

ORIGINAL ARTICLE

External intervention and responsive adaptation by the community: Experiences of improving house quality in an urban slum

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Abstract

Non-governmental organizations (NGOs), governmental organizations, or other entities may run their projects as external interventions within a community to reduce disaster risks and adapt to future climatic events. These external interventions may influence the community to take further adaptation measures for enhancing community resilience. The spontaneous adaptation process, referring as responsive adaptation, needs to be identified and acknowledged. This research aims to investigate the impacts of external interventions on the responsive adaptation process by studying a riverside flood-prone urban slum in Bangladesh. This settlement experienced a site development project, primarily run by an NGO, that allowed several modifications to the built environment, mainly targeting flood risks. Selected tools of participatory rural appraisal (PRA) or participatory urban appraisal (PUA) methods were employed to obtain data about the community's initiatives for further development. The results show that the site development project, especially its impacts on reducing flood risks, has influenced community members to invest in improving the condition of their individual houses. As a means of responsive adaptation, the conscious developments of their houses contribute to enhancing the resilience level. Through exploring the community's initiatives, this research identifies that the engagement of communities with their knowledge and investments can extend the success of the external intervention.

KEYWORDS

community resilience, external intervention, flood, NGO, responsive adaptation, urban slum

1 | INTRODUCTION

Enhancing community resilience has become the global development agenda (Chowdhoree & Islam, 2018; Rashid & Khan, 2013; Schelfaut et al., 2011) where development strategies and activities are intended to enable

communities to deal with uncertainties, considering the political and ecological constraints (Chowdhoree, 2020). The term is more popular in the disaster context (Borrero et al., 2013; Chowdhoree, 2020; Chowdhoree et al., 2022; Norris et al., 2008; Schelfaut et al., 2011) where it is often identified as the collaborative ability to

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resist, absorb, accommodate, and recover from the effects of disasters in a timely and efficient manner (Chowdhoree & Islam, 2018; Coles & Buckle, 2004; Schelfaut et al., 2011; UNISDR, 2009).

Enhancing community resilience is usually termed as “adaptation” (Chowdhoree & Islam, 2018; UNFCC, 2019; UNISDR, 2009) which allows practicing mitigation measures for reducing risks. It is the adjustment of different systems in response to uncertain events like disasters (UNISDR, 2009). A community can be resilient to any particular hazard if adaptation to that hazard is practiced through introducing changes and developing capacities or abilities (Chowdhoree, 2019). In this way, in the disaster context, “development” is associated with “adaptation”, and “development” should target to improve people's lives considering the uncertainties of disasters (Cannon & Muller-Mahn, 2010; Chowdhoree, 2020; Chowdhoree et al., 2022).

A community is not always in a condition to introduce changes or develop the capacity to solve its own problems, especially with the changing nature of disasters (Chowdhoree, 2020). In that case, various sectors and disciplines of government, the private sector, civil society, non-governmental organizations, community-based organizations, and research and academic institutes get involved as external bodies and collaborate with the community, aiming to conduct some interventions to develop adaptive capacities (or community resilience) among the vulnerable communities (Cahyanto et al., 2021; Cannon & Muller-Mahn, 2010; Chowdhoree et al., 2022).

The development often suggests big changes, not just any change, but a definite improvement, a change for the better (Chowdhoree et al., 2018; Slim, 1995). On the other hand, there can be small changes or refinements that happen incrementally or relatively continuously (Dale et al., 2010). Though “development” is often identified as the efforts of external actors, there are spontaneous efforts made by local communities for addressing their everyday challenges. Considering the scale and involvement of actors, the adaptation process can be classified into two categories: anticipatory adaptation and responsive adaptation (Cannon & Muller-Mahn, 2010; Chowdhoree & Islam, 2018; Mulligan et al., 2017; Tanner & Mitchell, 2008).

Anticipatory adaptation is a planned intervention (Kuruppu & Willie, 2015) that suggests bigger-scale changes, usually introducing structural mitigation measures and involving external actors. These are usually recommended by external experts and fund providers, anticipating the probable success of tackling higher-risk scenarios. But there is always uncertainty about the success of anticipatory adaptation (Cannon &

Muller-Mahn, 2010). On the other hand, responsive adaptation, as the local trend of innovation, is generated from the repeated experiences and available resources of local communities (Chowdhoree, 2020; Chowdhoree & Islam, 2018). The changes made by anticipatory adaptation may also influence the nature and practices of responsive adaptation, and the impacts of anticipatory adaptation may influence the community to take appropriate measures for responsive adaptation.

Non-governmental organizations (NGOs), governmental organizations, research and academic institutes, civil societies, or other entities usually run their projects as external interventions within a community with the aim of reducing disaster risks and adapting to future climatic events (Chowdhoree, 2020). These external organizations are often identified as “bridging institutes” that collaborate with the community (Hahn et al., 2006). Their involvement may result in anticipatory adaptations that may influence the community to take further adaptation measures in its everyday practices to continue the process of enhancing community resilience. As the consequences of anticipatory adaptation may influence the nature of responsive adaptation, it is important to identify the impact of externally supported anticipatory adaptation on the community and especially how the community takes actions for responsive adaptation.

This research studies a riverside flood-prone urban slum in Bangladesh to understand the impacts of anticipatory adaptation on responsive adaptation as local efforts for enhancing community resilience. Informal urban settlements or slums are often located on marginal land within cities or on the periphery because of the lack of alternative locations (UN-HABITAT, 2003; Utzinger & Keiser, 2006). These are also often seen at the riverside, as riverside lands usually belong to the state, and that land can be more easily accessed than private land. Because of their location, riverside slums are usually exposed to hydro-meteorological hazards such as landslides (Nathan, 2008) and floods (Aragon-Durand, 2007; Douglas et al., 2008) and their risk is increasing because of climate change impacts (Mulligan et al., 2017). The representative urban slum, chosen for this study, is known as Dakshin Rishipara. It belongs to the Bhairab municipality of Kishoreganj District. The settlement was primarily settled by some members of the *Rishi* clan on the edge of river Meghna in a flood-vulnerable location. This situation may force riverside settlers to displace from their present location. For this reason, this case of an urban slum is selected to get an idea about its flood vulnerability and the ways of its built environment modification to enhance resilience to flood. Because of its size and location, it was suitable to get detailed qualitative information as well as quantitative data. This case study-based

research uses multiple inquiries, including document review, observation, focus group discussions, oral history collection, transect walks, pair-wise comparisons, and a questionnaire survey, to obtain data about the community's initiatives for improving its built environment conditions. This study has been presented as a part of ongoing research that was initiated as a requirement for the first author's academic degree.¹ Data have been collected at regular intervals because of the easy accessibility and warm cooperation of the community members. This paper has been prepared mostly based on data collected in 2021.

2 | RESEARCH METHOD AND DATA COLLECTION

Conceptually, the current research is focused on identifying the changes in the built environment (from individual houses to site development) that contributed to enhancing the level of community resilience. It was designed as a participatory research project to capture the experiences and understandings of the community. Selected tools of participatory rural appraisal (PRA) or participatory urban appraisal (PUA) methods were employed to examine the interrelationships of community-level initiatives with authority-driven interventions (Abedo, 2000; Moser & McIlwaine, 1999). As tracing the evidence of responsive adaptation requires understanding the community's perspectives, its active participation in the data collection process is necessary. Through a series of semi-structured group interviews and transect walks with the 4–5 adult males and females, the oral history about the development of the settlement was collected. Memory-based information usually transfers orally to descendants without written evidence and often not in an organized manner (Chowdhoree & Das, 2022; Grele, 2007), and the method of oral history collection attempts to capture those data. In the semi-structured group interviews, the comments made by the majority were considered authentic oral information, but the memories of minorities were also considered with equal importance. The oral information collected here was also cross-checked with the information available in the available governmental and non-governmental documents. At the same time, the physical features, including existing houses, were surveyed and documented to get an idea of their building materials and construction methods. Four sessions of focus group discussions with 12–16 adult participants were conducted. It ensured the representation of participants from different parts of the settlement. In the focus group discussion, it was attempted to know the current and previous experiences of flooding and how

the community adapts to the condition. They were also approached to understand their interests in building better houses, considering the flood problem, and a pair-wise comparison was conducted to identify the most influential factors. Finally, a questionnaire survey was conducted to trace the changes in their housing condition.

3 | DAKSHIN RISHIPARA SLUM: PHYSICAL FEATURES

The slum is about 1.15 acres in size and is surrounded by water channels almost on its four sides (Figure 1). The main channel of River Meghna is on the eastern side of the slum, and other small tributaries are flowing on the other three sides. It is like a tip of land that is partially connected with the mainland to its north. There is an electricity distribution tower, and some families live within the boundary wall of that tower. Three types of land tenure were identified during the sessions of oral history collection:

- Privately-own land.
- Lands of the Bangladesh Inland Water Transport Authority (BIWTA) that have been leased to some inhabitants.
- Lands of the Power Distribution Board (PDB) where a tower is built.

In total, 61 *Rishi* families of the settlement legally own about 40% of the land. Some of their ancestors informally established the settlement in its current location in 1962. The area was smaller at that time, and the waste from nearby markets and shops used to be dumped here. As it was established by the members of the *Rishi* clan and was to the south of another neighborhood of the *Rishi* clan, this newly formed slum started to be recognized as Dakshin (South) Rishipara (Neighborhood of *Rishis*), referring to the other one as Uttar (North) Rishipara. After the initial establishment, some other *Rishi* families as well as some Muslim families started to live along the river edge. The lands on the river edge belong to the BIWTA which is a government organization that usually owns the lands along the river. As these homeless families used to live there, the BIWTA authority decided to lease out this land to the settlers in 1984. Almost 40 families are living within the boundary wall of the PDB tower, which cannot be an acceptable condition, and the authority never allows anyone to settle under the tower. The PDB objected to this settlement and attempted to evict them. But, in 2004, after having mediation with the councilor and the Municipality Chairman, the PDB

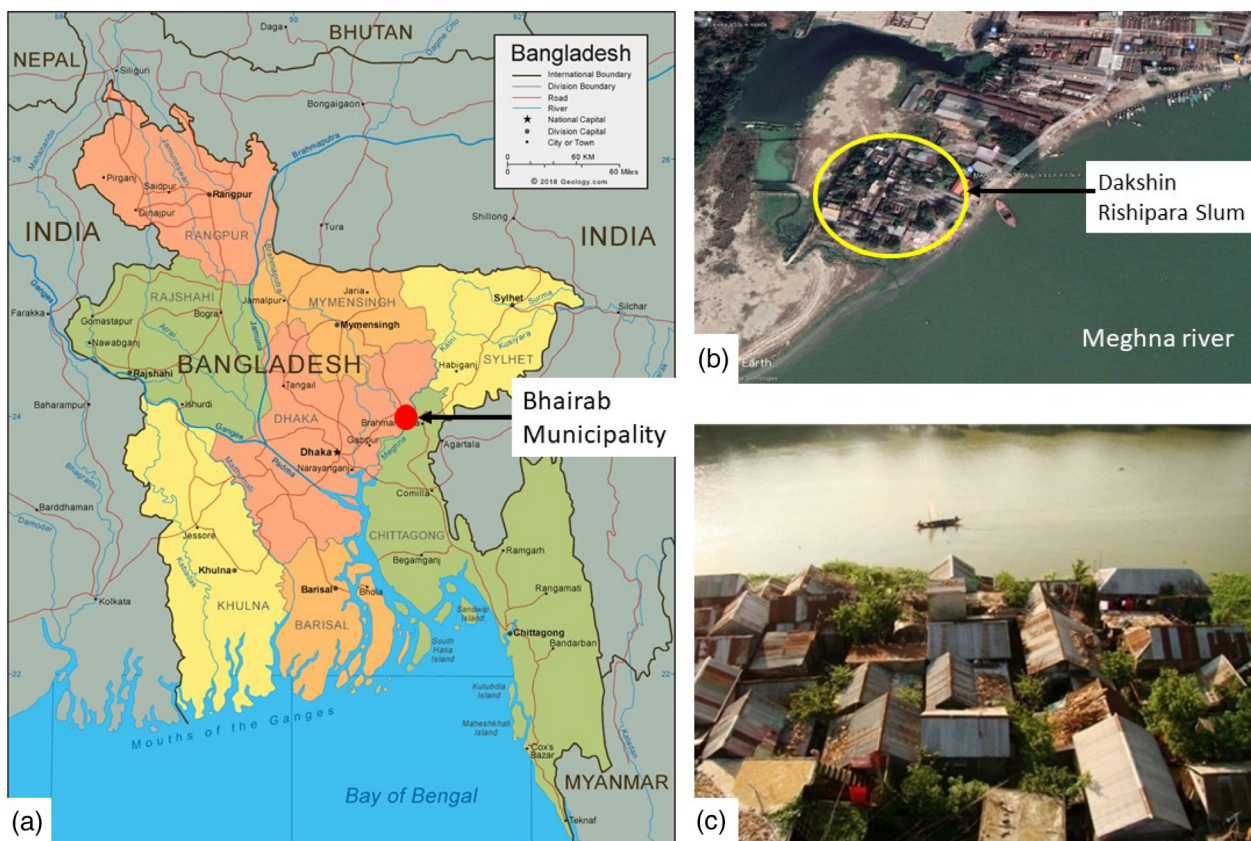


FIGURE 1 (a) The map of Bangladesh shows the location of Bhairab Municipality; (b) The google earth image of Dakshin Rishipara Slum; (c) A view of Dakshin Rishipara Slum.

withdrew their objection and agreed not to evict the settlers from that location.

4 | EXPERIENCES OF FLOOD AND ADAPTATION TO FLOOD

As a riverside settlement, Dakshin Rishipara has the threat of experiencing riverine floods, mainly due to the proximity of water bodies and the possibility of precipitation. During the focus group discussion sessions, the participants conveyed the information that their risk of flood got significantly reduced after the completion of a major site improvement project. This site improvement project was initiated by an NGO in 2006 and fully completed in 2009. The NGO identified this location for implementing one of their regular projects on disaster preparedness and collaborated with the municipality authority and local inhabitants. As a component of the project, the land was elevated up to 2.25 m to avoid the chance of getting inundated by riverine flooding, and almost 20% of its current area was reclaimed from the river by landfilling. A wide reinforced concrete wall was built along the periphery as a

protection wall for eliminating the chance of bank erosion. An underground drainage network was built, and outlets were placed on the protection wall for discharging the storm water into the river. But this drainage facility excluded the area within the electricity distribution tower area as the NGO identified it as a disputed land, and it restrained itself from intervening there. The rest of the area got a new layout of individual plots, aligned along the internal lanes, which ensure easy, and direct access to individual houses. After this modification, every family had to rebuild its house on its newly allocated plot (Figure 2).

Before this site improvement, the site used to experience floods almost every year. At that time, the area was smaller than its current size. There was no protection wall or embankment; the land elevation was lower, and there were no drainage systems, or access lanes. Based on the oral information and transect walk, the condition of that time was attempted to trace on a map, and it is shown in Figure 3.

After the site improvement, sometimes the area experiences waterlogging due to heavy rainfall. But the situation is very different inside the boundary wall of the electricity tower, as this area was excluded from the site



FIGURE 2 Map of Dakshin Rishipara Slum.

improvement project. This part does not have any internal lanes; it even does not have any proper access. It is not possible to make an entryway or any kind of opening in the thick boundary wall. As a result, the area within it, is sealed from the outside and inaccessible in a regular way. At one point of the boundary wall, a ditch or trench is made, so that people can pass under the boundary wall (Figure 4). The lower elevation and lack of a drainage system in this part of the settlement led to rain-waterlogging and house plinth flooding. However, its protected location within a protection wall protects it from riverine floods.

It was observed that the inhabitants, in general, are trying to improve the conditions of their individual houses, so that the houses do not get inundated or damaged due to waterlogging or heavy rainfall. To focus on local efforts, this study attempted to identify house

typologies, trace the change in house conditions or quality, and identify means and reasons for changes.

5 | HOUSE TYPOLOGY

Houses of this slum were surveyed and documented to get an idea about their building materials and construction ways. The advantages and disadvantages of individual types were also identified. In total, seven types of houses (Figure 5) are identified as follows:

- *Type 1:*

Houses of this type are single-story with 152–457 mm high mud plinths, bamboo posts, bamboo mat

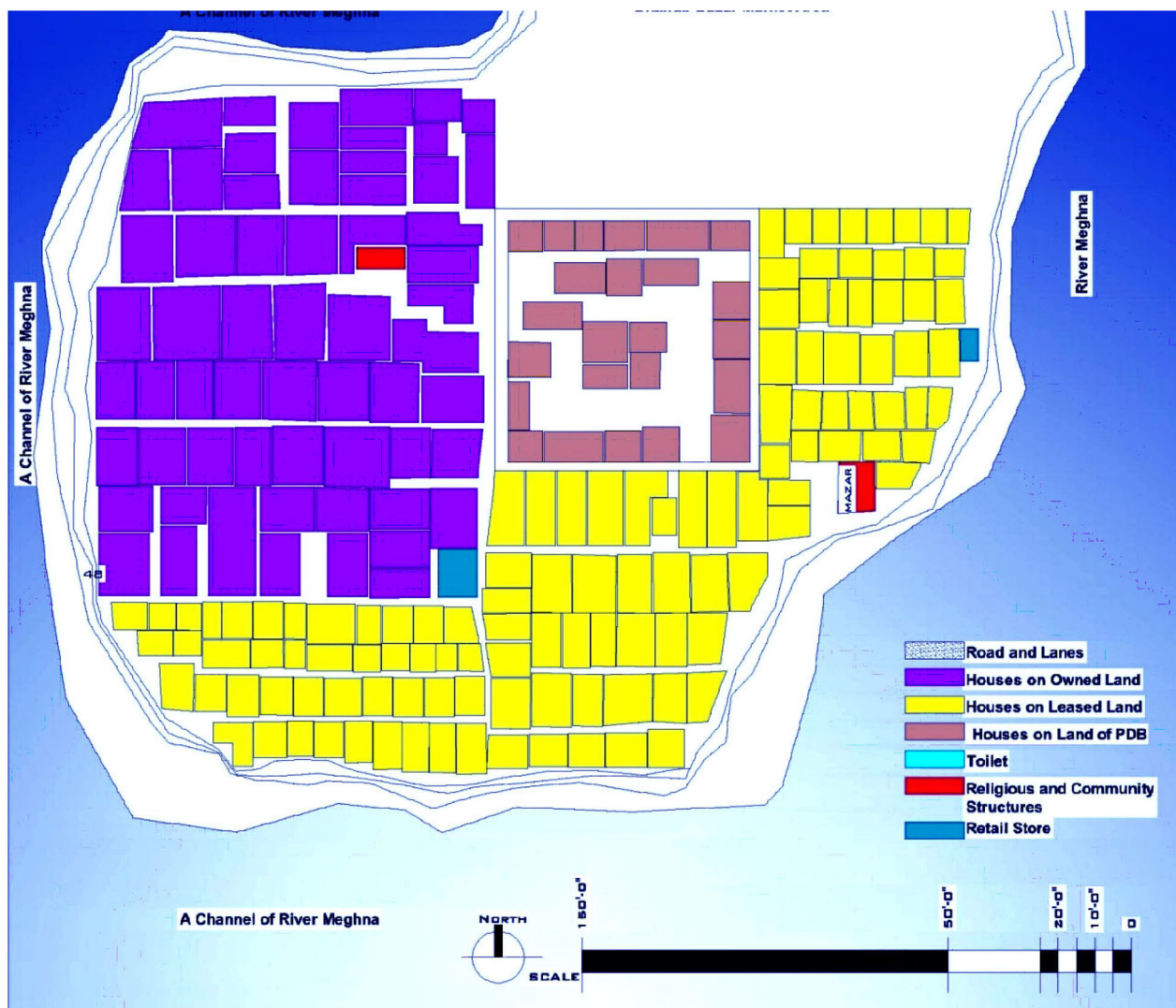


FIGURE 3 Map of Dakshin Rishipara Slum, showing the previous condition.



FIGURE 4 The area within boundary wall of PDB tower is accessed through a ditch.

walls, bamboo and timber roof trusses, and corrugated iron sheet roofs. These houses are very prone to damage from any adverse climatic condition like flood, heavy rain, tornado, etc. The mud plinth soaks up water and gets wet in damp weather. The bamboo posts are very prone to damage in damp weather (if not treated properly) and inundated conditions. Flood water can damage the plinth, and as a result, the whole structure may collapse.

- *Type 2:*

Houses of this type are almost like the houses of Type 1. The difference is in its plinth. The mud plinth is strengthened either with a peripheral brick wall or with cement capping, and the height can reach up to 711 mm.

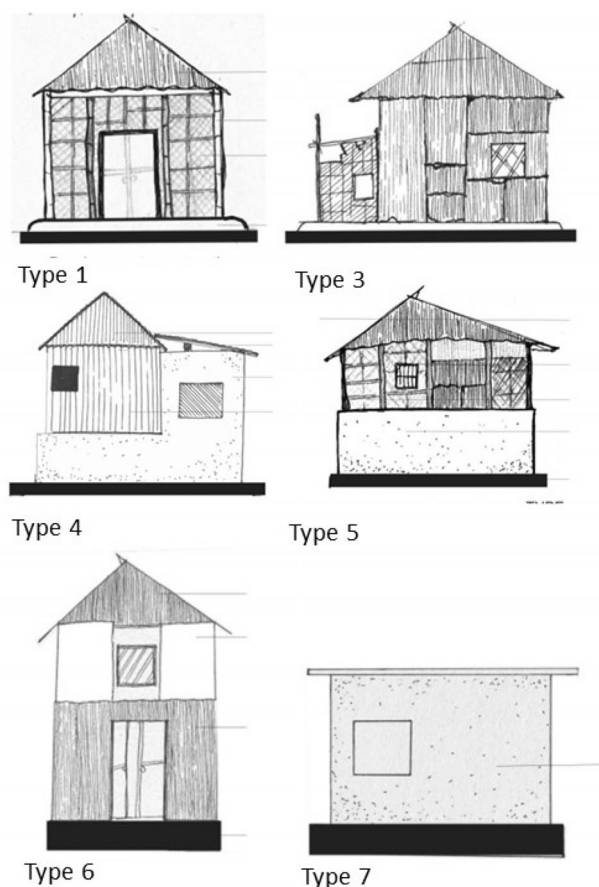


FIGURE 5 Different types of houses.



FIGURE 6 A house with half-brick wall (Type 4).

This peripheral brick wall or cement capping of the plinth does not allow the flood water to penetrate into the plinth until the flood level is lower than the plinth level.

- *Type 3:*

Houses of this type are single-story with 365–711 mm high brick-concrete plinths, reinforced concrete posts, corrugated iron sheet walls, timber roof trusses, and corrugated iron sheet roofs. In some cases, a rudimentary small shelter or a lean-to of corrugated iron sheets is attached to the main unit and used as a kitchen. The plinth is made of brick-concrete, and the plinth does not soak water and remains usable in a flooding condition. A higher plinth does not let the water get inside the house. Because of the cement finish, stagnant flood water or rainwater does not cause any harm to the plinth and posts of the structure. The whole structure remains usable in an inundated condition. The corrugated iron sheet can be easily replaced with brick walls. In cases of lower height at the door threshold level, flood water may get into the house. A smaller guard wall, such as a doorsill is usually made at the door threshold level to restrict water penetration. These types of houses have the risk of being flooded in severe conditions, and the occupants will have to evacuate at that time.

- *Type 4:*

These types of houses (Figure 6) have reinforced concrete posts over 305–813 mm high plinth of brick-concrete. The lower half portions (914–1219 mm) of the walls are made of brick, and the rest of those are made of corrugated iron sheets. A hipped roof of corrugated iron sheets rests over a timber truss on the main cell. A smaller guard wall of more than 305 mm at doorsill level is usually made to restrict the water penetration. The other cell, which is usually used as a kitchen and store, has a full brick wall and a mono-pitched corrugated iron sheet roof. The plinth is made of brick, and the plinth does not soak up water and remains usable during and after a flood. The higher plinth, as well as the half brick wall does not let water get inside the house. Because of the cement finish, stagnant flood water or rainwater usually cannot damage the plinth, foundation, and brick wall of the structure. The whole structure remains usable after an inundated condition. The guard wall at the door step restricts water penetration into the house. These houses also have the risk of being flooded in severe conditions, and the occupants will have to evacuate at that time.

- *Type 5:*

This type of house is very similar to the Type 4. Here, instead of corrugated iron sheets for the wall, bamboo mats are used and bamboo columns are used instead of concrete columns. The bamboo columns are the weakest part of this kind of structure and are very prone to damage in damp weather (if not treated properly) and inundated conditions. It has the risk of being flooded in severe conditions, and the occupants will have to evacuate at that time.

- *Type 6:*

These houses are double-storied structures mainly made of reinforced concrete columns and corrugated iron sheet walls over a brick-cement plinth of almost 610 mm in height. The gabled roof of corrugated iron sheets rests over a timber-bamboo truss. The upper floor is nothing but a mezzanine floor with a maximum of 1423 mm clear head space and it is accessed with a wooden ladder. The upper floor is usually used only for sleeping. Sometimes the lower level (up to 915 mm from the plinth) of the corrugated iron sheet wall is protected with an outer brick wall. These houses have all advantages of previous types; additionally, their upper level can be used even in severe flood conditions.

- *Type 7:*

The last type of house is a reinforced concrete frame structure with brick walls and a 610–915-mm-high plinth and a flat roof with the option of vertical extension. This kind of structure gives total protection from any climatic adversity. The scope of vertical extension gives opportunities to increase the level of resilience to floods. It requires lots of financial involvement to build this kind of house.

6 | TRANSFORMATION PROCESS OF INDIVIDUAL HOUSE IMPROVEMENT

To get quantitative information on improving the quality of houses, a questionnaire survey was conducted. The questionnaire was prepared to get information on four time periods. Most of the houses were rebuilt right after the completion of the site improvement project. Even after that, some inhabitants have invested in improving the quality of their houses, and some have plans to improve the quality in the future. For tracing the changes in the housing quality, data from five periods were collected:

Condition 4: The expected condition of the house within the next 5 years.

Condition 3: The current condition of the house while the study was conducted in 2021.

Condition 2: The condition of the house right after the site improvement.

Condition 1: The condition of the house before the site improvement.

Condition 0: To trace the transformation process, it was intended to know the earliest condition of individual houses as far as the inhabitants can remember. The condition 0 is based on the memory of the inhabitants without referring to any specific period.

It was identified that the performance of a house depends on the following items:

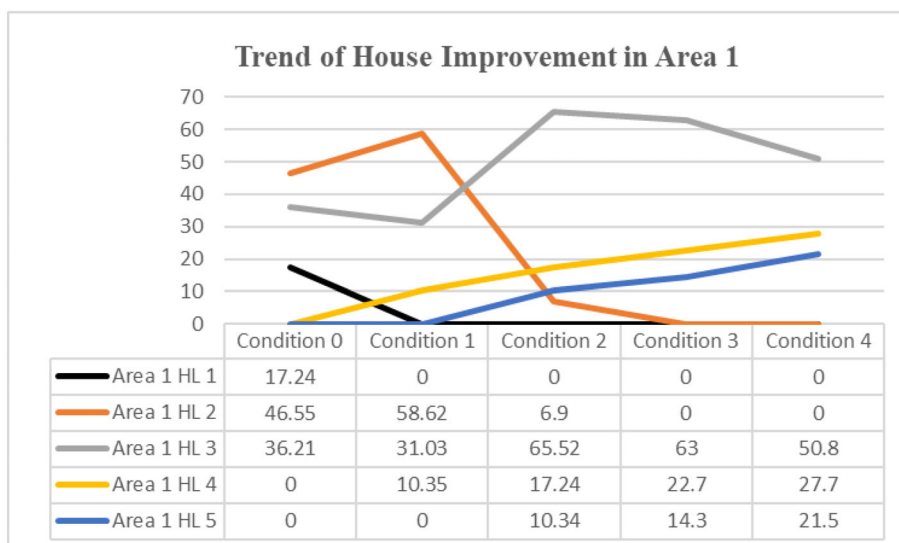
- *Materials of plinth:* Three types of plinths are identified: mud plinths, mud plinths with cement capping or brick edging, and plinths of brick-concrete. Among these, the mud plinth is the most vulnerable to flood or waterlogging and the plinth of brick-concrete is the most resistant to flood.
- *Materials of walls and posts (columns):* bamboo mats, corrugated iron sheets, and brick are used for walls. Brick cement walls perform better than corrugated iron sheet walls and corrugated iron sheet walls perform better than bamboo mat walls. Posts or columns of bamboo, timber, and reinforced concrete are common. Among these reinforced concrete columns are the most resistant.
- *Number of stories and scope of vertical extension:* houses with double stories always give chance to escape the flood.

Based on the performance of available types of houses in a flood condition, those are categorized into five types for this questionnaire survey. These house types based on their performances are categorized as five types of house level (HL): House level 1 (HL1), House level 2 (HL2), House level 3 (HL3), House level 4 (HL4), and House level 5 (HL5). House levels are explained below:

HL1: A house with a plinth of mud, walls of bamboo mats, columns of timber or bamboo and a roof of corrugated iron sheet/house of any other kind comparable to this.

HL2: A house with a plinth of mud and brick edging or cement capping, walls of corrugated iron sheet/bamboo mat, columns of timber or reinforced concrete or bamboo, and a roof of corrugated iron sheet/houses of any other kind comparable to this.

FIGURE 7 Line diagram of Area 1 (Field Survey, 2021).



HL3: A house with a plinth of brick-concrete, walls of half brick and half CI sheet or full CI sheet, columns of timber or reinforced concrete, and a roof of corrugated iron sheet/houses of any other kind comparable to this.

HL4: A house with a higher plinth of brick-concrete, walls of half brick and half CI sheet or full CI sheet, columns of timber or reinforced concrete, double storied, and a roof of corrugated iron sheet/houses of any other kind comparable to this.

HL5: A house with brick-concrete plinth, brick wall, reinforced concrete roof, double storied or having the scope of vertical extension, and with or without reinforced concrete columns/houses of any other kind comparable to this.

Here, *HL5* denotes the possible best quality and *HL1* denotes the possible worst quality.

The questionnaire survey was conducted in three locations, depending on the land tenure ship.

- **Area 1:** Households who own land (total population, $P_1 = 61$).
- **Area 2:** Households who are leaseholders (total population, $P_2 = 110$).
- **Area 3:** Households who have no legal right on land (living within the electricity tower's boundary wall) (total population, $P_3 = 40$).
- **Area 1:**

On average, this area was less affected by flooding in comparison with other parts of the slum. In a regular flooding condition, most of the area used to remain inundated under 0–610 mm water level. Figure 7 shows the line diagram of the outcome of the survey. Most of

the houses (58.62%) were of HL2 before the site modification. After the site modification, most of them (65.52%) had houses of HL3 and 10.34% of them had houses of the highest standard. Most of the occupants have aspirations to upgrade the quality of their houses in the near future.

• Area 2:

Figure 8 shows the result for Area 2. Before the site modification, most of the houses were of either HL1 or HL2. These kinds of houses are of lower standards and very vulnerable to flood. After the site modification the percentage of houses of HL1 has decreased from 45.5% to 19.97%. Here also, most of the occupants have aspirations to upgrade the quality of their houses in the near future.

• Area 3:

Figure 9 shows the outcome of the survey for Area 3. Whereas all houses were at HL1 before the site improvement, after the site improvement, 70% were at house level 02. As the area became safe from regular riverine floods, the inhabitants invested to uplift their houses to the second level with a plinth of mud, and brick edging and cement capping. These kinds of houses remain livable even in conditions of waterlogging due to heavy rainfall. But the inhabitants are less interested in further upgrading the condition of their houses.

6.1 | Conditions for individual house improvement

In the focus group discussion sessions, it was attempted to find out the influencing factors to build better houses

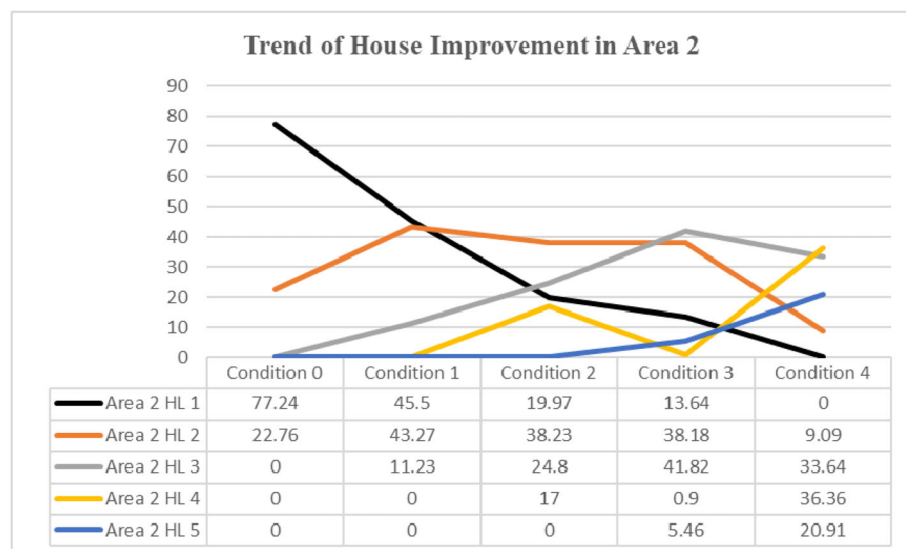


FIGURE 8 Line diagram of Area 2 (Field Survey, 2021).

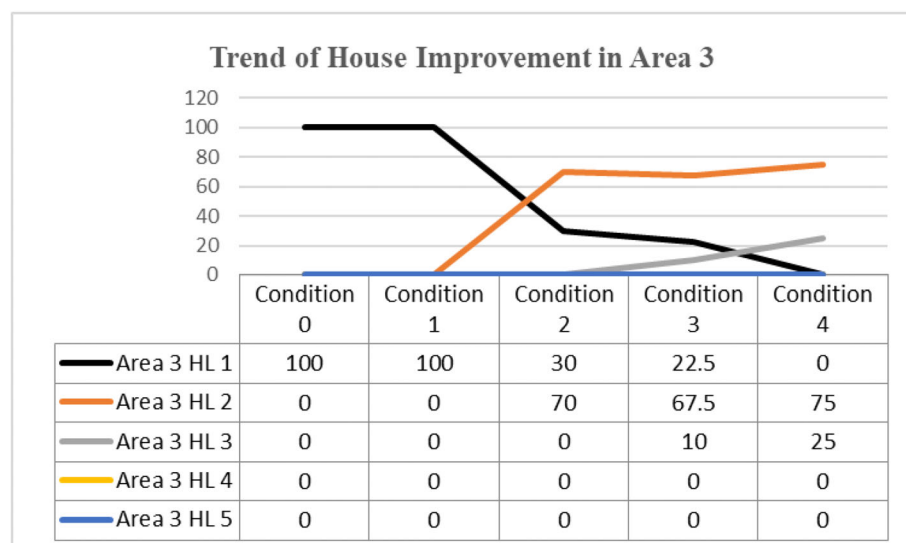


FIGURE 9 Line diagram of Area 3 (Field Survey, 2021).

that ensure comfortable living even in flood conditions. The influencing factors are listed below:

- **Assurance of not being damaged shortly:**
If the inhabitants get assurance that their houses will not be damaged shortly because of heavy rainfall, riverine flood, rain-waterlogging, or any kind of natural hazard, they become more likely to invest in building better houses. As they have limited financial ability for building such kinds of houses that can be used in severe disaster conditions, they always prefer to evacuate rather than invest their little savings in houses. After the site modification, they got some degree of assurance that their houses would not be damaged shortly by a flood.
- **Assurance of not being evicted or legal rights on land:**
A permanent location always influences them to build a permanent house. Chances of eviction or illegal occupation restrict investing more.
- **Availability of financial support or donations for building houses:**
The settlers are more interested in investing in building better houses if they get direct financial assistance or donations from any person or organization.
- **Availability of better building materials:**
If appropriate building materials are easily available at a cheaper rate, the local people will be willing to use those materials to upgrade the condition of their houses.
- **Availability of knowledge, skill development training:**
Knowledge or training on new construction technology or building materials will encourage the local people to incorporate those into their houses.
- **A source of pride:**
The person who owns a house of better quality feels proud of being the owner of that house. They become interested in building better houses as a source of socio-economic status or pride.

TABLE 1 Pair wise comparison of conditions for building better houses (Field Survey, 2021).

	Less likely of being flooded	No eviction	Micro-credit	Building materials	Source of pride	Urban look	Score point
Less likely of being flooded		Tie	Less likely of being flooded	Less likely of being flooded	Less likely of being flooded	Less likely of being flooded	4.5
No eviction	Tie		No eviction	No eviction	No eviction	No eviction	4.5
Micro-credit	Less likely of being flooded	No eviction		Tie	Micro-credit	Micro-credit	2.5
Building materials	Less likely of being flooded	No eviction	Tie		Tie	Tie	1.5
Source of pride	Less likely of being flooded	No eviction	Micro-credit	Tie		Tie	1
Urban look	Less likely of being flooded	No eviction	Micro-credit	Tie	Tie		1

- *Desire to get a typical urban look:*

There is a very common perception that houses with typical urban looks are better from every perspective. This urban look means brick or reinforced concrete built, multistoried and flat-roofed structures. The urban areas of Bangladesh usually have similar kinds of structures. Most of the local people have the desire to reside in a house with a typical urban look.

A pair-wise comparison (Table 1) was prepared based on the people's opinions to find out the most important factor for building better houses in the present condition. The following factors were identified to make the pair-wise comparison:

- Less likely of be flooded.
- No chance of eviction.
- Micro-credit financing.
- Building materials.
- Source of pride.
- Desire for an urban look.

The comparison was done through a voting process, and the community members participated as voters (Table 1). Participants who supported one of the two items were asked to raise their hands. The winner of the comparison was the one with the most votes, and each win is worth 1 point. If almost equal votes were cast for both items, it was considered as a tie condition. Each tie was worth 1/2 point to each. The first two factors scored the highest point. It means that less likelihood of being flooded (assurance of not being damaged shortly) and no eviction (assurance of not being evicted) acted as the most important conditions for building more resilient houses. They had complaints about not getting direct financial assistance for building houses, direct donations

of suitable building materials, and training on building cheaper but more resilient houses.

7 | DISCUSSION

The NGO-supported site improvement project in this slum can be identified as a means of anticipated adaptation. Here, the anticipatory adaptation as planned intervention introduced changes in the built environment with multiple structural mitigation measures for reducing flood risks in the area. The empirical evidence shows that the impact of this site improvement project influenced the inhabitants to invest in upgrading their individual houses. The upgradation of houses is important in the suited context where the site is vulnerable to flood and rainfall-induced waterlogging risks. The trend of upgrading houses is a regular process that is usually conducted by the owner. There are multiple factors that may influence to make spontaneous, small changes. In Dakshin Rishipara slum, the inhabitants were not much interested in investing in building houses of better quality before the site was improved, as the area was severely vulnerable to flooding and evacuation was a preferable option in most cases. The structural components of flood control (that were introduced by the site improvement project) encouraged the local people to invest more in housing. Micro-credit for supporting income was also identified as a reason for building better houses, as an increase in income is also a pre-condition for building better houses.

Though the community did not receive any direct assistance for upgrading their houses, this research has identified multiple factors that influence upgrading the quality of houses: less chance of flooding, rights on land, suitable financing, available building materials and technology, houses as a source of pride, and the desire for an urban look.

All these factors influence the everyday practices of the inhabitants for improving the condition of their houses, and these everyday practices result in responsive adaptation to enhance community flood resilience. Among these factors, the first two are prioritized by the inhabitants. Between these two the first factor was achieved after the site improvement project. It is also necessary to mention that a particular part (Area 3) within this slum did not get the chance to enjoy every benefit of the site improvement project. In this part, the pace of upgrading the quality of houses is slow if the pace is compared with that of the other two parts. This evidence proves the positive impact of the external intervention on the everyday practices of responsive adaptation. As a local trend, community-responsive adaptation is practiced based on repeated experiences and available resources, without conscious decision about adaptation (Mulligan et al., 2017). But the community always had the understanding that improving the condition of individual houses could ensure better protection from flooding. From their experiences, the majority of inhabitants realized that the area is almost free from flood risks, and in this case, if they invest in building better houses, the investment will not be wasted due to any flooding incidents. Moreover, better houses can provide them with a better living environment, even in a water-logged condition.

However, because Area 3 did not receive many benefits from the site improvement project, the residents there are comparably less interested in investing to improve the condition of their houses. The challenge of this settlement is that there is no acceptable solution for improving the site condition in Area 3. This kind of discrimination may result in tension and unrest in the settlement. The project, which appears to be effective, lacks the elements that would help direct future development and make long-term maintenance and monitoring easier. Locals are using their own materials and skills to construct their houses. A better solution would have been to use instructions or some other form of assistance.

Community's practices, which have been identified as the expression of responsive adaptation, support the concept that finds a community resilient while it can take action against any kind of risk, stress, or trauma and function positively (Chowdhoree et al., 2018; Pfefferbaum et al., 2005). Despite some drawbacks, responsive adaptation was made possible by anticipated adaptation's aftereffects, and the combined effects of both forms of adaptation ultimately had a positive influence on boosting community resilience through altering the built environment.

8 | CONCLUSION

The case of Dakshin Rishipara slum can be seen as an example of “development” that aimed to lower risks and

thus fits with the concept of adaptation. In this particular case, the site improvement project broadly contributed positively to developing the built environment by mitigating its built-environment-related vulnerabilities. For the areas of housing, urban development, and infrastructure, it is suggested to check whether flood-prone river banks have been ecologically protected while providing alternatives and accessible livelihood areas to the dwellers; whether housing standards, including low-income housing, are capable of withstanding different types of hazards; and whether the local authority is capable of integrating disaster risk into local planning and implementing risk reduction measures (United Nations Development Group, 2009). Floodplain evacuation is neither a socially desirable nor economically viable policy, particularly for a densely populated residential area. Externally supported planned interventions may support the vulnerable community in adapting to the situation, and the combined effects of community-level initiatives and authority-driven interventions may enhance community resilience. External interventions may fill some capacity gaps in the community, and appropriate policies of external organizations may guide a better partnership with community members so that effective collaboration may result in positive impacts of anticipated adaptation that may influence responsive adaptation. In this case, the “development” should be purposeful in the sense that its goal directly improves people's lives and engages them to increase their resilience level. The involvement of external organizations should engage the community in such a way that they can continue to work on it to extend the positive impacts without further assistance (Chowdhoree, 2020; Lawther, 2009).

Enhancing community flood resilience is identified here as a process of expanding people's freedom in a context where infrastructure-based development acts like planned adaptation to floods (Chowdhoree et al., 2022) that may influence the initiation of other types of possible changes. Anticipatory adaptation as well as interventions by external organizations often pose a risk of failing to meet expectations. There are cases where structural interventions in the built environment for mitigating flood risks actually brought unanticipated negative impacts on the environment and on the community (Choudhury et al., 2004; Chowdhoree et al., 2018; Katyal & Petrisor, 2011). But the studied case shows the positive impacts of the planned intervention. Here, the NGO, as the external organization, can take credit for collaborating in the right way with the community. NGOs are usually considered as the source of alternative developments in Third World countries that have colonial pasts (Bebbington et al., 2008) and can successfully address seemingly unsolvable challenges of development (Brinkerhoff, 2003; Chowdhoree & Islam, 2018). Despite

the fact that the investigated case illustrates the success of the external intervention and anticipated adaptation, it cannot guarantee that the outcomes will be the same in all instances of external intervention and anticipated adaptation. Although it cannot be said that the residents of Dakshin Rishipara are completely resilient to all forms of climatic hardship, they can be idealized as a repeatable example of the combination of anticipated and responsive adaptation for strengthening resilience.

DATA AVAILABILITY STATEMENT

A data availability statement confirms the presence or absence of shared data.

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ENDNOTE

¹ Chowdhoree, I. (2012). *Development of the River-side Urban Poor Settlement towards Flood Resilience: Roles of Different Actors*, submitted to the Department of Urban and Regional Planning of Bangladesh University of Engineering and Technology (BUET) for the Master of Urban and Regional Planning Degree.

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