributing actor, according to the participants' opinion.

Comparison between present and past community flood resilience level

The risk perception is inversely connected with the resilience perception. The participants associated their risk perceptions with the possibility of flooding and necessity of evacuating because of severity of flooding incidents in future. The recent changes in the built environment and past flood experiences provided the context for the participants to evaluate their present resilience level through comparing it with their previous resilience level. It was mutually agreed to comprehend the perceived level of resilience through the prediction of future risks. With this concept, the resilience levels were classified into five levels, as follows:

No.	Factors	Impact	Local people	GO	NGO/INGO	Donor
1	Land	Legally secured land for building houses	Donation from a local person	Leased from the BIWTA PDB agreed not to evict Land reclamation project is co-financed by municipality	About 20% of land is reclaimed from the River due to the project, run by CARE	The land reclamation project was co-financed by USAID
2	Protection wall	Protects from riverine flooding and bank erosion	Worked as construction workers	Co-financed by municipality	Decision taken and designed by CARE Bangladesh	Co-financed by USAID
3	Increased land elevation	Whole settlement has been raised up to embankment level to avoid the chance of water logging	Worked as labors	Co-financed by municipality	Decision taken and designed by CARE	Co-financed by USAID
4	Drainage system	Drains out the waste water and rainwater	Worked as construction workers	Co-financed by municipality	Decision taken and designed by CARE	Co-financed by USAID
5	Houses	Houses with higher plinth and more permanent material are considered as safe	Individuals are developing their own houses according to financial ability and local knowledge and skill	×	×	×
6	Micro-credit	Helps to increase the earning which may use for building better houses	×	Municipality-managed micro-credit services	×	ADB provided fund for micro-credit program

Table II.
List of actors and their roles for site and houses modification (Field survey, 2013)

Factors of built environment development	Roles and responsibilities	Actors	Nature of actors
Land (land reclamation)	Decision-making	CARE and municipality	INGO and GO
	Technological and professional contribution	CARE	INGO
	Financial contribution	USAID and municipality	Donor agency and GO
	Physical labor	Local people	Local people
Protection wall	Decision-making	CARE and municipality	INGO and GO
	Technological and professional contribution	CARE	INGO
	Financial contribution	USAID and municipality	Donor agency and GO
	Physical labor	Local people	Local people
Increased land elevation	Decision-making	CARE and municipality	INGO and GO
	Technological and professional contribution	CARE	INGO
	Financial contribution	USAID and municipality	Donor agency and GO
	Physical labor	Local people	Local people
Underground drainage system	Decision-making	CARE and municipality	INGO and GO
	Technological and professional contribution	CARE	INGO
	Financial contribution	USAID and municipality	Donor agency and GO
	Physical labor	Local people	Local people
Houses	Decision-making	Individuals	Local people
	Technological and professional contribution	Local Mason and individuals	Local people
	Financial contribution	Individuals	Local people
	Physical labor	Local people	Local people

Table III.
Specific roles of actors (Field survey, 2013)

List of factors	Municipality	CARE	USAID	ADB	Local people	Score point
Municipality		CARE	Municipality	Municipality	Municipality	3
CARE	CARE		CARE	CARE	CARE	4
USAID	Municipality	CARE		USAID	Tie	1.5
ADB	Municipality	CARE	USAID		Local people	0
Local people	Municipality	CARE	Tie	Local people		1.5

Table IV.
Pair-wise comparison of actors

Source: Field survey, 2016 (number of participants: 53 adults)

(1) Resilient level-04 (no risk of flood in future);
(2) Resilient level-03 (having risk of severe flooding after every 10-20 years);
(3) Resilient level-02 (having risk of severe flooding after every 4-5 years);
(4) Resilient level-01 (having risk of seasonal flooding every year); and
(5) Resilient level-0 (having risk of seasonal flooding every year and will have to evacuate).

A questionnaire survey was conducted to get responses from individual households about their perceived resilience level for two conditions: before and after the development. Though it is a

small settlement, every household's flood experience was not the same in the pre-development condition. The part of the settlement, which is owned by local households, had comparatively higher elevation than other parts of the settlement. As a result, those households occasionally used to face such kind of flood while they had to evacuate from their houses. But, rest of the households had to evacuate almost every year during the monsoonal flooding season. Even in the post-development condition, the area within the boundary wall of power distribution tower did not get any drainage service and internal access lanes. With these conditions, it was clear that the opinions of households may vary based on their previous experiences and future expectations.

A total of 205 families used to live in South Rishipara in 2016. But 11 of them has started to live there after the major built environmental development. These 11 families/households did not have any previous experience of this area. As the survey was conducted to compare present condition with previous condition, 11 new households were not included in this survey. The sample size was calculated as 65 with 95 per cent confidence level and 10 per cent confidence interval. Samples were chosen through proportionate cluster sampling system to ensure proportionate representation of cluster. The population was divided into three clusters:

(1) *Cluster 01*: This includes households who own land (total number, $P_1 = 58$).

(2) *Cluster 02*: This includes households who live on leased land (total number, $P_2 = 111$).

(3) *Cluster 03*: This includes households who have no legal right on land (living within the Power Distribution Board tower's boundary wall) (total number, $P_3 = 25$).

Each household in the population belonged to one and only one cluster.

Here, $N = 3 = n$ (selected clusters)

$P_1{:}P_2{:}P_3 = 58{:}111{:}25 = 19.43{:}37.19{:}8.37$ or 20:37:8

So, $n_1 = 20, n_2 = 37, n_3 = 8$;

Samples were chosen using a simple random sampling method from each cluster.

Figure 5 shows that about 66.7 per cent of respondents identified themselves at resilience level 0 before the development. It means they had to evacuate during the flooding period and take shelter somewhere else. In the post-development situation, not a single respondent identified him/her at resilience level 0. More than half of the respondents identified themselves at resilience level 03; it means that they did not expect to be a victim of severe flooding within next 10 years. A small portion of participants predicted to suffer from yearly flooding, even in post-development condition. But, overall, the result denotes an enhancement in the perceived level of community flood resilience.

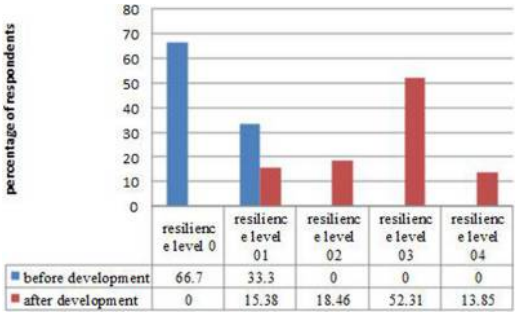

Figure 5.
Resilience level before and after development (field survey, 2016)

Key factors for enhancing community flood resilience through built environment development

From focus group discussions and group interviews, following factors that acted present to enhance the perceived level of community flood resilience were identified: coordination and cooperation among GO, INGO and donor agency; awareness about the risk of flood; protection wall; underground drainage system; elevated land; better houses; lanes and roads; and financial support through micro-credit program. Another pair-wise comparison (Table V) was conducted to rank these factors according to their perceived level of significance for enhancing community flood resilience. The factors "coordination and cooperation among GO, INGO and donor agency" and "awareness about the risk of flood" were identified as the most significant factors.

Reasons of success

In case of enhancing community resilience, the first question arises: who holds the ultimate responsibility for it? This question leads to find out roles of different actors. Godschalk and colleagues (1999) uncover many different views about who is or might be responsible. Many beliefs strongly support the idea of shared responsibility among many groups and actors, including government agencies and regulators (at a number of jurisdiction levels); private sector (i.e. building owners, corporations and merchants); professionals (i.e. architects, engineers); non-governmental agencies; and individuals (citizens, consumers, home-owners, etc.). On the other hand, some beliefs take it as special responsibilities and even some beliefs put greater emphasis on personal responsibility (Godschalk *et al.*, 1999; Berke and Beatley, 1992). It is true that personal responsibility of local people helps to build a resilient community. But, there are clear limitations of individual responsibility for certain scenarios. People are more vulnerable if they are more likely to be badly affected by events, beyond their control. In the case of South Rishipara, the community used to struggle with flood, and its condition was not improving until CARE Bangladesh came with a specific project and sufficient fund to implement that project. The reasons for success of the whole process of enhancing community flood resilience through developing built environment are identified as follows.

Partnership

In the list of factors of built environment development, "coordination and cooperation among GO, INGO and donor agency" and "awareness about the risk of flood" were identified as significant factors for enhancing community flood resilience. In the recent era of development, the exploration of partnership among GO, NGO (INGO) and donor is growing at a fast pace, and increasing examples are noted, particularly at the level of local government (Brinkerhoff, 2003). Donor-funded partnership offers much promise in supporting the contributions and improving the relationship between GOs and NGOs. It is increasingly recognized that NGOs can fill gaps in inefficient, ineffective and challenged areas of public services. NGOs' participation is deemed necessary to project objectives because of their ability to reach into the community and particularly to target groups and regions that can be politically and socially difficult. In this case, the municipality acknowledged and facilitated the project of CARE Bangladesh. This nature of the partnership, where multiple actors were involved, illustrated that donors can make meaningful contributions to improving partnership-like relationships between local GOs and NGOs.

Awareness

Awareness of potential risks is the first step for any disaster management activity. The risk is conceptualized broadly as the potential for comprehending unwanted, negative

List of factors	Coordination and cooperation	Awareness	Protection wall	Drainage system	Elevated land	Better houses	Lanes and roads	Micro-credit	Score point
Coordination and cooperation		Tie	Coordination and cooperation	Coordination and cooperation	Coordination and cooperation	Coordination and cooperation	Coordination and cooperation	Coordination and cooperation	6.5
Awareness	Tie		Awareness	Awareness	Awareness	Awareness	Awareness	Awareness	6.5
Protection wall	Coordination and cooperation	Awareness		Tie	Protection wall	Protection wall	Protection wall	Protection wall	4.5
Drainage system	Coordination and cooperation	Awareness	Tie		Elevated land	Drainage system	Drainage system	Drainage system	3.5
Elevated land	Coordination and cooperation	Awareness	Protection wall	Elevated land		Elevated land	Elevated land	Elevated land	4.0
Better houses	Coordination and cooperation	Awareness	Protection wall	Drainage system	Elevated land		Better houses	Micro-credit	1.0
Lanes and roads	Coordination and cooperation	Awareness	Protection wall	Drainage system	Elevated land	Better houses		Micro-credit	0
Micro-credit	Coordination and cooperation	Awareness	Protection wall	Drainage system	Elevated land	Micro-credit	Micro-credit		2

Source: Field survey, 2016 (number of participants: 53 adults)

Table V.
Pair-wise comparison of items for built environment development

consequences of an event (Rowe, 1977). A disaster management project should be started with a risk assessment and risk analysis, which are aimed at identifying, measuring, characterizing and evaluating the outcomes, resulting from any kind of hazard (Tierney, 1999; Mitchell, 1990; Crouch and Wilson, 1982; Lawrance, 1976). In the case of South Rishipara, local people were aware of flood risks as they had to experience it every year. The SHOUHARDO Program of CARE Bangladesh identified this location for implementing their project after having their own analysis and study, and the local authority was informed and sympathetic to the issue.

Adaptation

Adaptation, the continuous process of changing status to live with risks or threats, is classified into two types: anticipated and responsive (Tanner and Mitchell, 2008). As means of anticipated adaptation, a protection wall and underground drainage system were introduced, expecting their effectivity to keep the slum area free from any kind of inundation. Local people expressed their satisfaction with the performance of these major structural components of the built environment development project. The protection wall also helped to reclaim lands from the river, increase the land elevation and prevent the chance of overflowing the banks. Though a protection wall may have negative impacts on the natural flow of water, in this case, to keep the settlement free from inundation, the protection wall has been proven as a well-accepted solution to address the major problem. The chance of water logging because of heavy rainfall was avoided through providing an underground drainage system. These two major components of built environment have changed the built environment significantly. Without external assistance, it was not possible for local people to have this kind of anticipated adaptation with structural interventions.

Improving the condition of individual houses can be identified as a mean of responsive adaptation. Though better houses enhance the level of resilience, it gets less priority than others. There are some preconditions to invest for building better houses. As the area was prone to be flooded, local people were more reluctant to invest in building better houses, which might be damaged easily because of floods. The structural components of flood control have encouraged the local people to invest more in building houses of better quality. The micro-credit program for supporting income was identified as more significant than better houses, as an increase in income is also a pre-condition for building houses of better quality. Without any external assistance, the local people are continuously improving the quality of their dwelling units, as they have the expectation for it.

Filling capacity gap

Success was achieved because of the enhancement of capacities or filling the capacity gap. According to UNISDR (2009), capacity is the combination of all strengths, attributes and resources available within a community, society or an organization that can be used to achieve agreed goals, and those can exist in forms of infrastructure and physical means, institutions, societal coping abilities, human knowledge, skills and collective attributes such as social relationships, leadership and management. Capacities which are necessary for effective disaster risk reduction in general could be represented through comprising a society with organizations that particularly deal with disaster issues, well-developed disaster plans and preparedness, coping mechanisms, adaptive strategies, memory of past disasters, good governance, ethical standards, local leadership, physical capital and resilient buildings and infrastructures (Benson *et al.*, 2007). These all were present in the case of South Rishipara. The capacities of South Rishipara for enhancing community flood resilience are listed below:

- awareness of the potential risk of flood;

- organizations and authorities for good governance;
- risk assessment and analysis by organizations;
- skills and knowledge for enhancing resilience;
- a plan and project with clear goal and strategy;
- ability for implementing the project;
- cooperation and coordination among all partners;
- appropriate infrastructures; and
- availability of financial and all other kinds of resources.

Conclusion

This research intends to find out the association of built environment development activities with community flood resilience. A resilient built environment demands to reduce exposure of buildings and infrastructures to hazards and minimize their vulnerabilities through adapting proper structural measures. According to UNDP (2004), disasters are not the necessary result of hazards but occur only when these hazards intersect with the built environment, particularly, poorly located and poorly constructed infrastructures. The slum of South Rishipara was a similar kind of settlement before the recent adaptation of anticipated and responsive measures. The donor-funded GO-NGO-community partnership project, as a successful approach, has made some positive impacts on community flood resilience of the settlement. The existing reasons of vulnerabilities (Figure 4) were addressed at different levels, engaging different partners, and all partners enjoyed a shared opportunity to play their respective roles. Partnerships with other actors are usually pursued precisely, because these actors have something unique to offer, e.g. resources, knowledge, skills, relationships and consent (Brinkerhoff, 2003). In this case, an NGO adopted the partnership approach and initiated a development project, where the "development" was purposeful in the sense that its goal directly improved people's lives and its multiple components were carried out by multiple actors who have this as their principal goal. It cannot be claimed that the people of South Rishipara became totally resilient to any kind of climatic adversity, but the process of enhancing community flood resilience can be idealized as a replicable example.

Notes

1. The pair-wise comparison asks participants to vote on the relative significance of individual items. The comparison is the one with the most votes, and each win is worth 1 point. Each tie is worth ½ point.
2. Rishi is a clan of Hindu society in Bangladesh. Traditionally, people of this clan get involve into professions such as shoe-making and broom-making. Usually, they are identified as people of lower strata according to the traditional cast system.
3. CARE Bangladesh is a leading humanitarian organization fighting global poverty.
4. SHOUHARDO Program aimed to sustainably reduce chronic and transitory food insecurity of vulnerable households in 18 districts of Bangladesh by 2009.
5. *USAID* is the government agency providing US economic and humanitarian assistance worldwide for more than 40 years.

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Further reading

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