

Regeneration of Distressed Communities in Settlements Around Brownfields: Insights from Khulna, Bangladesh

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Abstract

As is known, Khulna, the third largest metropolis in Bangladesh has played a pivotal role in trade and industry during the 1950s and 60s. From the late 60s, the political shifts have caused a rapid decline of the industries, worsening the socio-economic condition of the workers' community and the physical condition of the surrounding urban areas of the industrial belt. Partial closures, leasing out, laying off of the mills and finally turning into urban brownfields, have made thousands of workers jobless. Khulna Newsprint mill is such a brownfield, closed in 2002 leaving a total of 6000 workers and employees unemployed with a hope of reopening. Despite 16 years passing, they continue to hold onto this hope of relaunching the mill while living next to the mill area with multiple deprivations in socio-economic aspects. In this context, the government has introduced a new industrial policy in 2010, emphasizing investment in State Owned Enterprises only for reopening. However, without recognizing distressed vernacular communities and a concurrent regeneration plan, this strategy has proven ineffective in a developing country like Bangladesh.

This research examines how distressed vernacular communities of urban brownfields can be regenerated. The objectives are to identify the socio-economic needs of the distressed community and investigate the spatial and physical resources of the Brownfield, which can be useful for the regeneration of the distressed community.

It employs qualitative case study method. Data is collected through a questionnaire survey, focus group discussion, participant observation, Key person interview, planning document study, drawing and photography analyzed through content analysis using NVivo and Spatial Mapping analysis.

In conclusion, the paper formulates a framework for the regeneration of distressed vernacular communities around the urban brownfields. It also provides recommendations for specialized policy guidelines on the sustainable regeneration of such distressed communities.

Keywords: Distressed Community, Urban Brownfield, Sustainable Regeneration

Introduction

As a developing country of the Global South, Bangladesh is facing rapid urbanizations and unplanned developments in cities. Informality is seen as an inseparable mode of urbanization (Roy, 2005) which gives rise to informal settlements which are vernacular in every sense of the word. However, they are often distressed communities with no access to land resources, housing or infrastructure. In 2009 in Bangladesh, the proportion of the urban population living in informal settlements ranged from 19.5% in Khulna to nearly 40% in Dhaka (Angeles et al., 2009). Though informality is a process (Roy & AlSaiyad, 2004) that plays a vital role in the economic dynamics of cities in developing countries, people from informal settlements (often distressed communities) remain unrecognized in planning policies. Studies reveal that most of the planning and building standards in developing countries neglect these poor or distressed people (Devas, 2001) who live in contemporary vernacular settlements.

On the other hand, Bangladesh has been implementing Neoliberal structural adjustment policies since the early 1980s (Nuruzzaman, 2004). After independence in 1971, it did not take long to fall prey to the global capital net, i.e., the World Bank-IMF reform trap. Like many other countries around it, Bangladesh came under the Structural Adjustment Programs. The aim of the Structural Adjustment Program is to bring everything within the reach of private businesses, turning every activity into something for profit and opening up every public space and property for corporate interests. The significant impacts of these reforms in Bangladesh have been that the big public enterprises have been dismantled; large mills have been replaced by export processing zones, shopping malls, and real estate while the permanent jobs in factories have been replaced by a system of temporary, outsourced, insecure and part-time jobs. As a result of these reforms, the numbers of urban poor are increasing in the cities of Bangladesh.

Khulna is the third largest industrial city in Bangladesh. According to Bangladesh Bureau of Statistics (BBS), 18.72% of the total employed people of Khulna are working in Industry (Sowgat et al., 2017). Thus during the 50s and 60s, Khulna became an important center for trading and industry, mainly based on the export of jute and jute goods. Many new industries have been set up and commercial activities have increased. As a result, Khulna has become one of the major focal points of trading and industries. Therefore, since the late 60s, industrial growth of Khulna has been falling due to dull export markets (Naznin, 2014). In fact, during the last three decades, the political shift from democratic governance to military regimes coupled with the policies pursued by successive governments have resulted in a rapid decline of the industries (Howlader, 2015).

After independence, almost all the mills in Khulna have been nationalized as state-owned enterprises with an aim to strengthen the contribution of the industry to the national economy. Partial or full closer, lease out and lay-off of the mills have made thousands of workers jobless and poor. The unstable condition of the worker's community and the decreasing value of industrial products have caused a gradual decline of the industries. National industrial policies of Bangladesh have invested more in the State Owned Enterprises and reopen the closed jute industries. However, there is no specific policy for brownfields in any national or local policy such as National Industrial Policy 2010, National Industrial Policy 2016, National Land Use Policy or the KDA Law Draft 2017. Another challenge is to find policies concerning distressed communities. According to Watson (2009), it is challenging to derive policy solutions from traditional planning practices for developing countries. He also insisted that city governments themselves are creating social and spatial exclusion by adopting inappropriate laws and regulations.' These are the reasons that the government's policy of just reopening the state owned enterprises by investing more and more didn't work. Without any regeneration scheme neglecting communities, the strategy of reopening brownfields won't work. According to Carley and Kirk (1998), the optimal way of re-invention pertains to urban regeneration where management and participation processes along with investment are aimed to support disadvantaged areas and communities, ensuring long-lasting improvements in the prospects of beneficiaries and full integration with society (Parvin & Mostafa, 2010).

In this context, this research aims to examine how distressed communities in settlements around such brownfields can be regenerated. The objectives of this research are as follows.

1. To identify the socio-economic needs of the distressed communities.
2. To investigate the spatial and physical resources of the selected Brownfield.
3. To provide a framework for the regeneration of distressed communities of urban brownfields.

Theoretical Framework Distressed Communities

A community is generally defined spatially as a specific geographic area and functionally as a set of social networks. Communities, then, are the spatial units in which face-to-face social interactions occur—the personal settings and situations where residents seek to realize common values, socialize youth, and maintain effective social control. Communities are often social entities with considerable face-to-face interactions among the members (Simandan, 2016). According to Kaufman (1959), a working definition of community is as a place-oriented process of interconnected activities wherein residents express a collective identity while engaging in shared life issues (Kaufman, 1959). Thus, it can be said that a community shapes up within a place but the place itself is not community. The place serves as the setting in which social interaction occurs (Theodori, 2005) among a defined group of people who share the common interests.

On the other side, distressed urban areas are portions of cities or their suburbs, usually at the scale of residential communities, in which social, economic and environmental problems are concentrated (Conway & Konvitz, 2000). The cumulative effect, though, is to limit access to opportunities, resources and services that are considered standard in other parts of the city. The intensity of impoverishment appears to have increased over the past two decades in many cities who are members of the ‘Organisation for Economic Co-operation and Development’ (OECD). Research suggests that inflammation of problems is systematic in many cases: a “spiral of decline”. That means the communities suffer from multiple deprivations and can be identified as distressed communities. Undeniably, they result in high social costs.

The term Brownfield originated in the early 1990s when practitioners and researchers saw how emerging regulatory frameworks were designed to protect the environment. It was used for the first time in the United States, in 1992 (Cheng et al., 2011). A second source of the term ‘Brownfield’ is given by the United States Environmental Protection Agency (US EPA). According to US EPA, Brownfields are;

“Abandoned, idled, or under-used industrial and commercial facilities where expansion or redevelopment is complicated by real or perceived environmental contamination”

US EPA, 2024:1

The definition varies between the American and European perception of it. The European concept sees brownfield land as derelict, underutilized or vacant land that may or may not have environmental damage, on which previous use has concluded or subsided and which the market was not able effectively to reuse without some sort of an intervention. The fact that we cannot absolutely and exactly define what a brownfield is and what it is not, presents one of the barriers to their reuse. Here is a definition now broadly accepted in the European space. This definition of urban regeneration has undergone constant revisions. During the post-1974 downturn, the economic restructuring has provided a further catalyst for change. According to Ward (2004),

‘a political reconceptualization of the inner city as a spatial coincidence of more fundamental social, economic and environmental problems began to occur in the 1970s.’

Ward, 2004:178

In 2008, Jones and Evans brought up that the large-scale process of adapting the existing built environment, with varying degrees of direction from the state, is today generally referred to in the UK as urban regeneration (Jones & Evans, 2013). However, urban regeneration also includes the intervention of small areas like a street or a single building or intellectual operations in larger spaces. Sometimes it means the use of strategic reactivation techniques such as the implementation of resources (used as urban catalysts) that contribute to revitalization of the areas where they are implemented. Couch, Skyes & Borstinghaus (2011) insisted that it was clear that some new form of policy interventions in inner urban areas were required: one that went beyond the traditional and rather limited approach of slum clearance and physical redevelopment, to one that additionally addressed wider social and economic issues. Since the Rio Earth Summit in 1992, UK policy has become framed by the goals of sustainable development. The concept of urban regeneration has been associated with processes of physical renovations to socio-economic interventions and the latest concern in political restructuring and environmental conservation, derived from a context of increasing globalization (Rossi & Vanolo, 2013). Although the concept of regeneration is continually evolving and encompasses a wide range of activities, the six themes of urban change provide a foundational definition of urban regeneration as:

‘Comprehensive and integrated vision and action which seeks to resolve urban problems and bring about a lasting improvement in the economic, physical, spatial and environmental condition of an area that has been subject to change or offers opportunities for improvement.’

Roberts, 2000:18

However, Turok (2005) comments about this statement that regeneration is rarely comprehensive and categorized regeneration into three elements: people, business and place (Turok, 2005). Later, Tallon (2020) explains that these three elements must be in balance to secure the development and progress of a community or locality for a long time. He also mentioned the approaches and the four dimensions of regeneration: Economic, Social, Physical or environmental and governance.

Table 1: Approaches to urban regeneration

Source: Tallon, 2020

Dimensions	Concerns
Economic	Job creation, income, employment, skills, employability, development
Social	Quality of life, health, education, crime, housing, quality of public services
Physical/Environmental	Infrastructure, built and natural environment, transport and communications
Governance/ Institutional	Nature of local decision-making, engagement of local community, involvement of other groups, style of leadership

Urban Renewal

Urban renewal has emerged in developing countries as a response to shifting expectations that have abandoned derelict urban buildings to be refurbished and reused, rather than demolished (Couch, 1990). Some of the urban renewal projects such as those carried out in Nigeria, the Ndoki and Aggrey Road Water Front in Rivers State, and the Maroko- Lagos and Aja experiment, in Lagos State are good examples of urban renewal. However, the renewal schemes did not really solve the housing problems of the squatter dwellers, but rather compounded them to intolerable levels especially with regard to break-up of social relationships and upsetting existing economic systems and opportunities (Dimuna & Omatsone, 2010).

The developing countries are more focused on improving the economic condition of their mass population which leads to gentrification. Karchi Development authority’s Metroville case of early 1970s shows gentrification which can’t be a solution where a distinct community is in need (Hasan et al., 1987). Here, urban regeneration can solve the issue in a sustainable way. The goal of urban regeneration approaches in developing countries is to reduce the impacts

of social issues such as overpopulation, migration and gentrification and ensure improved quality of life. Shen (2021) points this out,

‘With more importance going to social capital, the logic of urban regeneration has changed from spatial production to community construction.’
Shen et al., 2021:2

Many definitions of urban regeneration have emerged but the following are concerned about communities and their betterment. Although the authors are from different backgrounds and different timelines, they are consistent about one thing. For instance, Couch (1990) says that the process of urban regeneration is one in which the state or local community is seeking to bring back investment, employment and consumption and enhance the quality of life within an urban area. Even in 1994, the British Government's regeneration policy also prioritized the communities of need by reducing the gap between deprived and other areas, and between different groups (Couch et al., 2011). Brown (2006) gives the most contemporary definition of regeneration:

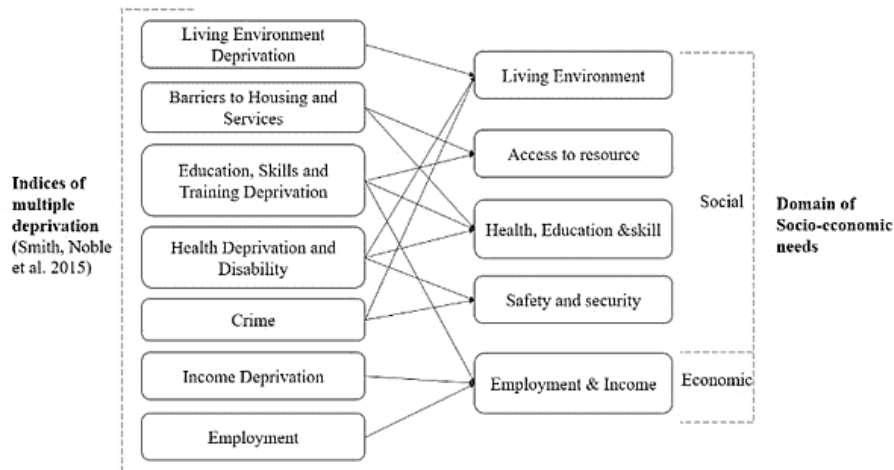


Fig. 1: Domains of Socio-economic need
Source: Author, 2023

'Urban regeneration is concerted social, economic and physical action to help people in neighborhoods experiencing multiple deprivation reverse decline and create sustainable communities.'

Brown, 2006:1

To sum up, it can be said that to regenerate a distressed community, first the deeply rooted issues have to be found. This problem can be solved by attracting external resources and investors which will be expensive and time consuming. Moreover, it may not be sustainable for a long time. The best possible way is to use neighborhood resources, government support and local investors.

This theoretical framework is the foundation of this study. It identifies the indicators of regeneration of distressed communities in the settlements around brownfields. In this case, the resources of brownfields can be utilized to regenerate the distressed communities.

For this, Smith et al., (2015) suggest a process. According to him, first, the socio-economic aspect of the domain of deprivation of the distressed community is identified from the indices of deprivation. The social and economic needs of the neighborhood are in those domains as they are deprived in these sectors. (Fig. 1)

Then the Brownfield types and potentials of an urban area are reviewed. Afterwards, the indicators of environmental dimension ascertain the physical resources of the Brownfield. As most of the brownfields have no dwellers within the site area, the socio-economic aspect mainly covers the condition of the communities. If the community is distressed socially, economically, or physically, the indicators of the socio-economic aspect of sustainable regeneration should include the domains of social and economic need and the environmental (built environment & non-built environment) element of the brownfield. Thus the indicators of regeneration of a distressed community of urban brownfield in such a context can be established.

Research Method

This research examines the brownfields and their impact on communities. It analyzes individuals' quotes and themes in the actual words of participants and provides evidence of different perspectives from the stakeholders. This is done in relation to KNM and the distressed community in Khulna, Bangladesh.

This is a qualitative research: the researcher, the person reading the textual passage, and the people from whom qualitative data are collected play a central role in research design decisions (Denzin & Lincoln, 2011). Besides, this research explores the contexts or settings in the issue has arisen (Cresswell, 2013). As Cresswell says, the focus of qualitative research is on understanding the phenomenon being explored, which means understanding the importance of sustainable regeneration in the urban brownfield area, rather than solely on the reader, the researcher, or the participants being studied (Cresswell, 2013). This research thus employs a case study exploring the issue in depth.

Research Design

Research design means the entire process of research from conceptualizing a problem to writing research questions, and on to data collection, analysis, interpretation, and report writing (Bogdan & Taylor, 1975). According to Cresswell, 'research design means the plan for conducting the study' (Cresswell, 2013).

In the first step, this research investigates the socio-economic needs of the distressed community in Khulna, Bangladesh. This phase is followed by the area sampling process. In this step, qualitative and quantitative data from field surveys about environmental, social and economic aspects of the daily lives of the participants are identified to gain insight knowledge. These are collected through interviews, observations and participant observations in fieldwork. Further, an open-ended questionnaire survey is administered, while examining documents and texts. As Myers (2019) points out, these lead to the researcher's impressions and reactions.

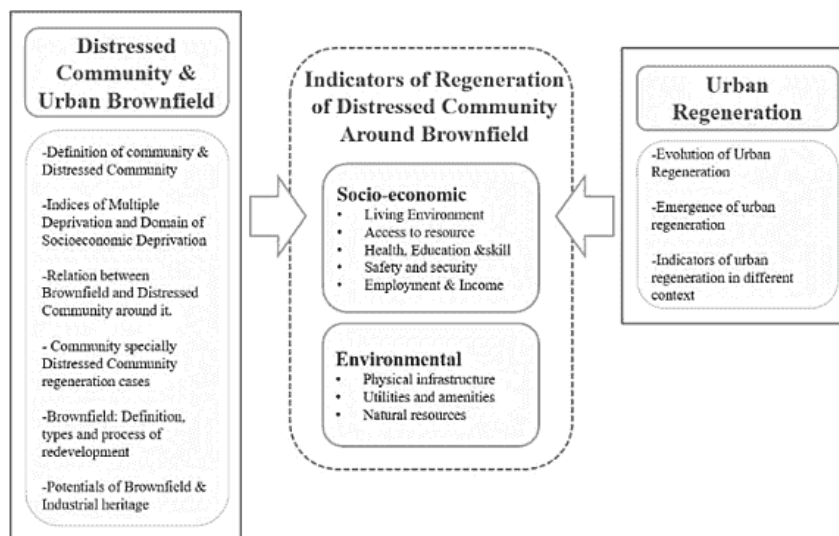


Fig. 2: Indicators of Urban Regeneration of Distressed Communities around Brownfield
Source: Author, 2023

Content analysis is carried out by NVivo. Data analysis also include Photographic analysis. Moreover, a household survey containing open-ended questions was administered. Focus group discussions with different age groups and professions were also carried out. Key informant interviews and focus group discussions were done to gain rich informative texts and corroborate the data gained from the previous interviews and observations. Finally, a data triangulation validated the findings in terms of data reliability.

In the Second stage, the study of the built area of the Khulna Newsprint mill to identify the spatial and physical resources was conducted using mapping and built-form study methods taken from physical planning and built environmental design fields (Knight & Ruddock, 2009; Opoku et al., 2016). This task acquired information about the remaining physical infrastructure, utilities & amenities, and natural resources within the mill boundary. Key informant interviews and focus group discussions with the mill authority, local people and different political groups were conducted to receive accurate information. Spatial Mapping, built environment study and photographic analysis were employed.

Video recording, Google Earth (maps), free-hand sketches and architectural drawings (plan, elevation, section, 3D visualization/animation) are used for documentation and mapping of both the community and the mill area. In the final stage, the Regeneration framework was developed in light of the findings from Stages I and II (Fig. 1.). It included activities such as investigating the remaining physical resources of the mill and it's usable parts regeneration framework for distressed community of the settlement around the brownfield. An analytical framework is developed to address the objectives of the study, for collecting data from the distressed area and the brownfield, analyzing the collected data and interpreting the output of the analysis (See Fig. 3).

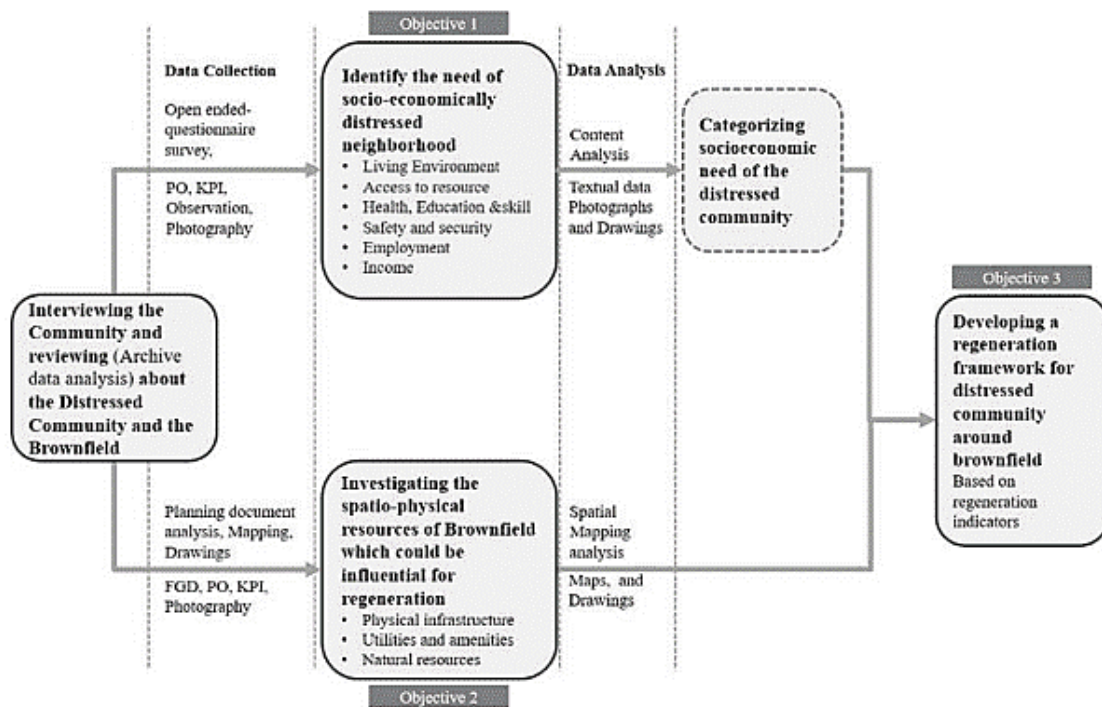


Fig. 3: Analytical framework of the research

Source: Author, 2023

Unit of Analysis and Sample Design

To select the unit of sampling who were the respondents, this research followed an area sampling process. The total population is divided into two geographic subdivisions as the rail line cuts through the settlement. The clusters are divided based on the geographic location. The first division includes those respondents whose houses are at the mill side and the second division includes those at the side of the BIDC road.

The sampling size was guided by two major factors. First, there was the need to have an adequate sample size required to address the research questions, and the second was the determined cluster of the area that is representative of the entire two portions of the settlement. Therefore, the two selected parts of the settlement are 15 households on the right-hand side from the Newsprint mill gate and 15 households on the left side from the newsprint mill gate. A total of 30 households (11 households in total were surveyed during the pilot survey) were selected within the two parts of the settlement. It refined the final data collection framework and also the triangulation of the data for better validity. One respondent from each household was selected for an interview based on age, gender and occupation. Thus, 30 respondents participated during the data collection time.

Furthermore, 03 focus group discussions (FGD) were also conducted, two in the settlement where each discussion consisted of 6 and 8 respondents accordingly and another one with the security guards within the mill (some old workers are now employed as security guards). Finally, a total of 6 key informants were interviewed including an ATP (Assistant Town Planner), the present MD (Managing director) of KNM, one security guard and 3 community leaders (two male and one female).

In addition, this study adopts purposeful sampling to reach further persons who are most affected due to the shutdown of the mill. Purposeful samples may be biased also because they were selected before. The other participants who were left out could have played a vital role in the outcome of the research. In this research, purposeful sampling can be justified on the ground that people who are poor and live alongside the BIDC road and of other mills are more vulnerable to disaster.

Data Collection and Validity

Qualitative ways are flexible procedures of data collection that can be made to suit any society and enable a researcher to thoroughly understand the context of the society (Bryman et al., 2008). In this research, before developing the theoretical framework, a pilot survey (6th August, 2022) was conducted. It explored the relation of urban brownfield with the distressed community and the process of urban regeneration. Differences between theoretical perspective and contextual understanding was the main concern for conducting the pilot study.

The gap and vulnerabilities guided to develop the theoretical framework and getting knowledge about important attributes of Sustainable brownfield regeneration. After that, an adequate number of relevant literature about urban regeneration, community regeneration, Brownfield and distressed urban area (neighborhood) were reviewed for problem identification and filling the research gap.

Further reviews were conducted to formulate the conceptual framework. During February 2023, a detail survey of the distressed community was conducted. Another was conducted in August 2023. The survey of mill area also took place in August 2023. The interviews involves presentation of oral-verbal stimuli and reply in terms of oral-verbal responses. This questionnaire method of data collection is quite reliable and helpful for a qualitative survey (Cresswell, 2013).

In this research, two sets of questionnaires were used, one for the dwellers of the households: a Reflexive Conversation (RC) and the other for the key informants, who participated in Key Person Interviews (KPI). The questionnaires consisted open ended questions with a few semi-structured questions.

The RC was designed to identify the existing built-environment, economic and social deprivation and their adaptation through these deprivations. A door-to-door questionnaire survey was conducted. The focus of the questionnaire survey was to collect demographic and socio-economic data about the target population of the distressed neighborhood. Alongside, data about their personal and community life, social relations, participation in the community activity, life through the socio-economic threat in the context, livelihood, adjustments with the present situation, maintenance process of the house, innovation to adapt were also focused. However, both semi-structured and open ended questionnaire survey have been administered.

The open-ended questions was provided to the respondents which gave them the opportunity to express their personal views (Cresswell, 2013).

The questions in the questionnaire were arranged to collect different data about their living environment, safety, security, health, education, skills etc. Some questions were also intended to collect information about income opportunity, employment and unemployment, job security to understand their economic status. Alongside, there were some other questions which were intended to collect information about their basic needs, threats and risks of life.

Key informants were selected through ‘purposive sampling technique’ for accomplishment of key informant interview. ATP (Assistant Town planner) was the key informant from the Government organization who provided information about the government role in the brownfield. Present MD of Khulna Newsprint mill was selected as the mill authority who gave information about the role of the BCIC and their future plans about the mill property. Three community leaders were the representatives of the settlements to co-operate for providing information and one security guard was the guide to conduct the survey of the Mill area.

This research, employed both participant and field observation (Cresswell, 2013) in order to find “what is the socioeconomic condition of the people in this neighborhood, and what are the resources that exist within the mill area and how they are related.”

Observation is another important tool. In fact, it is the main data collection tool for the objective 2, as there is no community in the mill except a security and the authority. The condition of the resources as well as the existence were observed and recorded for spatial mapping analysis. In addition to that, FGDs were used for collecting in depth information about the socio-economic condition and deprivation in the context and for exploring the potentials of urban regeneration as well. This part has helped to find out information on neighborhood history, impact on the settlement of the mill’s closure, multiple deprivation of the distressed neighborhood, and the opportunities and barriers of regeneration. FGDs were conducted also with the non-participating household members. Through focus group meetings, as was expected, some key aspects were revealed. They are barely addressed in the questionnaires. Thus, it helped the triangulation process of the data on various built-environment, economic and social domains. The interviews and focus groups were tape recorded with prior consent of the participants. Later on, they were translated and transcribed and categorized according to pre-defined variables for analysis.

Data Analysis and Validation

For data/information analysis, two particular methods are used. These are content analysis and spatial mapping analysis. These analysis have been employed in two socio-spatial levels. Content analysis has been done by using Nvivo in this research.

Content analysis is a research technique used to make replicable and valid inferences by interpreting and coding textual material. Berelson (1952) defines content analysis as a research technique for the objective, systematic, and quantitative description of manifest content of communications. In this research, the built environment, social and economic domain was the first category to which the participants responded.

Content analysis has been used to determine occupations, income opportunities of the dwellers of the neighborhood and their socio-economic threats. Moreover, content analysis has been also used to find out people’s perceptions about regeneration. Spatial analysis is an approach to applying statistical analysis and other analytic techniques to data which has a geographical or spatial aspect (Hemakumara & Rainis, 2015). They include any of the formal techniques which use their topological, geometric, or geographic properties.

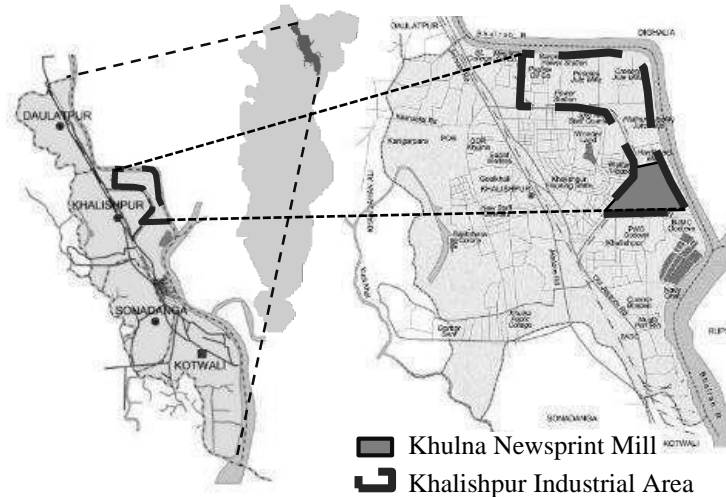


Fig. 5: a) Location of Khalishpur Industrial Area
Source: <http://www.banglapedia.org/httpdocs>, 2023

Triangulation is a crucial step in the evaluation and impact assessment process. In triangulation, researchers make use of multiple and different sources, methods, investigators, and theories to provide corroborating evidence (Cresswell, 2013). According to Staley and Shockley-Zalabak (1987), it involves the use of multiple and diverse data sources and collection techniques to study a single research question or understand complex phenomena.

Data triangulation has been conducted for ensuring validity and comprehensiveness in this research. Alternative independent measuring instruments: semi-structured questionnaire, FGD, observation schedule, recordings are used for this purpose. They complement each other and help construct validity. Triangulation (both data and methodological) has also been done within the family members by observing them in different times in a day. Besides, key informant interview also helped in the process of triangulation by validating data collected from the households.

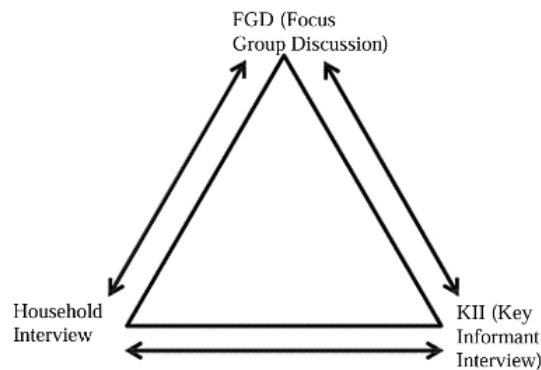


Fig. 4: Data Triangulation of this research
Source: Author, 2023

The Study Area

As stated before, the Khulna Newsprint Mill is located at the bank of Rupsha river within the Khalishpur industrial area. Khalishpur industrial area is constituted of four Jute mills, two hardboard mills and one newsprint mill. The industries are all located on the North side of the Khulna News print mill. All the industries are secured areas and comprise a gated community. Ward no. 8 and 13 constitutes the whole industrial area of 380 Acres (KDA master plan, 2000). Total population of the area is 38504 (23095 male & 15409 female) (Bangladesh Population Census 2001, Bangladesh Bureau of Statistics). Khulna Newsprint Mills (KNM) a prime newsprint paper producing industrial unit of Bangladesh in the public sector. It was

established by the Pakistan Industrial Development Corporation 1959 on the bank of the river Rupsha at Khalishpur in khulna district. Total mill area of the mill is 87.61 acres of land (Khulna Newsprint Mills completes 15 yrs of closure, 2017). It is the largest paper mill in Bangladesh (Studies, 2001) and is the only public sector enterprise of its kind. Sandwell and Company, a Canadian firm, worked as the consultant in its construction and commissioning (KPI). In 2001, KNM had debts of Tk 100 billion and the once rated industry unit of the public sector was on the verge of being declared a sick enterprise. Besides, the expenditure is more than Tk 1.4 million per month in this closed mill (Khulna Newsprint Mills completes 15 yrs of closure, 2017). However in the following 20 years or so, at least Tk 33 crore was spent for paying salaries of around 50 people, including five permanent officers and 30 security guards, who still remain employed; electricity bills, water pump and guest house maintenance and office expenses (Roy, 2021).

The workers of the jute mills are the largest part of the industrial area. Most of the permanent workers of the jute mills live in the housing area of the industries others usually get lands within the industrial housing zone. But many casual workers live in subhuman condition beside the BIDD road which is cutting through the Khalishpur area into two division one is the Industrial Zone and the other is the residential zone (see fig. 6). There is a commercial belt at the side of BIDD road. Behind the linear commercial belt now there is a squatter settlement now. Between the commercial belt and the boundary of Khulna Newsprint mill, there is a large linear settlement of squatters from the Crescent bazar area to Alamnagar. The space between the commercial belt and the boundary is 30 feet to 50 feet wide and almost 8,500 feet long (survey and KII). The most shocking side of the settlement is that the rail line connecting Dhaka and Khulna is cutting through the front side of the mill facing the BIDD road. The opposite side of the industrial area is the Khalishpur residential area.

Findings and Analysis

The socioeconomic needs of the distressed community

The only socially and economically distressed community around the brownfield is the adjacent linear squatter settlement. Around 300 families used to stay there for a long time. However, a sum of 173 families are currently staying in the informal settlement while others have left due to multiple uncertainties.

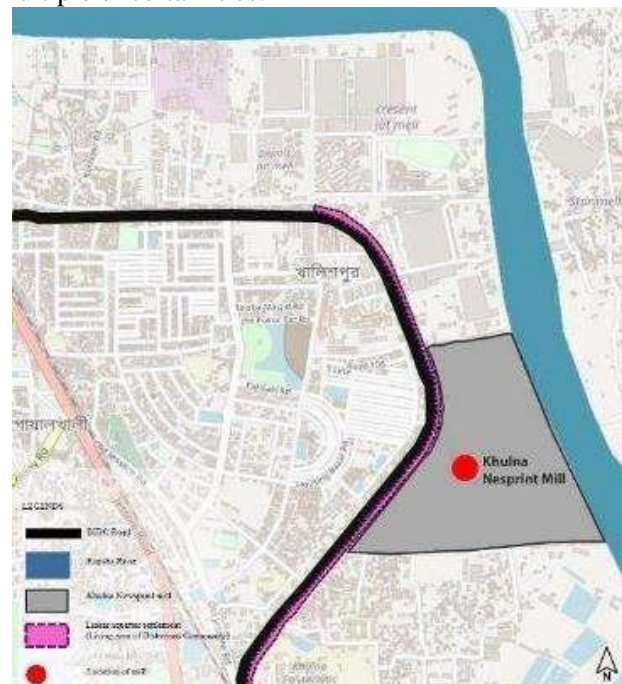


Fig. 6: Location of the Study Area (The distressed community and Khulna News Print Mill)



Fig. 7: The informal settlement
Source: Author, 2022-2023

Fig. 8: Present condition of the houses
Source: Author, 2022-2023

Unemployment, temporary jobs and low wages has led their life to a subhuman condition. Low cost of housing, opportunity of living near workplace have brought them to this settlement. The socio-economic status of the other communities in the neighborhood is very high comparison to the squatter settlements. So, the distressed community only share the serve-service relation with them. It can be said that they are on the verge of social exclusion. in this research the socio-economic need of the neighborhood will be investigated under 5 indicators (from the indices of deprivation). They are living environment, access to resource, health education & skill, safety & security and employment & income.

Living Environment

Tenure Security: This community People are living in the government land for 15-20 years as if it's their ancestors'. The price of the land varies from 50 thousand to 2.5 lakhs (Open ended questionnaire survey). Mainly workers who had no allotment in the industrial housing area and the ex-mill workers started to live there. Having no legal tenure, they are living under the threat of eviction always.



Fig. 9: Land use of linear squatter settlement (The distressed)

Sense of Community: As the settlement is linear, a household can connect and interact with (10 from each side) 20 households maximum (Open ended questionnaire survey and FGD). For this reason, they have no common community representative. In addition to that, there is no space for community gathering except the rail line, as it's a congested linear settlement. Having no one to represent and central discussion or gathering space, strong sense of community isn't grown among them though they are connected with each other.

Building material: Having no tenure, they don't build house permanently. Temporary materials of construction like ACI sheets, bamboos, bamboo fences, sacks, long polythene sheets are mostly used here (See Fig. 5). Old houses of 10-15 years are quite stable and use permanent structure of brick. Because of having no space and tenure also, vertical extension of houses can't be done. But if any household get extra space beside their house the extended their houses to grab the space. Around 18 families have given one room on rent and are adjusting within one room only.

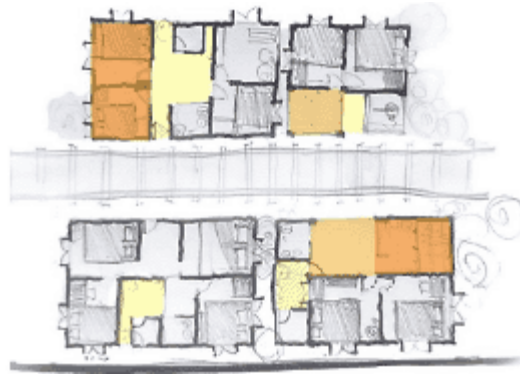


Fig. 10: Congested Household Space
Source: Author, 2023

Household Size and Space: As the settlement grows linearly between the commercial belt and the industrial boundary, the width of a household is minimum 10 feet to 20 feet (PO). The household space is not enough for a large family (See Fig. 6). Large families of 5-10 members have to adjust within one or two room also. Families leaving for 15-20 years, with time they have to divide the plot among the next generation (FGD). One Respondent (R1, August 2023) said,

“My family is big. The total member is ten includes me, my husband, one daughter, four sons two daughter in law and a grandson. I'm staying here with my husband while he was working in the mill as casual worker as we have no place to live nearby. Now my family become big but there is only two room and no space for extension. So, I covered the veranda, one of our son sleeps there with her wife and my two sons and daughter sleeps with us.”
(R1, August 2023)

Access to resources: As they are squatters, urban facilities like water, electricity, sanitation system and waste disposal system is hard to get for them. Now they have got electricity connection in their entire settlement by paying 30,000 from each household (RC and FGD).

For water supply, they have got tube-well after every ten houses. As one tube-well is used for washing, drinking, bathing of ten houses, it gets futile. The tube-well is placed in front of one house after nine houses. Usually The tube well adjacent houses extended their boundary covering the tube-well like to claim their authority on tube well. Even they have no pond or any kind of natural water source to use. One Respondent (R2, August 2023)

“The Tube-well for ten houses includes me are after two houses from mine. They covered the tube-well with ACI sheet as it is for them only. They don't say no to fetch water from the tubewell but it's awkward to enter into someone's house now and while. So, we fetch water from the other tube-well in front of Mostafa brother's house 8 house back from my house.”

R2, August 2023

Waste disposal and management system is also poor. All houses have their own toilet in their household area built with temporary materials which are unhygienic. The disposal system of the waste is unhygienic too. The wastes are dumped into the adjacent drain which is adjacent to the industrial boundary. As Light and wind remain trapped between the mill boundary and the housewalls, the drain area always remain shabby, smelly and unhygienic. There is no access to the river bank for public from any community of khalishpur as the access is blocked by the heavy industrial zone and gated area. Other public spaces like wonderland, restaurants are not affordable to them usually also. One Respondent (R3, August 2023) said about recreational place as follows.

“We came here before 4 years ago to my brother’s place as my husband died. Before that we used to live in ‘Char Rupsha’ other side of the rupsha ferry ghat. There was enough space for children to play. They bath, swim and play into the river also. But here the river is not accessible, no open space for recreation.”

R3, August 2023

Health, Education and skill: Children goes to the nearby schools of the settlement ex. UCEF School, Satellite Town High School, Khulna Newsprint mill school. The number of the students who can do the further study are very little. Mid age people of the settlement have done their education from 5 to 10 class. It means most of the people of the settlement are literate. According to the population census of 2011 the average literacy rate of the wards in which this settlement is located is 76.94 % (RC and FGD). Household level is 6 inch to 3 feet down from the rail line surface. During rain, water washed away the top surface and flooded the households. To prevent this, they used a barrier of 3inch to 6 inch at the entrance of the



Fig. 11: Children playing on the rail line

Source: Author, 2022

house. But during heavy rain it can’t prevent water from entering into the house.

Safety and security: The middle space of rail line is the main circulation spine of the settlement as well as gathering space. As there is no space for children, they play most of the time on the rail line as shown in Fig. 7. Parents has to keep watch every time their children on rail line. They maintain the time of train-passing to stay safe. One Respondent (R4, February 2023) said:

“What to do? There are no space within the house, no playground or free space within our area. He is only 3 years old and has to play. I have to remain concern and keep remembering the time of train. Even if I forget, the sound of train coming alerts me.”

R4, February 2023

Another problems are drug addiction and criminal activities (Amanullah, 2011) among the young people. Though the number of young children who is drug addicted is lower now, it’s a threat for the parents. As seasonal misery water born disease can be counted. The unhygienic waste disposal system and the wash water of the rain creates ideal environment for germs. Almost 70% of the interviewee has told that they are more concerned about tenure

security and household space. Secured tenure and enough household space is the most demanding sector. Other need will be also fulfilled once these two are achieved.



Fig. 13: People's perception about their involvement with occupation combined

Source: Author, 2023



Fig. 12: People's perception about their involvement with occupation (Left: male; right: female)

Source: Author, 2023

Employment and income: Most of the men work as day laborers in which the chance of getting work daily is uncertain. The income varies from 150tk to 350 tk per day. A few work as casual workers in the jute mills. It also has no guarantee that every day they will get work. Per week income from that work varies from 1400tk to 1800tk. Others usually pull rickshaws and vans, drive autorickshaws, or work as carpenters. An auto driver earns 800tk-1000tk per day but from it, he has to pay the auto rent of 300tk-400tk. Van or rickshaw puller earns daily 500tk-700tk per day and from it, they have to pay 200-300tk per day for rent. Every type of work is temporary. Income is either per day or per week basis. When can't get work or sick the whole family has to suffer.

Women of those families have to work also to support the male in bearing housing expenditure. Majority of working women are housemaid. Nearby housing neighborhood is an opportunity for them. Supply of house maid in housing area of Khalishpur basically comes. In 4-6 houses, women convert their front portion of their houses into a small shop of daily accessories or only of dry foods and chocolates (FGD & PO). The earning from a shop varies from 500tk-2000tk per week. In most cases, it is a contribution to house expenses. A few women sews cloths and of the community people to earn some money and support their family. There are two young girls who teach children of primary school at their home to support the family (FGD). Some families pay them according to their affordability and others get free tuition. There is hardly space for vegetation. Any of the house hold can't raise live-stock because of the rail line. Because the livestock die with train accident before they are grown up. Women and girls do craft work on cloths also. It is also additional to total family income. So, the main occupation of the dwellers of the area more or less can be categorized. from the interview and field survey (Fig. 12).

As the economic condition is not stable due to uncertain income sources and low wages and are socially deprived comparison to the other community communities, it can be said they are distressed in socio-economic aspect. The major threats are the job insecurity and the

eviction with which they have to deal with everyday life. Another threat is the accident, basically a great threat for children. To overcome these threats, improvement the socio-economic condition of the community need to be ensured. The social and economic need of the distressed community can be identified from the discussion stated before. All the identified needs can be categorized into three broad sector as shown in the Figure 8.



Fig. 14: People's perception about threats of the living
Source: Author, 2023

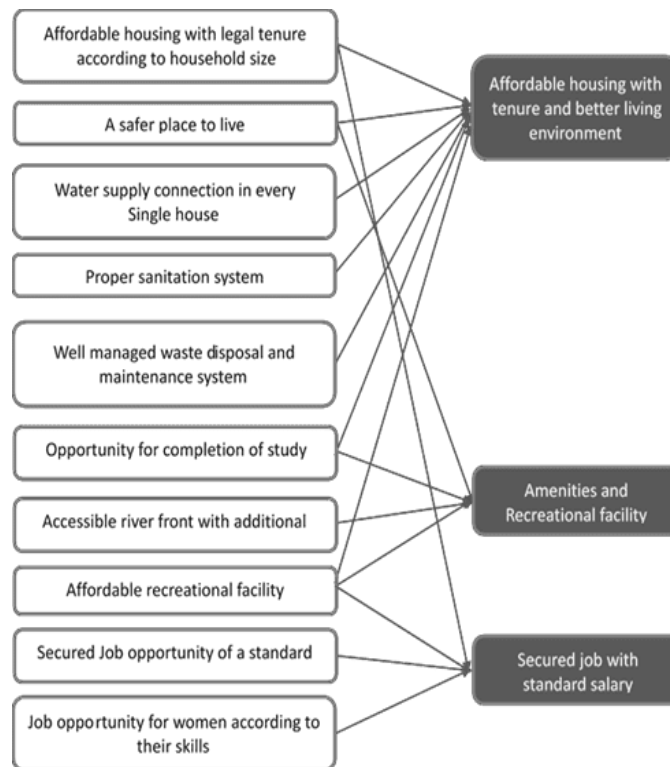


Fig. 15: Categorizing the identified socio-economic need
Source: Author, 2023

Objective 2: The Spatial and Physical Resources of the Brownfield Physical infrastructure of the mill area

Total area of Khulna Newsprint mill is 87.61 acres. The total production area is of 34.43 acres (Khulna Newsprint Mills completes 15 yrs of closure, 2017). The North portion of the area is production zone and the south portion of the area is for housing of the employee and the workers which is 53 Acres (Khulna Newsprint Mills completes 15 yrs of closure,

2017). Institutional zone basically includes the administrative building, hospital, mosque, fire service building, school buildings and the guard rooms beside main entrance (See Fig. 16)

As stated before, the production zone is the most secured and not accessible, anyone who wants to enter needs written permission from BCIC. The housing area is accessible for the dwellers of the mill. The school area is also accessible for the students, teachers and the dwellers. The most active zone is the admin zone compared to the housing area. Anyone can access to the administrative zone.

As there is no access into the production zone, the roads are mostly unused. Only a few security guards get the chance to enter. The portion of housing beside Southern boundary is fully dead area. Nobody lives there, so no one uses the road. But the first road towards the housing zone is the most vibrant road of the area because the housing located there mostly in use of the guards and their family. Maximum “Pucca” road is in good condition and are ready for vehicles also. The paths within the housing area used as shortcut road not paved even are in bad situation. During rainy season those can’t be used. After entering the production zone the right hand side includes the three paper mills, one Grinder plant, two Chipper plant, one building of technical monitoring, one yard and several storages. Most of the structure of the right side like paper mills (See Fig. 17), Grinder plant Technical monitoring building and some storages are reusable after some modification and cleansing. The buildings carry the history of the mill. At the left hand side there were the complementary functions like power plant, water plant, a steel yard for mechanical waste dumping. Power plant produces the power to meet the necessary electricity for production. Water plant reserves the water for the production and supplies it. The dumping zone contains the waste of the chemicals and the waste part of machineries.



Fig. 17: Paper mills at the right side of the production zone



Fig. 18: Housing (good conditioned, partially damaged and fully damaged from left to right respectively)

Source: Google map

The housing zone includes the housing of the workers and the employees. There are two types of housing for workers according to the accommodation system. One is the single unit for the workers without family other is for the worker who lives with family. Both are vacant except some family units. The oldest workers and some guards for security now live in the housing zone. The number of living people are the families of maintenance workers and security guard which is 35-40 people (KPI). According to the construction material there are two types of housing one is container type. Condition of the housing has degraded as they are abandoned and not maintained properly. According to the present condition of the housing building, it can be divided into three category. The first one a few which is in good condition, the less damaged buildings, in which people are living now. The following one is partially damaged which needs modification like painting, plastering, rebuilding a wall. The last one is the fully damaged like buildings with no or broken wall, buildings without roof, doors and windows. These type of housing is the largest number (See Fig. 18).

Khulna News print mill has four jetties of their own for shipping the products, Bringing the wood and raw materials, transportation of the worker from the river side area. Vantor's jetty is almost fully damaged. Others are partially damaged. A few small ships of the transportation are still here. Ships are one the bank or partially damaged. Guards are always there to protect the property from the outsiders.

Utilities and amenities: The utilities and amenities consist of the Electricity, water supply and service functions within the mill area. The mill area has the electricity supply from government from the very first time. Till now the supply system is quite good. Production zone has its own power plant to support the amole need of electricity. Water supply system is also quite good. The worker has the water supply in houses. The container houses have tube-well for drinking water. A pond is also there for the daily need of water. People used to bath and wash cloths their till now. The mill has a school for the children of the workers. After closure the number of student reduced. But now children from community also came there. The school has its own playground and library. Another service function is the hospital. Hospital is not in use now. Since it's abandoned the structure of the building is partially damaged and it needs modification. Along with them there is an administrative building water tank for supply of water, a mosque, "Eidgah" and a fire- service building of its ownof student reduced. But now

Natural resources: The mill area is full of natural resources. After being abandoned there is nobody to harm the nature. Large trees, Shrubs, Open fields are available (See Fig. 19). Among all natural resources, Rupsha river is the most appealing and beneficial. Along with it there are two water pond, two playgrounds.



Fig. 19: Condition of river, Vegetation beside road and central pond

Source: Author, 2022-2023

In the second part, the spatial and physical resources are analyzed to know how the remaining resources can be used to serve the demand of the community. Usable properties has been figured out from the survey findings according to the objective two of the research (see Table 2).

Table 2: Usable spatial and physical resources of khulna Newsprint mill
Source: Author, 2023

Objective	Indicator	Existing condition	Usable resources (buildings and spaces)
Investigating the spatial and physical resources of Khulna Newsprint Mill which could be useful	Physical Infrastructures	Most of the buildings of the left side of production zone are fully damaged and unusable	Vacant land of fully damaged buildings of dead production zone
		The production zone area is fully dead area, not accessible	
		The three buildings of paper mills, grinder plant and some storages are at well state	Free large inner space of the paper mill and plant's building
		The machineries of the mill is large, heavy, nonfunctional and every parts	Production Machineries
		The buildings of housing zone are in threedifferent state (well-stated, partial damaged, fully damaged)	Housing buildings (Well-stated and partially damaged) Vacant lands and used building materials of fully damaged buildings
		Roads are in good state except the shortcuts	Interconnected road network
		Decks of Jetties are partially damaged, not in use	Decks (partially damaged)
	There are many small ships at the jetties fully and partially damaged		
	Utilities and amenities	Electricity and water supply systems are well	Supply of Electricity and water
		Hospital is non-functional	Hospital building
		School buildings are in use but students are decreasing	School building and education facility
		The playground is not open for all	Playground for children
		Fire service building is not in function	Fire service building
	Natural resources	Riverbank is not in use	Large riverbank area
		Ratio of Vegetation is satisfied but no proper	Open green space

Regeneration Framework for the Distressed Community of the settlement around Brownfield

After 16 years of shutdown the area of 50 acres including housing portion and a little of production zone is proposed to sell to the North-west Power Generation Company for power plant of 750-800 Megawatt. But a heavy industry like power plant should not be at the bank of the river. Power plant water discharges are filled with toxic pollution such as mercury, arsenic, lead, and selenium. Water pollution occurs when foreign materials, either from natural or other sources mixes with water, contaminate water supplies (Bhuyan & Islam, 2017). Reopening of the newsprint mill is not possible because the supply of Grewa had been reduced, which was the main ingredients of the production. And the national demand of newsprint paper is covered overall by another paper mill companies like "Bashundhara".

According to the respondents, the opening of “Bashundhara Paper Mill” is the main cause of the shutdown of the newspaper mill, Khulna. Government also had lost money on the project. So this whole brownfield area with it’s all resources should be used for the betterment of the wholw settlement especially for the distressed ones. Since among the neighborhood the linear informal settlement is more deprived from social and economic perspective, their socio economic need is identified. If the identified socio-economic need can be fullfilled using the brownfield resources only then the regeneration will be sustainable.

The usable resources should be used according to the intervention strategies of the research framework to serve the distressed community. In figure 14 the relation between the usable resources and the categorized social and economic need of the distressed community is shown with the modes of intervention. The vacant buildings of the paper mill can be a space of public gathering function or income generation space for mass people. As the previously used building will serve a new function it can be called as adaptive reuse. It can be an option of secured job for the community people according to their skill. As an example a large part of people of the selected community is attached with jute related work. So the whole space of the mill can be a workshop for further production of jute based material or jute craft.

On the other side the housing building which are at well state can serve the community people for their accommodation. The electricity and water supply, education facility, health facilities and others can be ensured the better and safe living environment. Along with it the vacant land of the production zone, deck, green space and the large riverbank can be redesign with recreational and commercial facility to attract public and to give diversified income opportunity to the community dwellers.

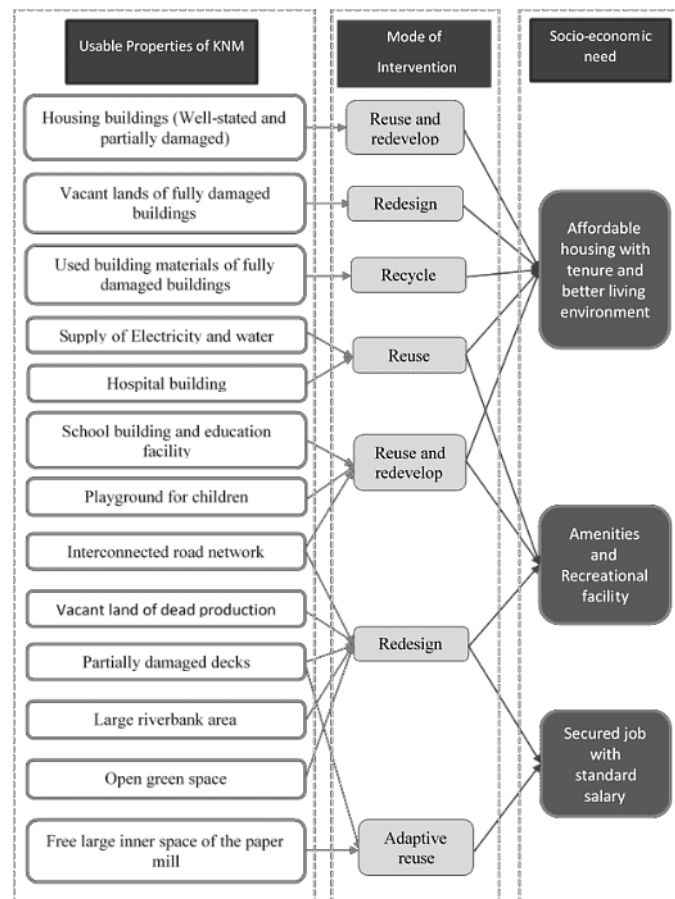


Fig. 20: Regeneration framework of Distressed Community around brownfield (Mode of intervention for using the resources of brownfield to fulfill the socioeconomic need of the distressed community)

Source: Author, 2023

Conclusion

This research examined an urban vernacular settlement in the context of an urban brownfield. Although they have great potentials of development, they are often neglected as shown in this research. Brownfields have huge impacts on the surrounding communities socially, economically and environmentally specifically. They cause multiple deprivations in the neighborhood communities. This paper concludes that the resources of the brownfield in Khulna and the distressed community are interlinked.

Therefore, it is imperative that the brownfield and its resources are used to regenerate the distressed communities. For this, a framework has been proposed, which can be a useful guide for any type of urban brownfield with a distressed community with contextual variables. It offers a designer means as to what to do or what not to do and how to best use the resources. This research contributes to urban design to deal with contextual issues. It encourages the policymakers of Bangladesh to acknowledge brownfields in producing industrial policies.

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Conflicts of Interest

The authors declare no conflict of interest.

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