1. Context of Housing and Hazards

1.1 Introduction

The context of housing in Bangladesh is shaped by the interaction between people and nature, where nature is beneficial but also presents hazards. Indeed, natural hazards (and also man-made ones) are an integral part of life in Bangladesh, all the more so because a hazard only results in a disaster only if people are vulnerable, this is to say: HAZARD + VULNERABILITY = DISASTER. The poverty of the majority of the people places them in a vulnerable position where they are unable to cope with the frequent hazards that they face – thus disasters making the headlines.

What constitutes the nature of the housing of this majority? This is the main question which this chapter seeks to address. Perhaps what sets the tone is the fact that most of the existing housing and houses which are going to be built in the next few decades are likely to be non-engineered. This form of housing is clearly vulnerable to various hazards and thus arises the importance of addressing the need to reduce this vulnerability, in other words, "building for safety"; this is a basic principle behind the deliberations of this book, hence this introductory chapter begins with a general review of this principle. This is supplemented by highlights of some of the key issues facing building for safety programmes.

Following an overview of general principles in this chapter, some selected aspects are then presented to compose a larger picture of the housing context. Firstly, the housing characteristics and conditions of low-income groups are delineated through the findings of a demographic survey. This shows that although both rural and urban housing are vulnerable to hazards, the urban situation is certainly more precarious. Notwithstanding that, because of the preponderance of rural housing, secondly, it has been chosen to discuss some of its main characteristics. A wide array of rural house types, construction methods and building materials are described

here. Thirdly, an important user-group – women – is dealt with, where the significance of their contribution to housing is underscored. Similar to selecting women as a specifically important and representative group relating to housing, the most widely used house building material in Bangladesh – bamboo – is also discussed. The report here of diminishing bamboo supply reflects the broader scenario of an overall reduction in the resource base of natural building materials, posing a serious constraint on building adequate and safe houses, and augmenting hazard-vulnerability. Finally, as an example of unique context within Bangladesh, the housing of ethnic communities in the Chittagong Hill Tracts is described.

1.2 Design, Construction and Building for Safety

From time immemorial, natural disasters have been causing the loss of millions of lives and resulting in colossal damage to the economy. In fact, the terms "natural hazard" and "natural disaster" were used almost synonymously. During the last few years, a clear distinction has gradually emerged between the two. A natural hazard is a "natural phenomenon or a combination of phenomena which threaten people or physical assets" while "a natural disaster is an event, sudden or progressive, which impacts with such severity that the affected community has to respond by exceptional measures" (Carter, 1991). Whereas it is extremely difficult to reduce natural hazards, developments in science and technology have now made it possible to reduce natural disasters, i.e. the impacts of natural hazards. This realisation is reflected in the change in nomenclature of the global efforts now underway to mitigate natural disasters. Originally it was named IDHR (International Decade for Hazard Reduction) when it was first proposed in 1984, but, later on, when it was adopted by the UN General Assembly in 1987, its name was changed to the IDNDR (International Decade for Natural Disaster Reduction).

The housing situation in Bangladesh is extremely poor. According to the 1991 housing census, the backlog in housing was 3.1 million units, composed of 2.15 million units in rural areas and 0.95 million units in urban areas. By the year 2000, the housing shortage is likely to exceed 5 million (GOB, 1996). If we take into account the replacement needs of the rudimentary thatched houses, the target will be much more. About 90% of dwellings in rural areas and about 60% in urban areas are non-durable, which implies that even if they are not subjected to extreme natural hazards, they would have to be replaced within 10-15 years.

Although natural hazards affect developed as well as developing countries, there is a difference in their impact. In the developed countries, improved mitigation measures have resulted in a dramatic reduction in the loss of human lives. For example, a magnitude 7 earthquake in a developing country may result in thousands of deaths, but an earthquake of similar magnitude in a developed country (eg. California in USA) may kill only a few persons. However, the overall loss to the economy is much higher in the case of developed countries. For example, in 1992, Hurricane Andrew caused an estimated loss of US$ 15.5 billion in Florida and the Great Hanshin earthquake in Kobe in 1995 resulted in an estimated loss of US$ 75 billion to physical assets (about 1.6% of GDP).

We have been fortunate that no major earthquake has affected Bangladesh during the last 78 years. The last major earthquake which had its epicentre within Bangladesh was the 1918 Srimongal earthquake which caused a lot of destruction in the Srimongal area and damaged houses as far away as Kishoregonj. A review of the damage statistics of the 1897 Great Indian earthquake shows that most of the brick masonry buildings in Dhaka collapsed or sustained major damage. The effect of a similar earthquake on the city (with a population 65 times more than in 1897), which has a large number of 3-5 storey brick masonry buildings with very little seismic resistance, would be catastrophic now. Moreover, many of these are on fills, with a possibility of ground failure during earthquakes. The traditional light-weight low-rise buildings in the north east part of the country (timber frame with thin bamboo mat walling) had excellent earthquake resistance, but these are unfortunately being replaced by multi-storied brick masonry with reinforced concrete (RC) floors and roofs which are extremely vulnerable to earthquake damage.

1.2.1 Types of Natural Hazards

The various types of natural hazards may be classified as follows :

Atmospheric Hazards

- Tropical cyclones
- Storm surges
- Extra tropical cyclones
- Tornadoes/Thunderstorms
- River floods
- Droughts

Geological Hazards

- Earthquakes
- Tsunamis
- Volcanic eruptions
- Landslides
- Snow avalanches

Other Hazards

- River erosion
- Wildfires
- Locust infestation

It is estimated that about 3 million people around the world have lost their lives during the last 20 years due to natural disasters and around 1 billion people have been affected. The total damage during the period is estimated to be US$ 200 billion. Although all sectors of the economy are affected by natural disasters, destruction of infrastructure constitutes one of the major components of this loss.

1.2.2 Natural Hazards in Bangladesh

Bangladesh is one of the most disaster-prone countries in the world. The major natural hazards which affect housing in Bangladesh are as follows :

- Earthquakes
- Tornadoes/Thunderstorms
- Tropical Cyclones and Storm Surges
- River Floods
- River Erosion

1.2.3 Impacts of Hazards on Housing

The effects and consequences of some of the major natural hazards on housing are shown in Table 1.1.

1.2.4 Review of Present Situation in Bangladesh

Until recently the question of housing for the rural poor has received little attention from national decision-makers. There is currently a shortfall of 3.5 million units of adequate accommodation in Bangladesh. The study titled "Bangladesh 2020 - A Long-Run Perspective Study" (World Bank-BCAS, 1998) has projected a national population of 170 million by the year 2020 (medium growth scenario), of which 110 million will be living in rural communities; so the existing problem of rural housing is likely to increase greatly if it is not addressed as a matter of urgency.

World Bank economists use three economic indicators when assessing individual poverty levels; one of those is the material used in constructing the person's house roof. Figure 1.1 shows the present situation in Bangladesh.

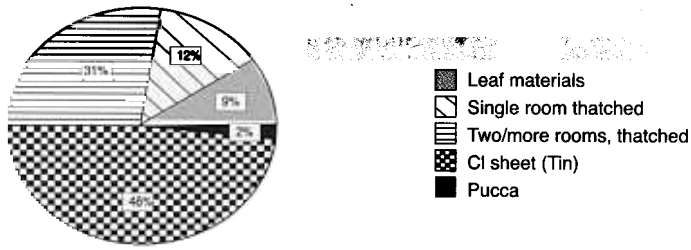

Figure 1.1: Roof Materials Currently Used in Bangladesh

Thus, more than half the buildings of Bangladesh have roofs of natural organic materials. These have a short lifespan of typically less than 5 years, so natural decay is often enough to destroy them without including the hazards. Therefore, low-cost improvements that increase longevity will have a very significant role in developing rural resilience to natural hazards.

1.2.5 Government Policy

A National Housing Policy was approved by the government in 1993 with the prime objective of ensuring housing for all strata of society including the disadvantaged and shelterless poor. However, little action has been initiated to follow-up the above policy objectives. The current five year plan (1997-2002) has been recently approved by the government and includes considerable emphasis on rural housing (GOB, 1997), using inexpensive, affordable materials allied to soft loans for low-income households. For this purpose, a special fund would be created by the government. In vulnerable coastal areas additional grants will help local bodies to further reduce costs to the homeowner. This policy appears to reflect a significant shift of emphasis toward the rural poor. Its implementation could make a major impact on poverty alleviation.

1.2.6 Engineered Housing

Buildings which are designed by competent engineers and supervised by them during construction are termed "engineered buildings". The design is governed by building codes which specify the loads, the design methodology and the details to be followed to enable the structure to resist the effects of natural hazards. In Bangladesh, efforts were initiated in 1973 to analyse the hazards due to extreme winds (Choudhury, 1974) and in 1979, to prepare an outline of a

Code for Seismic Resistant Design (GSB, 1979) but it is only recently that a comprehensive National Building Code has been formulated (BNBC, 1993). The Code includes a wind speed map, seismic zoning map and a table giving the storm surge heights at different locations. The use of these values and the provisions of the Code should lead to construction of buildings which provide adequate safety against natural hazards. The Code also includes detailed recommendations for strengthening masonry buildings against earthquakes by providing horizontal as well as vertical reinforcement.

Hazard	Effects	Impact on Housing
Flood (can be caused by unusually intense rainfall or by changes to earth's surface, such as deforestation upstream)	Inundation	Damage to human settlements : walls may collapse, foundations may fail. Forces evacuation
Tropical cyclone, Tornado, Thunderstorm	High winds	Damage to buildings and other man-made structures: roofs blown away, collapse of walls & frames. Collapse of foundation
Storm surge	Inundation and wave action	Collapse of walls due to inundation; foundation failure; collapse of walls and roof due to wave action
Earthquake	Tremors (ground shaking) Liquefaction Ground failure (horizontal displacement)	Damage to buildings, buildings, particularly unreinforced brick masonry and mud-walled housing. Buildings surface sink into soil Damages buildings on the rupture lines
River erosion	Loss of ground support	Collapse of foundation

Table 1.1: Effects of Major Natural Hazards on Housing

1.2.7 Non-Engineered Housing

Most of the existing housing and houses which are going to be built in the next few decades are likely to be non-engineered, i.e. they would not have the benefit of being designed and supervised by engineers. Most likely, these are going to be designed and built by owners. These are the

houses which are the most vulnerable to natural hazards. Our efforts should, therefore, be directed towards reducing the vulnerability of these non-engineered constructions. Fortunately, during the last few years, a number of projects have been undertaken in different parts of the world aimed at developing techniques for reducing the vulnerability of non-engineered construction against extreme winds and earthquakes (NBS, 1977 and IAEE, 1981).

These studies have identified the following four factors which have a strong influence on the vulnerability of housing :

- Siting
- Design
- Construction Methods
- Materials

Taking all these into consideration, simple guidelines have been proposed for use by non-technical people and are presented in an illustrated booklet titled "43 Rules - How Houses Can Better Resist High Wind" (NBS, 1977). The International Association of Earthquake Engineering has prepared a manual for earthquake-resistant non-engineered construction (IAEE, 1981). By following these guidelines, it should be possible to reduce significantly the damage to housing due to natural causes, leading to a reduction in the loss of human lives and property.

The guidelines mentioned above have been available for quite a number of years. A question may naturally be asked : "Why are these not being followed in practice?". The answer is that the fruits of R&D are not being transferred into the field. As mentioned earlier, most of our houses are designed and built by owners or artisans who do not have access to these booklets. Obviously, there is a necessity for bridging this gap by transferring technology to the people, mostly living in the rural areas, who are actually involved in non-engineered construction. The lessons learnt from "agricultural extension services" may be used in this effort.

The following are some of the steps which may be used :

Translating the guidelines into Bangla, including some modifications to reflect the conditions in Bangladesh.

ii Training of trainers may be arranged by BUET and HBRI

in association with NGOs involved in housing and banks providing micro-credit for housing (e.g. Grameen Bank).

iii Training programmes for artisans (masons, carpenters and other building-related technicians). These may be organised by NGOs.

iv Use of mass media (e.g. TV) to demonstrate good practices.

Figure 1.2: A Flooded Rural Settlement Showing Damage to the Lower Part of Houses

Experience of other countries shows that post disaster reconstruction provides an excellent opportunity for introducing improvements in housing technology. The experience of Tonga may be cited, where, following the 1985 typhoon, a few thousand houses were built using the help of BRE (Building Research Establishment), UK. This has resulted in a dramatic improvement in the building practices in the island.

1.2.8 Housing in Flood-Prone Areas

The obvious measure which may be adopted for flood-prone areas is to raise the floor level above the level of flood-water. This may be achieved by:

a. raising the level of ground on which the building rests
b. building on stilts
c. floating house with floor level rising along with the flood water

The first solution is very common in our rural areas where individual houses, clusters of houses or a whole village may be raised above the flood level by earth filling. However, adoption of this solution throughout the whole of the flood-prone areas does not appear feasible under the prevailing socio-economic conditions. Buildings on stilts are quite

common in the coastal areas as well as along the river banks or roadside ditches (Figure 1.3). The major problem is that, unless properly braced, the unsupported lengths of columns may be excessive, leading to reduced resistance to lateral loads due to wind or earthquake. Floating houses supported on half-cylindrical ferrocement pontoons have been developed in Thailand but appear to be an expensive solution.

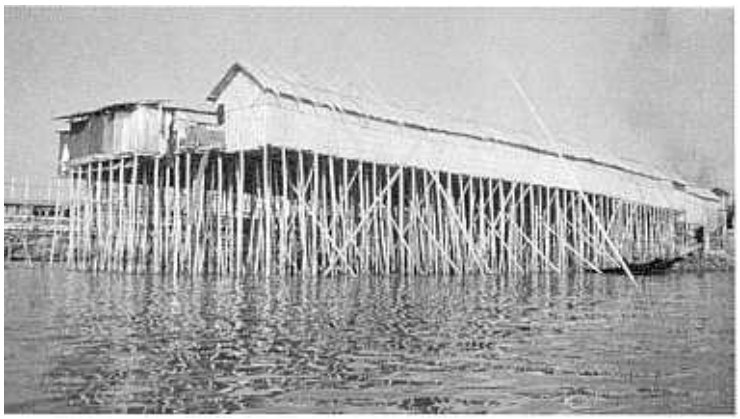

Figure 1.3: Houses on Bamboo Stilts Along Riverbank

Houses on reinforced concrete stilts have been used in areas subjected to storm surge (e.g. Urir Char). However, the cost of Tk. 1 lac for a single room (around 3m x 3m) is beyond the means of most families. A model house on stilts is shown in Figure 1.4. The use of precast prestressed space frames may lead to a reduction in the cost. Moreover, a structure which can be dismantled and re-erected at a new site would enable its use in areas subjected to erosion.

1.2.9 Post-Construction Repair and Retrofitting

Mitigation techniques to reduce the vulnerability of housing to natural hazards can be incorporated most economically and effectively during construction. However, there is a large stock of existing housing which has already been built without adequate protection against natural hazards. Techniques for retrofitting have been developed, particularly for brick masonry and mud-wall housing. These include adding a ferrocement veneer, vertical corner reinforcement embedded in mortar, introducing tie beams and adding buttresses (IAEE, 1981).

1.2.10 Mud-Walling Technologies : Some Notes

Mud walled construction remains common in North Bengal where houses made in this way are vulnerable to the high seismic risk there. There is still work needed in this area.

Mud construction is typically vulnerable also to erosion by both rainfall and flooding. The addition of a straw binder

helps to increase resistance and, in the 1960s, the well-known Egyptian architect, Hassan Fathy, experimented with stabilising mud bricks with straw. A series of tests was carried out at Central Building Research Institute, Roorkee, India, to find out the efficacy of different treatments to increase the durability of mud walls subjected to rain. Treating the surface of wall with asphalt-kerosene mixture was found to be effective. In 1979 a BUET research project followed up CBRI's lead and concluded that spraying mixture of equal parts of kerosene and asphalt at a rate of 740 grams per square metre onto the mud surface provides optimum stabilisation. The cost of that measure would be a mere 28 Taka per 10 sq. m. of wall area.

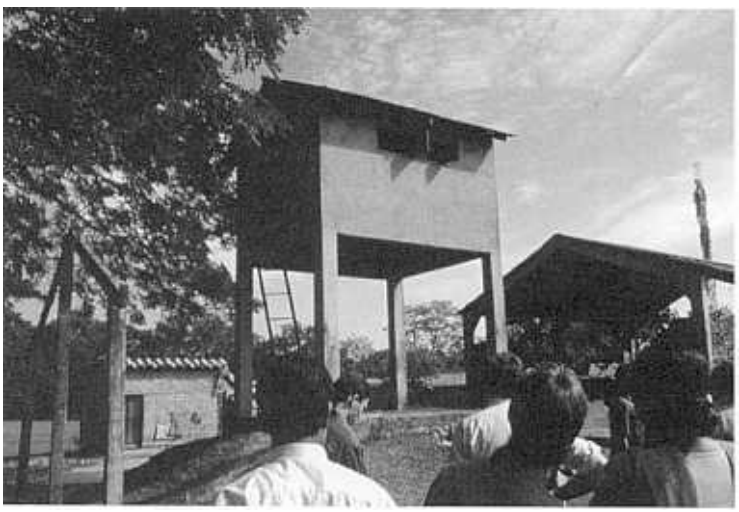

Figure 1.4: House on RC Stilts

1.2.11 Bamboo and Thatch

Bamboo frames are often damaged by the poor quality of the jointing arrangements. Considerable work has been done in the Philippines to develop more rigid joints; that experience should be incorporated into Bangladeshi programmes.

The fire resistance and water-proofing of thatch can both be improved by spraying appropriate chemicals onto the completed roof. Research will show us the most cost-effective and appropriate treatments for improving thatch performance and reducing the serious fire-hazard they present.

1.2.12 Improved Structures

Many NGOs have developed improved model houses. After a tornado devastated villages in Shaturia (west of Dhaka), Enfants du Monde (EDM) set up a programme to distribute their model houses freely to poor beneficiaries. However, when subsequently surveys were carried out to determine

programme impacts, it was found that almost all the distributed houses had been sold by the poor people to relatively well-off people to realise the considerable capital that they represented. This trend has been found by many other similar programmes and reinforces the need for home improvements to be affordable within the means of the owner.

There are particular problems to be overcome in the surge-prone areas where cyclones can generate wind-speeds up to 250 kph and surge waves of 6m or more. Stilted house may be appropriate here, although until now no such solution has found much acceptance. One of the reasons is the relatively high cost (around US$2,500 for one room (floor area 18 sq.m.) on stilts. Another problem occurs in river bank areas where land may be eroded away at any time and demountable houses will be needed. There are thus several particular cases to be considered.

1.2.13 The Way Forward

The 1996 International Workshop on Housing and Hazards generated important recommendations. In particular, the following points should be prioritised:

- Full scale tests on various house-types to enable the preparation of design and detailing guidelines;
- Estimation of costs of improvements;
- Preparation of manuals - these should be written in simple language with pictorial instructions;
- Develop a training programme with workshops for all levels of involvement in the house-building process, including engineers, technicians, craftsmen and owners, with particular emphasis on women;
- Draw appropriate lessons from dissemination successes in other fields such as oral rehydration therapy and agricultural extension;
- Involve NGOs and the mass media such as radio and TV in the dissemination process.

Although Bangladesh is among the most disaster-prone countries in the world, its national efforts have not been significant. A large volume of literature exists. What is now required is a concerted effort to transfer the know-how to people who are actually involved in the design and construction of housing.

1.3 Some Key Issues in Building for Safety

Statistics show that the numbers of people affected by disaster is growing annually by 6%. However, the impacts of a disaster will vary according to the circumstances of the

community affected. For example, in 1993 both Latur (India) and Los Angeles (USA) were struck by earthquakes of magnitude 6.5 (Richter). 8,240 died in Latur while the death toll in Los Angeles was a relatively low 60.

The lesson from the earthquake in Kobe makes another point: this event killed 5,466 and caused damage totalling $100bn. This is an illustration of the way in which property losses are escalating alarmingly. These issues were addressed in the 1996 INDNR theme "Cities at risk".

Much of the death toll from earthquakes results from collapsing masonry and buildings. The reality is that these deaths primarily occur in the dwellings of low-income families. Since such families are normally well below the threshold of engineered structures built by qualified builders, there is a clear need for more community-based training programmes in hazard-resistant housing. The various issues surrounding vulnerability must be examined to determine any social, cultural or maybe political reasons for unsafe practices.

1.3.1 Risk Assessment

In assessing the risks affecting them, a community will need to consider three elements:

1. What preparedness measures are in place or can be developed. Have they the necessary knowledge, resources and authority to put them in place? Who will take responsibility?
2. Are there ways of reducing the risk by, for example, moving homes out of flood-prone areas (or above them on mud platforms) or mitigating winds by the use of wind breaks.
3. Can realistic warnings be issued that will enable the most vulnerable to take effective action before a disaster to mitigate its likely effects.

Building stronger houses is one way of reducing the risks created by a hazard. Building for safety includes better basic construction and the retrofitting of existing structures with strengthening elements.

1.3.2 Building for Safety

The objective of a Building for Safety programme should be to promote community self-reliance and to create a culture of safety. There is no need to make major changes in building technology; indeed this should be resisted, since Bangladesh

and many other hazard-prone countries are littered with failed projects that attempted fundamental changes.

Rather than physical changes in technology, the objective should be to create a team of experienced local builders and craftsmen. Supply of components and materials should be associated with advice and explanation of their uses and benefits so that the culture of safety is built up gradually.

This process should focus on and involve the most vulnerable social groups.

1.3.3 Effective Training

Figure 1.5 illustrates diagrammatically the importance of increasing participation of a participant in effective learning.

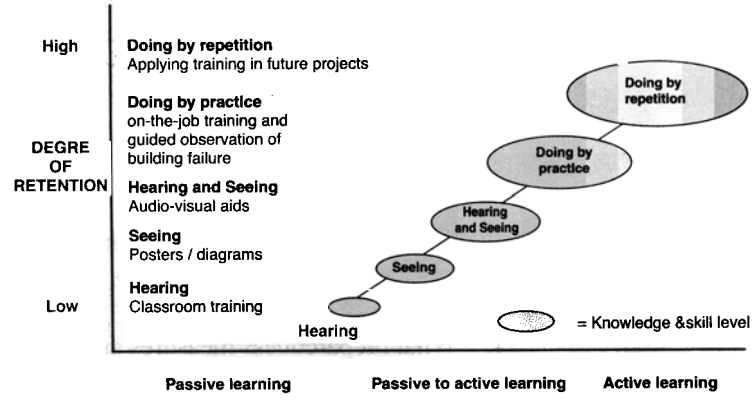

Figure 1.5: Format of Training for Building Improvement Projects (After Asyan et al., 1995)

This diagram highlights the fact that effective learning must be based on direct experience. Therefore, trainees need to avoid class-room based theoretical training approaches. Students retain more of the message for longer by active involvement, ideally including repetition of activities.

Training needs to include everyone - the building users as well as the builders. Conducting building for safety training programmes provides opportunities for incorporating a range of other skill training.

By linking Building for Safety programmes with income generation activities it is possible to enable participants to generate the funds necessary for improving their homes. This has been done, for example, in Anhai Province in China.

1.3.4 Community Based Programmes

Although the risks from earthquakes are not so severe in Bangladesh as those from floods or cyclones, it is still vital to design and construct safer dwellings for poor families. Probably the only way to do this is through community training.

The best time to introduce safe building training is after a disaster as part of the reconstruction process. This time presents a unique window of opportunity. Probably the next best time to introduce improvements will be when new dwellings are being built. However, the most difficult thing will probably be to address the need to make existing buildings safe. This is expensive and socially disruptive as well as often technically difficult.

To be effective, training needs to be experiential - where advice is given on the job - rather than in a passive class room situation. Community-based training in building safety is best organised in conjunction with other opportunities for developments in leadership, skills, local preparedness planning and income generation as new skills in building can be marketted and general community development is seen as a positive outcome of the process (Figure 1.6).

Figure 1.6: Community-Based Training Workshop in Dinajpur

Here, it has been challenged that the most effective way to build houses for low-income families in hazard-prone areas is by using building contractors. Building for Safety community-based programmes may take longer than those undertaken by large building firms and they may be less tidy. Also, opposition may be expected from vested interests in modern technology, such as contractors. However, community programmes offer significant benefits, in terms of social gains, which decision-makers should consider very carefully.

1.4 Low-Income Housing Pattern

Low-income urban and rural communities are the primary victims of natural hazards here in Bangladesh, as in other developing regions. Therefore, investigations have to be made to understand the process that creates this state of vulnerability of the low-income community and its influence on the housing pattern of these people.

1.4.1 Method of Study

The study aims at investigating the process leading to the vulnerable housing pattern of low-income rural and urban communities. The study, therefore, is based on relevant data collected through a field questionnaire survey.

1.4.2 Questionnaire

In preparing the questionnaire the following things were considered: (i) the difficulty of the field questionnaire survey exercise, (ii) length of the questionnaire, (iii) simplicity of the questions asked, and (iv) the circumstances in which the questionnaire would be completed. A typical questionnaire sheet (translated from Bangla) used during the field survey is presented in Table 1.2. Questions were asked regarding the respondent's profession, place of residence, housing type, rent/ownership status, length of stay, number of family members, experience of hazards, reason for living in a hazardous house, efforts to improve housing safety, whether benefited by any government/official help, daily income and age.

Survey area (to be completed by the surveyor):
Person surveyed is Male/Female (to be completed by the surveyor):

Survey Questions:

1. What do you do for a living?
   (Permanent/Temporary job, Professional/Casual labour, type and duration of work)
2. Where do you live?
3. What type of house do you live in?
4. Are you Tenant/Owner of the dwelling place?
5. How long have you been living in this house?
6. How many persons are living with you?
7. Is your house safe from flood and storm? What type of difficulties have you faced so far?
8. If it is not safe, why do you live in this house?
9. How did you rent/build this house?
10. Have you ever asked the owner of the house to make it strong? Why didn't you strengthen it yourself?
11. Does any leader or officer ask you about your welfare?
12. How much do you earn daily?
13. Your age, please.

Table 1.2: Questionnaire Sheet

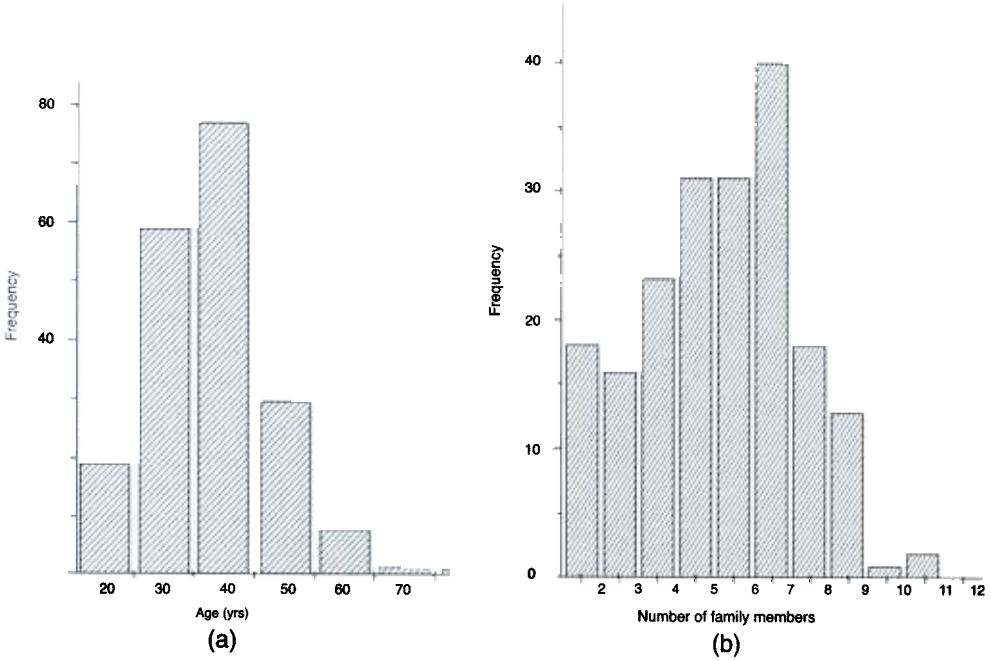

Figure 1.7: (a) Age Distribution of the Respondents, and (b) Number of Family Members of Respondents' Families

1.4.3 Data Collection Area

While the ultimate target was to cover a few regional cities of Bangladesh and a number of rural regions in different corners of the country, due to financial and time constraints, the areas covered were the Dhaka City area and rural areas including Char Hijli, Char Motto, Gopalpur, Dashara, Bhabanipur, Malancha and Bolta of Manikgonj district. However, cross-section of most of the low-income target groups has been covered in the questionnaire survey.

1.4.4 Analysis

A total of 198 low-income persons have been interviewed with only about ten percent female respondents; one can well understand the difficulty of interviewing women in this conservative society. The respondents' age distribution has been presented as a frequency histogram in Figure 1.7(a). It can be observed that the majority of respondents are in the 30-40 years age band. The number of family members of the respondents has been presented in another histogram in Figure 1.7(b). This reflects the well-known low acceptance of population control measure among this group. It can be seen that the majority of the families are of 5-7 members. Having this sort of family size and an average daily income

as shown in Figure 1.8 as a frequency histogram, one can easily imagine the financial hardship of these low-income communities. For the majority of families the average daily income is in the range of Taka 50 to 100 and for the rural subjects it is only about Taka 50. It is understandable that with such a low income level, it would be difficult to save much for housing cost/improvement after meeting other household costs.

The occupation of respondents is shown in Figure 1.9. Here it can be seen that the majority of respondents are rickshaw-pullers and hawkers with a considerable proportion of daily labourers. Other groups covered are earthworkers, small shopkeepers, servants/maids, street children and sweepers.

1.4.5 Housing Pattern

The analysis of survey data shows that about 90% of the low-income respondents live in rented accommodation, while only 12%, especially in rural areas, own their accommodation. This reflects that the low-income urban community is mainly composed of a migrant population. The respondents were also asked about their duration of stay at their present places and this is presented as a frequency histogram in Figure 1.10. It can be observed that more than three fourths of the respondents were living for less than five years at their present address. The subjects were also asked about the hazards they had faced in their houses. Almost all the respondents admitted that they have faced one or more hazards. The types of housing hazards experienced by the respondents are presented in a frequency histogram in Figure 1.11. It can be observed that majority of these poor people suffered from floods, rainwater logging and leaking of rainwater through roofs. A water-logged low income settlement is shown in Figure 1.12. A considerable portion also suffered from cyclonic storms while only a few suffered from fire hazard. The types of housing for low income people are presented in a frequency histogram in Figure 1.13. Here it can be seen that only a few live in brick-built pucca houses, especially, domestic workers/maids; most of the respondents live in *sapra* type unsafe houses made of bamboo, polythene, thatch/leaves and occasionally having metal roofs. When asked why they had chosen such places of accommodation, more than half answered that they have no other places to go to or to take, indirectly reflecting their financial and social vulnerability. But a considerable proportion (about 30%)

blamed their financial hardship for choosing their unsafe and cheap accommodation. About 10% of the respondents answered that they lived there as these were their familiar places.

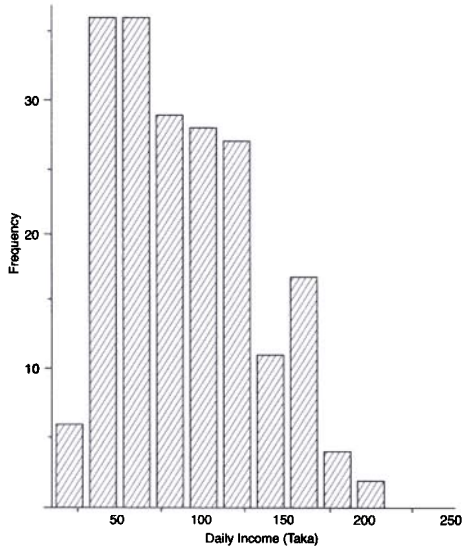

Figure 1.8: Histogram of Daily Income of the Respondents

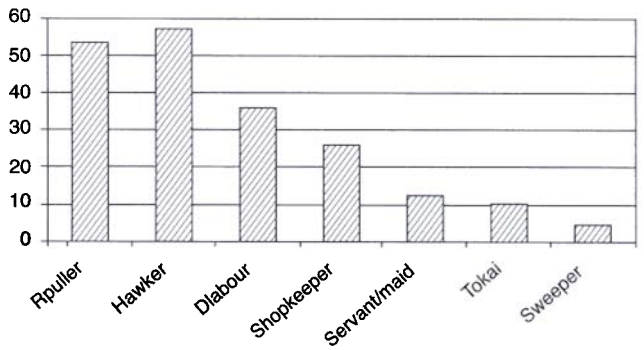

Figure 1.9: Occupations of the Respondents

Note: Rpuller means rickshaw-puller, Dlabor means day-basis labourer

The respondents were also questioned whether they had asked their landlords to make their house safer; only about 23% percent answered in the affirmative. The rest were either afraid or did not bother to ask. But the rural community with dweller-ownership invariably blamed their financial hardship for not having improved their houses which normally were constructed by them with partial involvement of local artisans. They admitted that they solely depended on the artisans for any sort of safer construction technique. However, the group in urban areas which had solicited the landlords, did not achieve any better housing condition other than experiencing

the red-eye of the landlords or their hoodlums. The majority of the subjects opined that they were almost bound to accept what their landlord/employer offered them; this also reflects that the low-cost houses, especially in Dhaka, were not enough in number to meet the growing demand of migrants. When asked whether any political, community or government members have inquired about their well-being, only about 5% answered in the affirmative. A portion of the respondents also admitted the occasional armed threat in their neighborhood to establish the sheer authority of landlords.

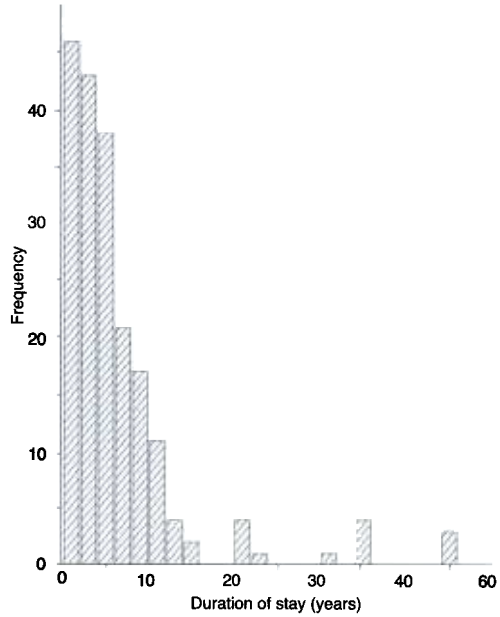

Figure 1.10: Frequency Histogram of Duration of Stay at the Respondents' Present Dwelling

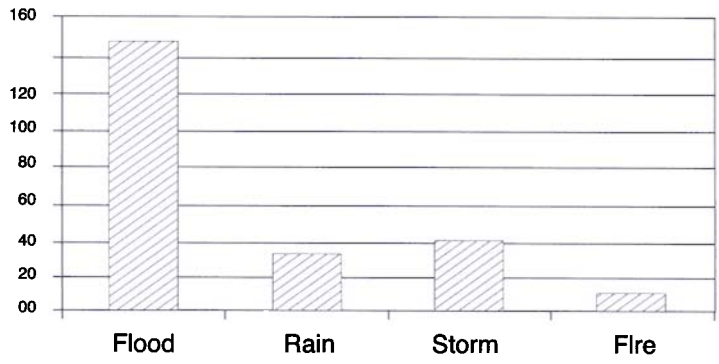

Figure 1.11: Frequency of Types of Experienced Housing Hazards

1.4.6 Implications

It has been found that the factors influencing the low-income housing pattern were: ownership of the land/house; government/community regulation scheme; duration of stay at

a certain place; income level; familiarity with a certain area; and work requirements. This study has revealed that there is a serious lack both in the people's attitude and in commitments from political/community/government side for ensuring reduced hazards in the house. In addition, government level inspectory regulation is necessary to ensure minimum level of safety in low-income housing. In rural areas, where a significant portion of low-income people own their dwellings, they can be benefited by local artisans well-trained in the low-cost safer house building techniques. With an average daily income of only Taka 50, they need a government/non-government organization-managed housing finance scheme in order to improve their financial capability for safer housing. Also, a campaign to increase the safety awareness of these low-income communities will go a long way towards the target of reduced hazards in their housing.

Figure 1.12: A Water-Logged Low-Income Settlement

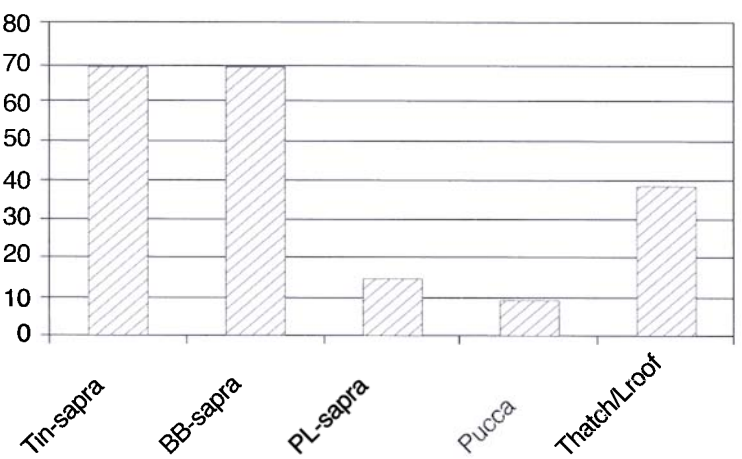

Figure 1.13: Types of Housing of the Respondents

Note: BB means bamboo, PL means polythene,L roof means roof made of leaves/thatch

1.5 Rural Housing Typology, Construction Technology and Indigenous Practices

Housing is a more complex commodity than most people realise. Safety and comfort are still the basic essentials for housing. Housing is a composite social entity. There are single family houses, duplexes, apartments, row houses, permanent, semi-permanent and temporary houses. A housing environment can be an index of the social health, happiness, social justice and dignity of the inhabitants. Housing has multifaceted economic and social characteristics and it also has social benefits. Housing can contribute to community development by improving equity and efficiency in society. Income earning opportunities can be improved by locating low-income housing areas near employment concentrations.

1.5.1 Rural Housing in Bangladesh

About 80% people of Bangladesh live in rural settlements and 86% of the dwelling units are located in rural areas (GOB, 1993). There has, however, been very little public sector involvement in rural housing. There is virtually no land use plan for the rural areas of the country, which comprise about 85 percent of the total land area. The present facilities in respect to housing and physical infrastructures are very inadequate in the rural regions of Bangladesh (GOB, 1997). Traditionally, rural housing has been taken care of by the villagers themselves. The government could not make any significant contribution in this respect except from the distribution of some building materials, as relief measures in areas ravaged by natural calamities, such as flood and cyclone (Hasan, 1991; 1998).

Because of the subsistence nature of the economy, 85% of the dwelling units in the rural areas are in the form of shelters, which do not provide adequate protection from wind, rain and flood. Presently, there is only one tube-well for every 105 persons to supply drinking water in the rural areas. The sanitation coverage in the rural areas is only 36 per cent of the population (GOB, 1997). Due to the natural process of wear and tear, lack of repair, and due to the poverty of the rural population, rural housing conditions have deteriorated seriously. At present, about 30% of the rural families do not have their own homestead. They live in 'Ijmali' (shared properties), mortgaged or rented homesteads. The majority of the houses in rural areas are built inadequately in terms of structural qualities (GOB, 1993). The housing shortage in the rural areas is increasing rapidly, and it is projected that this shortage might exceed 5 million units by now, if the current trend continues (GOB, 1997).

1.5.2 Some Important Characteristics

In rural Bangladesh housing processes are more vernacular in nature which evolved through ages. Housing types developed in the rural areas in relation to the physical environment, socio-economic and cultural development. The cultural change which followed the Industrial Revolution in most developing countries has had little impact on the traditional way of life; thus little impact on the housing processes in the developing world. Only recently, an accelerating growth of population in a number of developing countries has brought about a change in some of the associations of the functional characteristics of housing for accommodating more population in limited housing space inherited though generations. An example of such a change of this type is the use of courtyard in rural farm houses which was formerly an essential part of these houses for its manifold uses (e.g. for better air circulation, recreation and for household and other farm related functions). The courtyard has functional utility for husking of cereals, drying of jute fibers, clothes, etc. This space is gradually being decreased by the construction of new housing units and many of the post-harvest operations are being performed now in mills or even on the roadside.

1.5.3 Design Process

Physical control is quite apparent in the housing processes in rural areas. Land level is one of the major criteria in selecting housing site. Bangladesh is predominantly a flood plain/delta terrain. For this reason, a major part of the high lands are preferred for building a house. Where high lands are not available or scarce, as in the Haor areas, houses are built on artificially raised ground. Moreover, the availability of housing materials and their regional differences have an impact on housing construction and design. Climatic impact characterizes the roofing design of rural houses. Pitched roof is the common design to drain off rainfall quickly.

Social and economic determinants of the housing processes encompass a number of factors, such as the income, status and size of the family in the household. Besides, a number of cultural practices influence the design and form of a house, particularly, the orientation or location of individual housing units. For example, sleeping units in the households are generally made south-facing by both Muslims and Hindus (two major religious groups of Bangladesh), while kitchens are normally constructed west-facing. The Hindus have the

tradition to build cattle sheds and latrines away from the housing complex. However, in some parts this practice is also common among the Muslims. The salient features of a typical rural house is shown in Figure 1.14.

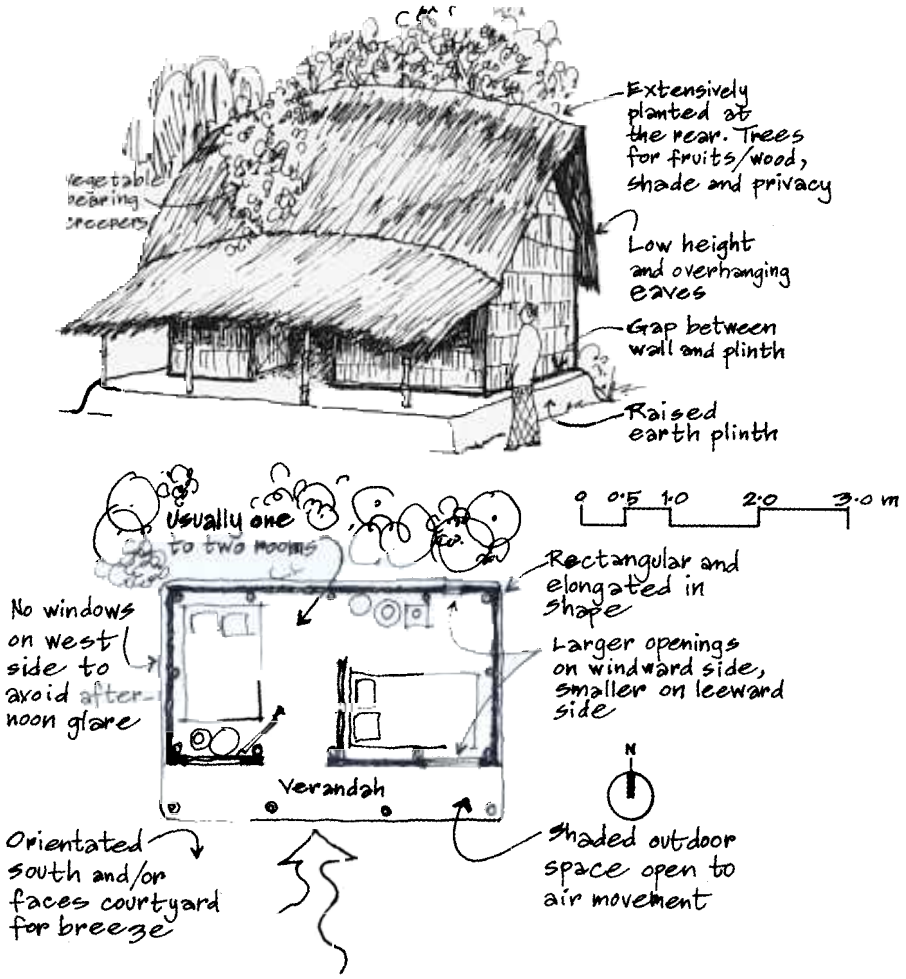

Figure 1.14: Salient Features of a Typical Rural House

1.5.4 Housing Layout

The house is the symbol of position and status among the rural inhabitants of Bangladesh. Thus housing design varies according to socio-economic status of the household. But this might not be the rule, since often the houses are generally inherited and their structure and design tend to be the reflection of aspiration and status of the ancestors. Nevertheless, large farmers usually possess a more elaborate housing structure than those economically less well off.

A house in rural Bangladesh may consist of one or more rooms, depending mainly on the socio-economic status of the owner. Rooms are different in sizes and shapes, though rectangular is the common shape. Housing units /rooms are constructed around a rectangular or square courtyard (Figure 1.15). In order to get rid of smells, it is regarded sanitary to build the cowshed and latrine away from the main housing area to one corner of the housing perimeter. Kitchens, normally smaller in size, are built separately. In dry seasons and among the poorer families, cooking is usually done in the courtyard and the space is rarely roofed. Kitchen, cowshed, poultry pen and latrine are less emphasized in the total housing layout, as are reflected in their inherent designs and locations. These are usually built of inferior materials and are also poorly constructed.

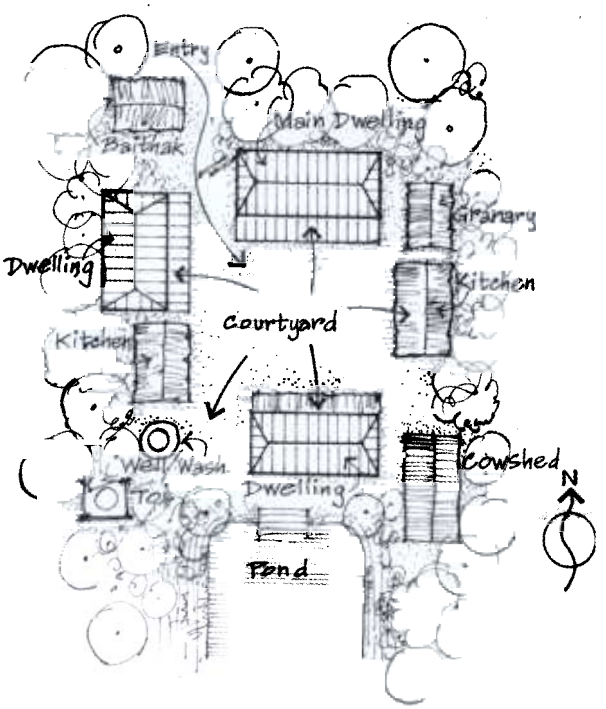

Figure 1.15: A Typical Courtyard Layout of a Rural Homestead

In some parts, as in northern and mid-western Bangladesh, the houses in rural areas tradionally have inner and outer courtyards. This practice exists in favour of the farmhouse operations. Since such households belong normally to large farmers, they compose a self-reliant functional entity. But more recently, as a result of the pressure of population on land as well as the development of community and village-based

commerce and agricultural services, this tradition is gradually eroding. In some parts of the country, especially in the south, a pond is an essential part of the house and has manifold uses. A house is surrounded by perennial trees giving protection from sun, storms and cyclones and they also offer some degree of privacy. A house often has a boundary wall to ensure privacy of the inmates, which is normally made of bamboo, palm leaves, straw or corrugated iron sheets, etc. depending on the social and economic status of the owner. In some areas, as in northwestern Bangladesh, rooms are built around a courtyard instead of a wall for maintaining privacy for the household. A typical rural homestead is shown in Figure 1.16.

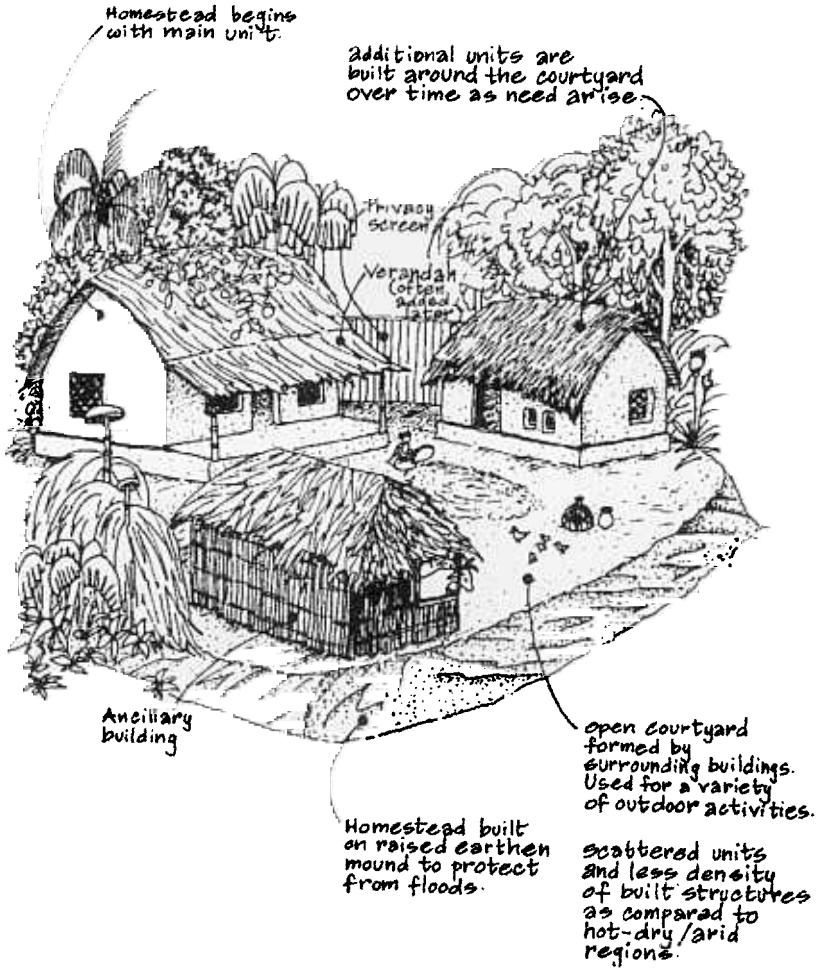

Figure 1.16: Salient Features of a Typical Rural Homestead

1.5.5 House Form

The form of a house manifests the complex interaction of many factors, which is revealed in variations of the construction designs. The family owning a house made of corrugated iron sheets (CI sheets) is very common in rural areas. There are variations in the design and size of CI sheets. Shape of the roof is related to the status and wealth of the family (Figure 1.17). Roofs with fours facets of CI sheets, *chouchala* (four pitched) and with two facets, *dochala* (gabled), show two major variations in the design and indicate the position of the farmer in the rural society. The high roofed *chouchala* with an attached verandah is aesthetically more attractive than a same sized *dochala* house. The rooms in these houses have high windows. The plinth of these types of houses are sometimes made of cement. Two-storied houses built with CI sheet built house, although very rare, are highly prestigious in rural areas. Such houses, which are made of mud/CI sheets, are owned mainly by affluent farmers and households.

Figure 1.17: Typical Roof Forms of Rural Houses

1.5.6 Amenities and Services

Amenities and services such as water supply, latrine, sewerage, drainage, electricity, etc., do not seem to have priority in the housing structure in rural Bangladesh. Natural sources of water are still vital in rural livelihood, but other sources, such as tubewell and dugwell, are gradually being considered important nowadays. About 54 percent of the households use a pond as

general source of water followed by tube well (21 percent). Drinking water is mainly fetched from tube-well (53 percent) followed pond (21 percent). About one-third of the rural houses do not have any arrangement for latrine. Most houses do not have any drainage facilities (GOB, 1997).

1.5.7 Construction Materials and Technology

Houses in rural areas are mainly made of locally available indigenous materials such as bamboo, straw, grass, jute sticks, *golpata* (palm fronds), mud and CI sheet. The wall is made of straw, jute stick, bamboo, mud and CI sheets, while thatch or CI sheet roofing, and sometimes roofing with tiles is used, as in some parts of Rajshahi, Kushtia, Bogra and Jessore. Bamboo is widely used as a common house building material.

CI sheets and thatch/leaves (like golpata) roofing is found in majority of houses in rural Bangladesh. In most cases the floor is made of mud (i.e., *kutcha*). Cemented floor, brick built wall and concrete roofing (i.e., *pucca*) used to be rare in the rural areas of the country. However, pucca buildings are increasingly becoming common in many villages of Bangladesh. Previously, the houses of the big landowners and the former zamindars (landlords) were mainly included in this group. Brick built mosques or temples are not uncommon in the country. About 35 percent of roofs of rural houses are built of strong materials which range from cement and mortars to CI sheet and wood, and only 13 percent of the walls of the housing units are made of permanent and semi-permanent materials, such as CI sheet and cement/brick. A large proportion of dwelling structures in the rural areas is temporary in nature; this type of construction is called 'kutcha'; it accounts for about 80 percent of the total rural houses. The physical conditions of most of these may be described as moderate to poor (GOB, 1997).

It has been observed that straw and bamboo are the most commonly used building materials in the construction of housing in rural areas of the country. These are used as the chief construction materials for walls. Straw, and bamboo form the main housing materials for the construction of both wall and roof. In Pabna and Sirajganj districts CI sheet is mainly used for construction of walls. In Dhaka District, the use of cement and brick is quite common as materials used for both walls and roofs, perhaps due to the nearness to the capital city and also to relatively better economic condition of the inhabitants as a result of the degree of urban exposure.

Cement and brick walled house is also prevalent in the border regions of Jessore district, which may be due to long settlement traditions adjacent to old human habitats near to West Bengal. In this area, mud-walled and tiled-roof houses with spacious courtyards are also quite common.

Mud/kutcha brick is commonly used in the walls of the houses in some parts of north Bengal where the elevation is above flood level and the soil has the right characteristics for brick-making. Similar houses are also prevalent in Kushtia District where the house are built with high plinth and spacious verandah and have an inner courtyard to accommodate storage units. Tiles are predominantly used for roofing of houses in Naogaon district and also in western areas. CI sheet forms the common material of houses in southern Bangladesh (Hasan, 1999).

The above description portrays only the key characteristics of building materials in rural Bangladesh, and some exceptions are not unlikely. However, the generalised picture of the materials used for housing can be broadly classified under: (a) *kutcha,* (b) semi-*pucca,* (c) *pucca.* It should be noted that the pattern obtained through the categorization of rural dwellings into these three main classes closely follow those obtained earlier.

1.5.8 Rural House Types

In the plain lands of Bangladesh, although there is more similarity than difference in geographic conditions, there are some variations in housing characteristics. Houses are often constructed of organic materials and have varying sizes and shapes. The majority of these houses is temporary in nature. In the rural areas of Bangladesh, the following types of houses are commonly found in different parts of the country (Hasan, 1999).

1.5.9 Bamboo Walled Houses

In some areas in the eastern and northern part of Bangladesh, the houses are mainly bamboo walled, with thatched curved roof built on high plinths (Figure 1.18). Shapes are predominantly oblong.

A small verandah with wood or bamboo support is the common design. Plaited bamboo plastered with a thick layer of mud is often used for walls for house construction in southwestern and northern parts of Bangladesh. The same type of housing style is also common in the islands and in the coastal regions of Chittagong. In the latter case, the only difference is found in the roofing design, which is usually

constructed as double facet and the main roof is separated from that of the verandah. The houses are mostly one and a half storied in height. In the rural areas, in and around Dhaka, Narayanganj, Chandpur and Pabna, bamboo walled houses with CI sheet roofing are quite common.

Figure 1.18: Bamboo-Walled House

1.5.10 Mud Walled Houses

The northwestern regions of Bangladesh have a distinctive characteristic of mud-walled housing. Oblong shaped mud walled houses with thatch and tile roof are common in Bogra, Pabna, Khushtia and Jessore. In Chapai Nawabgangj, the roof of a mud walled house is moulded by brick dust mixed in with lime, which is peculiar to this area. In the region from Bogra to Kushtia, mud-walled houses with CI sheet roofing are another common type. Relatively taller mud-walled houses of about 15 feet high are found along the southwest border of Bangladesh. Bamboo fenced outer boundary walls of houses is the characteristic housing feature of the region between Darshana and Jessore. Above flood level land, relatively less rainfall and dry climate, and the lateritic soil are the main reasons for the development of mud walled housing structure in these regions.

Mud-walled houses with two to three level roofs are common in Chittagong region. A two-storeyed mud-walled house is shown in Figure 1.19. The walls are made of sun-dried mud of one to two feet thickness. The heights of these houses can vary: one type is about ten feet high, and the others are around double its height. The roofs of the house are thatched, tiled or made of CI sheet.

1.5.11 Timber Houses

A relatively small population group of Bangladesh build timber houses. In the Mogh communities of Cox's Bazar, Teknaf and Moheshkhali, timber houses represent a different

cultural heritage with distinctive architectural tradition. The houses are normally built on a wooden platform above the ground, to keep away poisonous snakes and ferocious animals. The reasons for this may lie in the existence of forests in surrounding regions, which are infested with wild animals and reptiles. These forests also provide ample timber for house construction. The space beneath the platform allows free airflow, and is also used for various household purposes. The houses are generally painted black, and have woodcarvings on cornices and doors (Figure 1.20).

Figure 1.19: Two-Storeyed Mud-Walled House

1.5.12 Timber and Brick Houses

In the eastern part of Sylhet, often the floor, bottom section of walls and the plinth are made of brick, and the rest of the wall is made of reed or bamboo matting, plastered with cement or mud on both sides. These houses have timber frames and columns. The roof is normally made of CI sheet or straw. Figure 1.21 shows a timber and brick house.

Figure 1.20: Timber House

Figure 1.21: Timber and Brick House in Sylhet

1.5.13 Corrugated Iron (CI) Sheet Houses

In regions, especially in the north-eastern part where rainfall is very high, houses with CI sheet roofing are very common. Figure 1.22 shows a CI sheet house. The development of this house may have its origin in the British colonial past, when such houses were built in tea plantations and for administrative headquarters. These houses also provide effective protection against heavy tropical rain, and the sheets are damp-proof, light, and durable.

In north-eastern Bangladesh, particularly in Sylhet, houses have boundary walls made of CI sheet or bricks. Some of the boundary walls are colorful and have high gates, which are considered prestigious in this region. Often the owners of these houses reside abroad, mainly in the UK.

Figure 1.22: CI Sheet House

In the southwestern part of Bangladesh; in Faridpur, Madaripur, Barisal, Patuakhali and Bhola, CI sheet houses are also

common, where sheets are used both for roofing and wall construction. In central Bangladesh, such as in Dhaka, Comilla and Mymensingh, CI sheet is mainly used for the roof, while mud or mud blocks are used for walls (Figure 1.23). In the southern part of Khulna, especially in the Sundarban region, *golpata* (palm fronds) is commonly used as a roofing material for bamboo walled houses.

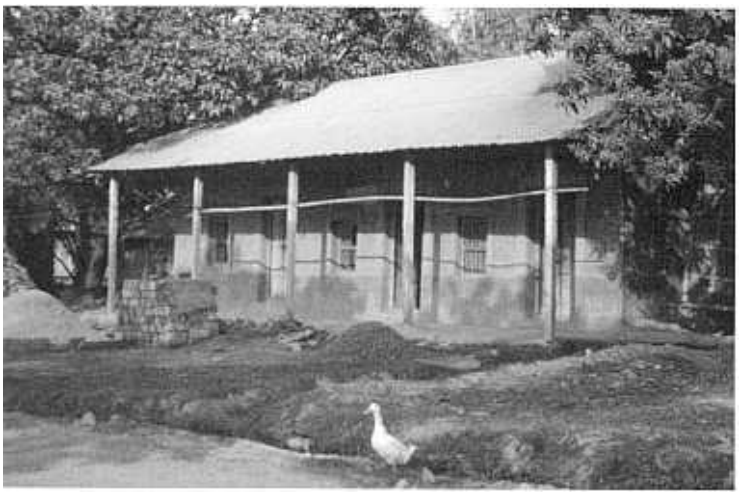

Figure 1.23: House with Mud Walls and CI Sheet Roof

1.5.14 Thatch/ Straw Houses

In the *Haor* basin and in areas along major rivers of Bangladesh, organic building materials such as reeds, long grass, thatch, and jute sticks are widely used for roofing and wall construction. This is mainly because reeds and long grasses are abundantly available in *char* areas and on riverbanks. Moreover, these areas are often flood-prone and subject to various hazards and risks like river bank erosion, which forces people to use cheap materials for house building. Figure 1.24 shows a typical thatched house In relatively flood free areas, such as in Bogra and Tangail district, temporary roofing materials like thatch or long grass are used upon mud walls.

1.5.15 Indigenous Practices in Rural Housing

In rural areas of Bangladesh, the housing processes are vernacular in nature, which evolved through ages. These housing processes manifest the agrarian economy of the country, and have developed in relation to its physical and cultural set up. Rural houses are generally constructed of locally available indigenous materials, and these are characteristically less variable. The majority of rural houses are apparently temporary in nature, particularly with respect to the materials used for their construction (Hasan, 1999).

Vernacular building forms are well developed in rural Bangladesh, but these are undergoing rapid changes because of industrialized building materials. The use of corrugated iron (CI) sheets has become quite popular and widespread, and the production and use of traditional building materials is diminishing consequently (Ahmed, 1994). Vernacular architecture in rural Bangladesh has evolved corresponding to its main physiographic regions. A number of techniques for house building using indigenous materials exist in the country. The layering technique involves building with large earth blocks or sun-dried bricks. There is another commonly used technique, which is plastering bamboo mat walls with mud. This method adds sturdiness to the otherwise flimsy though highly developed bamboo construction techniques (Ahmed, 1994).

Figure 1.24: Thatched House

As discussed, different kinds of indigenous practices are found for house construction in rural areas of Bangladesh. In the northwestern region, particularly in the Barinda highland, houses are often made of mud and earth. At first, mud is collected and kept in a mound and wetted regularly by pouring water. The people themselves soften the mud by pressing it with feet. In the end, the softened mud is placed at different layers for building the walls of houses. In some areas, particularly in the southwestern region, construction of houses with sundari tree as support material and *golpata* as shading material is very common. At first, the frame of the house is made using sundari planks or poles of different thickness. Outside cover is then attached to this frame. The choice of building materials for this depends upon

affordability. Some people use galvanised iron (GI) sheet, some use thatch, and some use bamboo mat or wood. Often the bottom portion of the walls is constructed of 5-inch thick brick walls (sometimes the entire walls). For rural housing, the common practice in most areas of Bangladesh is to use a bamboo frame. Bamboo poles are first dug deep into the ground and then fixed strongly by compressing earth around the bottom of each pole. Then transverse bamboo rafters are tied to the vertical poles. These are tied either by steel wire or rope. Finally, the frame for the roof is made. In the end, different kinds of materials are used for covering the frame. For example, CI sheet can be used for both walls and roof. Bamboo mat for walls and CI sheet for roof. Alternatively, bamboo mat for walls and either straw, grass or thatch can be used for roof. A number of indigenous construction techniques are also found in the rural areas of the country. Phasing construction over a period of time is very common. Often the walls and frame of the house are constructed in one season or year, and the roof is made in another year or season. Upgrading or extension of the house over time is another common practice. Often thatch roof is replaced by CI sheet roof when households have enough money at hand. For rural houses, the common practice is to build a one-room house first. Then incremental additions are made to the house: e.g., a few more rooms, a verandah, a permanent kitchen, or better quality windows are added. However, the toilet is generally placed a little away from the main house. Attached toilet is still very uncommon in the rural areas of Bangladesh. In rural areas, most of the houses are placed around a courtyard. This inner court provides light, ventilation, seating and cooking area and a private space for family members. This is a very vernacular, fundamental and indigenous concept of house building in the country, and has been practiced in Bangladesh from generation to generation.

1.5.16 Prospects

Housing processes in the rural areas of Bangladesh are more vernacular in nature than in the cities. They have evolved over a long period. Houses are often constructed of organic materials and have varying sizes and shapes. In some areas in the eastern and northern part of Bangladesh, the houses are mainly bamboo walled with thatched curved roof built on high plinths. The north-western regions of Bangladesh have distinctive characteristics of mud-walled houses. A relatively

small population group of Bangladesh build timber houses. In north-eastern Bangladesh, particularly in the Sylhet region, houses have roofs and walls made of CI sheets or bricks. In the southern part of Khulna, especially in the Sundarban region, golpata is commonly used as a roofing material for bamboo walled houses.

In Bangladesh, very little government attention is given to rural housing except for a few NGO assisted houses. Still the housing situation in the rural areas of Bangladesh is by far better than in the urban slums and squatter settlements. One important reason can be that rural householders are generally the owners of their homes. Therefore, they try to maintain and clean their houses as much as possible within their affordable limits. But in urban slums and squatter settlements, occupants have very few rights on the houses where they live. Unfortunately, in recent times, there is a phenomenon of rural slum formation in many areas of Bangladesh. Increasing population density, lack of space for house construction, dwindling land-to-man ratio, and persistent poverty are the main causes for such development. The government could come forward to provide land (particularly *khas* land) to these rural slum dwellers, especially for house building.

In most cases, rural people know better how to build their houses, when to build, and what materials to use than professional builders or engineers. They have a keen sense of resource management for house building within their meager means, which calculative and strategic planning may not be able to work out. This is basically by virtue of their indigenous knowledge passed on to them from generation to generation. Therefore, professional planners, architects and engineers could learn from them. What is necessary is to provide rural people with adequate finance, building materials, technical know-how, information and infrastructural support. For example, most of the rural areas of Bangladesh are beyond the electricity and telecommunication coverage of the country. Provision of infrastructure including transport networks, water supply electricity and telecommunications facilities would definitely increase the quality of life of rural people. Finally, financial assistance (either in the form of credit or grants) would eventually enable rural people to build safe and permanent houses according to their own needs and resources.

1.6 Role of Women in Rural Housing

In Bangladesh women represent about half of the total population. Various indicators reveal that the status of women is lower than that of men. Traditional socio-cultural practices limit their opportunities in education, skill development, employment and participation in the national development process. Their literacy rate is 38.1% and life expectancy is 58.1 years. There are also sharp differences between boys and girls, women and men, in the national status (BBS, 1993).

Women's participation in the development process is a common phenomenon all over the world. They play an important role in each sector of national activity. Rural women are mostly engaged in their household work, especially in house management. They are also involved in housing development such as construction, repair, etc.

In the study area (Gonali village, Khulna), most of the houses were kutcha and constructed with mud, straw, *golpata* (kind of palm leaf available in the Sundarbans), etc, which need regular repair and maintenance. Rural women play a vital role in this respect. They collect local building materials and build, repair or maintain their own houses with the help of family members (Figures 1.25 and 1.26). But their contributions of time and labour generally tend to be undervalued. This study has investigated the contribution of women in rural housing development and the causes of their involvement in this field.

Figure 1.25: Rural Woman Constructing the Plinth of her House

1.6.1 Objectives of the Study

Women constitute a power by both their direct and indirect involvement in development work. They also participate for the development of their own dwelling units. The potential of women in this field should be better understood and their increasing roles in this field should be clearly identified by this study.

The specific objectives of this study are:

I. To explore women's contribution to rural housing development
II. To find out the causes of their involvement
III. To search the problems faced by women during construction, repair and maintenance of their houses.

1.6.2 Methodology

The study is based on fieldwork in Gonali village in Dumuria Thana, Khulna. Gonali is a Muslim–Hindu village and male-female ratio 1.219 (national figure is 1.04). Data has been collected from observation and in most cases collected through a structured questionnaire. Out of 295 households (BBS, 1991), 112 households were taken as samples, about 38 % of total households. The sample consisted of 50% Hindu and 50% Muslim households.

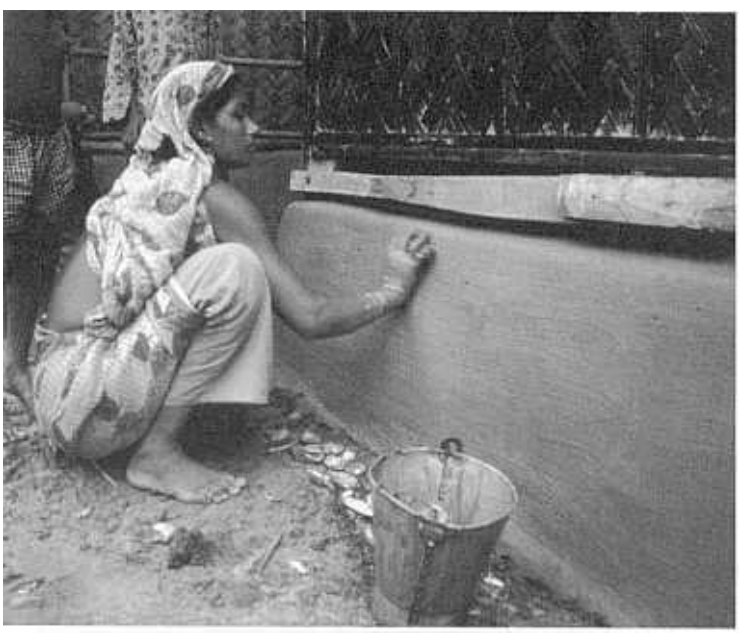

Figure 1.26: Rural Woman Maintaining the Mud Plinth of her House

1.6.3 Analysis of Findings of the Study

Status of Education : Obviously, education has empowered women in various stages of housing development activities such as the plan, foundation, construction materials, etc. of the houses. In the study area, it is seen that 20.69% of the women were literate and 24.14% were non-literate. Table 1.3 shows that women were less educated than men. The involvement of women was found to decrease in housing development activities with the increase of educational status.

Sex	Frequency	Level of education				Total
		Literate	%	non-literate	%	
Male	283(54.95)	158	36.32	82	18.85	240(55.17)
Female	232(45.05)	90	20.69	105	24.14	195(44.83)
Total	515(100.0)	248	57.01	187	42.99	435(100.0)

Table 1.3: Level of Education

Monthly Income : Table 1.4 reveals that 9% women had no income and were completely dependent on men. Most of these women had some sources of income. The majority (58%) earned Tk100 – 500 and only 2.5% earned Tk 1000 – 3000 per month. They estimated that they sold their vegetables, eggs, milk, etc., and earned small sums of money. But the lion's share was spent on house construction, repair and maintenance. Some of the women who earn more than Tk 1000 had taken loans from NGOs. So it can be said that if loan programmes are implemented by the GOs and NGOs, then the income level of women increases. Consequently they will be able to follow an important role in rural housing development. Although some women were empowered by loans in the study area, the overall income level of women was unsatisfactory.

Monthly income range (Tk)	No. of households	Percentage
No income	10	8.93
Less than Tk 100	23	20.54
100 – 300	28	24.99
301 – 500	37	33.04
501 – 1000	10	8.93
1001 – 2000	3	2.68
2001 – 3000	1	0.98
3000 +	-	-
Total	112	100.0

Table 1.4: Monthly Income of the Female Members

1.6.4 Interval and Involvement of Family Members in Construction, Repair and Maintenance

In addition to construction, women have involvement in house repair and maintenance activities. They have the duty of protecting houses from various natural disasters such as rain, cyclone, tornado, water logging, etc. Along with men, they contribute in keeping the house clean, thus protecting the houses from becoming dilapidated. In this village 30.9% male and 65.9% female were engaged in construction, repair and maintenance activities. This shows the great helping hand of women in maintaining the houses. Table 1.5 shows that children

also sometimes help in various stages of housing development activities. So women's involvement is clearly significant in housing development as well as in rural economic development.

Table 1.5: Average Interval and Level of Involvement of Family Members

Types of Work	Average interval (days)	Involvement of the family members			Total
		Male(%)	Female(%)	Child(%)	
Construction	74	59(20.3)	44(15.2)	2(0.7)	105(36.2)
Repair	23	21(7.2)	52(17.9)	4(1.4)	77(26.5)
Maintenance	10	10(3.4)	95(32.8)	3(1.0)	108(37.2)
Total	107	90(30.9)	191(65.9)	9(3.1)	290(100.0)

There are various types of work in which women are engaged such as soil carrying, mixing, layering, polishing, foundation, etc. (Table 1.6). In the study area, the women were engaged 4.2 hours per day, i.e. 17.5% of a day. For earth works (soil carrying, mixing and foundation preparation) about 23% women were involved. For polishing and structure preparation 25% and 20% women were involved respectively. In fact, they mainly spent their time in maintenance activities like floor polishing and mud collection. If a woman's participation of each day is converted to monetary value (i.e. wage rates), then women can save Tk 36.75 (considering Tk 70 for 8 hours) per day, obviously an illustrative contribution of rural women.

Table 1.6: Types of Work and Average Working Hour Per Day

Participants	Types of work			Average working hour per day
	Earth works(%)	Floor polishing(%)	Structure preparation(%)	
Housewives	17	22	13	3.1
Others female members	06	03	07	1.1
Others	02	01	04	0.5
Total	25	26	24	4.7

1.6.5 Sources of Funds and Types of Problems Faced by Women During Construction, Repair and Maintenance

Funding is an important aspect of housing development. In the study area, the major sources of funds (45.53%) constitute family savings and only 2.68% have taken NGO loans for construction, repair and maintenance of their houses. Table 1.7 shows that 21.43% and 30.36 % respondents have built or repaired their houses with the help of relatives and personal savings respectively. Table 1.7 also indicates that the government's involvement in rural housing development is almost nil, as indicated in the National Housing Policy (GOB, 1993) and Fifth Five Year Plan (1997-2002) of GOB (1997).

Construction, repair and maintenance of houses are tedious tasks. In the study area, 18.75% women considered it as physical suffering. The majority of the respondents (33.93%) identified excess rain as a major problem, because most of the walls were constructed with mud. About 11% claimed that the natural courses of Beel Dakatia (a large natural water body), blocked by human action, results in inundation as a common phenomena in the study area, especially in the rainy season. Table 1.6 also shows that women face financial problems (28.57%) for the construction, repair and maintenance of their houses. So, this indicates again the need of involvement of GOs and NGOs for financial and technical support for better participation of women in rural housing development.

Sources of fund	Frequency	%	Types of problem faced	Frequency	%
Banks	-	-	Salt problem	09	8.04
NGOs	03	21.68	Excess rainfall	38	33.93
Relatives	24	21.43	Financial problem	32	28.57
Personal savings	34	30.36	Physical suffering	21	18.75
Family savings	51	45.53	Others	12	10.71
Total	112	100.0	Total	112	100.0

Table 1.7: Sources of Funds and Types of Problems Faced by Women

1.6.6 Women's Contribution

Without the contribution of women, the entire infrastructure of rural society would collapse. If women obtain equal rights they too can participate positively along with men for rural housing development and also play a critical role in the national economy of Bangladesh. The study findings proved that women contribute money and physical labour during the period of construction, repair and maintenance. However their contributions are not recognized by society. Their contribution in rural housing development is appreciated in terms of money (average Tk 36.75 daily). Without the contribution of women, most of the dwellings would fall into miserable condition. It is essential to empower women through some income-generating activities by the government and NGOs.

1.7 Bamboo Cultivation and Rural Housing

Bamboo cultivation is significantly important for rural housing in Bangladesh because bamboo is the most widely used natural building material. In the 1991 census it was found that bamboo was used in walls of more than 56% of housing throughout Bangladesh and even more in rural areas: nearly 60%. More than 47% and more than 51% of roofs of housing throughout Bangladesh and in rural areas respectively used bamboo (BBS, 1993).

Bamboo is an easily transportable building material (Hodgson and Carter, 1999) and is used for making numerous items and implements for regular use. It may be noted that there are more than 70 items that can be made with bamboo, which are not only linked to housing but to various different items catering to people's needs (Choudhury, 1984) and which provide a livelihood to many people in rural areas (Figure 1.27). Some of its uses in buildings other than directly as a building material are scaffolding, shuttering and ladders for various construction works (SKAT, 1991), Figure 1.28. Bamboo rhizomes are used as fuel in brick kilns (Abedin and Quddus, 1990; Johnson and Ritchie, 1993). Small rural bridges are commonly made of bamboo and it is also the main raw material for paper and pulp factories (Choudhury, 1984; SKAT, 1991). It can nevertheless be accepted that one of the vital uses of bamboo is for construction and that it is the most commonly used building material in rural housing of Bangladesh. A rural house buit of bamboo is shown in Figure 1.29.

Figure 1.27: Bamboo Artisans at Work

Figure 1.28: Bamboo Scaffolding is Used Extensively in Construction of Urban Buildings.

1.7.1 Scarcity of Bamboo

Bamboo is a distinctive and important plant in the ecosystem and economy of Bangladesh. There is however evidence showing diminishing supply of bamboo in Bangladesh and an accompanying steep increase in price. Yet bamboo is an important natural resource and widely utilised for making numerous articles for daily use. Bamboo is used as a building material in more than 60% of houses in Bangladesh and especially in rural areas its use is significant. Studies in the field of low-income housing show that that the phenomenon of declining supply and increasing price of bamboo has a two-pronged effect on low-income communities (Ahmed, 1998). For households that can afford it, the alternative is to opt for building materials such as CI (corrugated iron) sheet, RC posts and brick. These products have adverse environmental impact during their production and embedded energy cost in transport, and whether they are environmentally appropriate as building materials can be questioned. On the other hand poor households are unable to afford even bamboo to maintain their houses regularly. A bamboo house requires frequent maintenance, failing which a household is compelled to live in a weakened and hazardous structure. The alternative is to build with weaker, smaller and cheaper pieces of bamboo or other more flimsy materials, thus representing a decline in quality of housing of the poor. Recent studies show that in Bangladesh "extreme" compared to "moderate" poverty is reducing more slowly, indicating growing inequality (DFID, 2002); the qualitative difference in housing between that of the "moderate" and "extreme" poor resulting from diminishing bamboo resources is illustrative of this increasing inequality.

As most of the rural population is poor and live below the poverty line, it is important to develop low-cost and affordable building materials for rural housing. If the cost of building materials is too high, it presents tremendous difficulty for low-income villagers to afford and build houses. Additionally, frequent natural disasters compound the problem greatly. About a few decades earlier most rural homesteads had a small bamboo garden (*bash jhar*) in the backyard (Figure 1.30). At that time the population of Bangladesh was lesser and there was enough space for most households to have a little bamboo garden growing without much attention or nurturing. Over time with high population growth, cultivable land in Bangladesh has become scarcer. On the other hand, bamboo continues to play a vital role as a building material and also for many other purposes, and there is still high demand for it. However, there has been very little serious initiative to improve bamboo cultivation processes in this context of demand and scarcity.

Figure 1.29: A Rural House Built of Bamboo

Wells et al. (1994) have documented the increasing scarcity and resulting rise in the price of bamboo in Bangladesh. This has also been widely observed by various experts (Abedin and Quddus, 1990; Boa and Rahman, 1987; Choudhury, 1984; Dunham, 1992; Dunham, 1991; Haque, 1986; Johnson and Ritchie, 1993; SKAT, 1991). The price of bamboo and timber has almost tripled in the decade 1980-90 at a greater rate than inflation (SKAT, 1991) (Figure 1.31). More recent figures show that the price of a bamboo pole has increased further from Tk 80

in 1990 to Tk 100 in 1997 to Tk 120 in 2001. This price increase reflects the supply constraint, which is also evident from the greater distances travelled by traders for village bamboo supplies (Abedin and Quddus 1990; Johnson and Ritchie 1993) (Figure 1.32), and from the lesser number of bamboo traders, harvest of immature poles, smuggling in from India and illegal appropriation from state forests (SKAT 1991).

Figure 1.30: Rural Bamboo Stand (Bash Jhar)

Various factors are causing this scarcity. Population increase is attributed to as the obviously main reason (Abedin and Quddus, 1990; Choudhury, 1984; Johnson and Ritchie, 1993; Dunham, 1992; Dunham, 1991; SKAT, 1991), but other factors are also responsible. Poor management of bamboo resources, both in villages and forests, has led to declining production. It appears that while there is increased demand for bamboo, there is lack of management skills in the villages (Abedin and Quddus, 1990). For example, new poles are harvested from the edge of clumps, leaving old poles at the centre. These are then prone to disease that eventually affects the whole *bash jhar* (Johnson and Ritchie, 1993). In fact, the disease, bamboo blight, is common in Bangladesh (less common in other bamboo-producing countries) and due to poor management it has reduced bamboo supply greatly (Boa and Rahman, 1987). This does not imply that villagers are completely negligent about their bamboo plantations; they do apply simple management techniques. However, the increased demand and poverty leads to over-harvesting and cutting immature bamboo, adding to the scarcity and increasing the chance of disease (Johnson and Ritchie, 1993). This is a vicious cycle: more demand leads to over-harvesting, which then leads to scarcity and further

pressure of demand. Not only in villages, but also in forests, bamboo is declining by about 3% per year (Wells et al., 1994; Johnson and Ritchie, 1993). Combined with over-exploitation and encroachment of agriculture due to increased population, poor management is also responsible (Johnson and Ritchie). The lack of management is compounded by over-harvesting of easily accessible areas of the forests, while remote areas are left alone (Choudhury, 1984), thus affecting the overall stock.

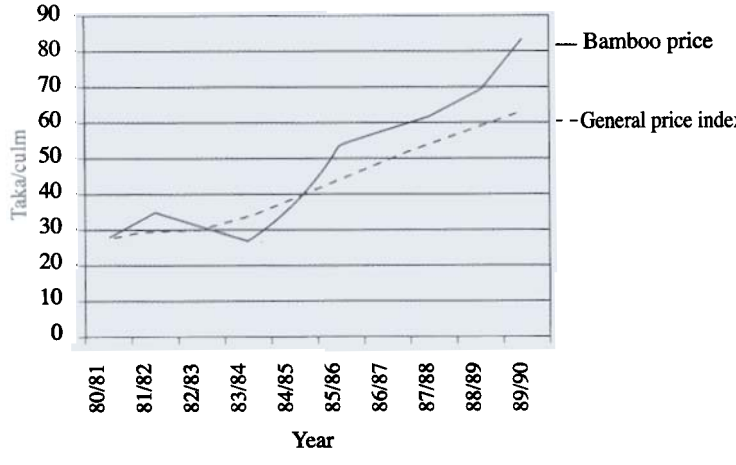

Figure1.31: Increase in Bamboo Price in Dhaka, 1980-90 (Source : SKAT, 1991)

The principal effect of bamboo scarcity on households with lower income is that they use inferior quality and lesser quantity of bamboo for building houses. Because of this, such houses require frequent repair and maintenance. Additionally, because such houses tend to be flimsy and not durable, it presents a safety hazard for their occupants (Ahmed, 1999).

Figure1.32: Bamboo is Transported Over Long Distances

1.7.2 Redressing Bamboo Scarcity

Two main remedial measures to prevent decline of bamboo supply have been suggested. Firstly, a chemical treatment of bamboo to prolong its life and thus reduce pressure on existing stock has beensed (Dunham, 1991; Dunham, 1992; Proshika, 1993). Application in Bangladesh has so far been piece-meal and safety issues related to toxicity of chemicals have not been addressed adequately. Secondly, the regeneration of bamboo supply through improved cultivation and management has been proposed (Farrelly, 1996). There are many afforestation and social forestry programmes in Bangladesh, but none particularly address bamboo cultivation. Inadequate disease prevention and mismanagement of existing resources contribute further to decline in stock. There thus seems to be potential for introducing hazard-free bamboo treatment as a sustainable process for the utilisation and consumption of the resource within the framework of a wider initiative for its improved and sustainable regeneration, production and management. Various livelihoods are linked to bamboo and an initiative for bamboo regeneration would also regenerate these livelihoods.

During the Housing & Hazards International Workshop in 1999 at BUET, Dhaka, recommendations were formulated for research into the regeneration and improvement of supplies of natural building materials. Research into socio-economic factors was another major recommendation of the H&H workshop. These two recommendations inspired one of the authors to conduct research on bamboo cultivation. The methodology followed was Participatory Action Research (PAR), emphasising the importance of involving the end-user in the research. This research was a learning-by-doing type, where the principal research investigator, a rural inhabitant himself was the end-user. The research was primarily concerned with socio-economic factors, such as awareness building and motivation of rural people for improved bamboo cultivation rather than purely technical matters.

1.7.3 Bamboo Research – Stage 1

At the end of February 1999, through consultation with villagers, a local person who knows how to cultivate bamboo with his indigenous knowledge was identified and consulted. At the outset, the villager cut a little piece of bamboo (2 feet high) from an existing bamboo garden. Then the root, called *guri* in Bangla, was planted by the edge of a pond for two months. The guri was planted there because the environment of that place is the best for growing new bamboo shoots. The shoots are called *gei* in Bangla. In April the gei was

transplanted into the bamboo garden by digging a hole of 3 inches by 3 inches. The depth of the hole was one and a half feet. After transplanting the gei, necessary organic (mainly cow dung) and also some chemical fertiliser was mixed into the soil. The little bamboo (*gei*) was watered until the peak rainy season at the end of August. There were now more geis in the bamboo. Once more shoots start coming out from the bamboo, it starts growing longer and longer. One of this newly grown bamboo plants will produce more bamboo in the coming years. In 3-5 years, one of the grown plants would produce about 30 new bamboo plants around it (Rasul 2000).

1.7.4 Bamboo Research–Follow-up

During the first phase of the research the geis were not planted in an organised manner because it was the first such experiment. The principal researcher did not have much prior experience on cultivating bamboo and had to begin almost from scratch; thus quick and good results could not be expected. Additionally, the monitoring method was not formulated earlier: the geis' growth needs to be measured every two months and the thickness attained in different parts of the pole (base, stem and tip) should be recorded, as well as the amount of fertiliser used for each gei per week.

Beginning in April 2002, this time a piece of raised land, measuring 20 feet by 20 feet (400 square feet) was selected adjacent to the existing bamboo garden. Figure 1.33 shows the bamboo plantation pattern adopted during the course of the research. After acquiring this land, it was dug up to a depth of 1.5 feet. After digging, the research investigator added 40 kilograms of cow dung and 10 kilograms of fertiliser or *mati shar* (consisting of TSP, urea, etc). The soil was thus fixed with these fertilisers. Four pieces of bamboo, each about 2 feet long, were buried into the soil for 15 days by the side of a pond where it was a bit moist. The land was divided into quadrants, each quadrant measuring 10 feet by 10 feet, and the four bamboos were transplanted with each bamboo at the centre of each quadrant at a distance of 10 feet from each other. These were watered throughout the whole month of June 2002, 27 times in 30 days. At the time of writing this paper in July 2002, the planted bamboos had started growing and the leaves and shoots were beginning to come out. One gei was observed and more was to come. It is important to remember that during the dry season, the plants need to be watered more intensively. Each bamboo

plant should be given 1-2 kilograms urea fertiliser in addition to regular watering. The harvest from each individual bamboo is expected to be 30 poles in 3 years. This method produces more harvest than traditional bamboo production techniques and by separating the stands reduces risk of bamboo blight.

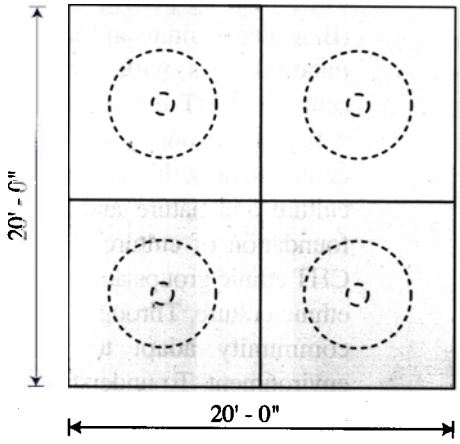

Figure 1.33: Bamboo Plantation Pattern

1.7.5 Need for Initiatives

Raising awareness of bamboo cultivation is very important for rural housing in Bangladesh. The cultivation process is very simple indeed. It can be done easily in villages and the rural people of Bangladesh can be benefited by efforts for promoting improved bamboo cultivation. Economic benefit, access to bamboo as a building material and opportunity for generating local employment would be possible if such bamboo cultivation initiatives are taken. There is a need to establish bamboo farms to demonstrate the potential of improved and sustainable bamboo production and to address the environmental implications of the decline of this local resource. Other than improved bamboo farming, some of the main activities of these farms could be researched, such as the development of bamboo cultivation and propagation methods, bamboo treatment with adequate safety measures and the production and marketing of treated bamboo building products (furniture, household and agricultural implements and handicrafts). Such a farm founded on the principle of sustainable production of bamboo should allow for generating sustainable livelihoods for local cultivators, artisans, manufacturers and entrepreneurs. It could work as a model of how bamboo can fit into the rural environment and serve a variety of domestic and community needs of a village. The bamboo farm could also work as an educational centre for documentation, research, exhibition and dissemination.

1.8 Ethnic Housing Pattern in the Chittagong Hill Tracts

The Chittagong Hill Tracts (CHT) is renowned for its indigenous culture, which enriches the cultural diversity of Bangladesh. It is the native land of 20 different ethnic groups. This region also has natural diversity consisting of hills, forests, water bodies and wildlife. Housing is an important component of the culture of CHT ethnic groups, which is remarkably unique in this area. Their housing pattern is different from that of the mainstream (Bangalee) culture in terms of design, technology and building materials. As with other components of their culture, for centuries CHT ethnic people have been fostering this housing pattern traditionally. House or habitation is the core element in ethnic society. It maintains the relation between the border of culture and nature and plays a significant role in knitting the foundation of culture. The house acts as the base from which CHT ethnic groups act upon nature. It is the labour space of CHT ethnic culture. Through living in a house, members of the ethnic community adapt to nature and cope with the inimical environment. To understand the adaptation and coping strategies of CHT ethnic people, their housing pattern has to be studied. This section focuses on three issues - understanding the pattern of ethnic housing, assessing the relation between housing pattern and ecological system, and analysing resistance capacity and adaptive value of ethnic houses in hazards, disasters and other inimical situations.

1.8.1 Socio-Cultural Aspects of the Ethnic Population

This section is based on an anthropological study of nine small and big ethnic groups in Bandarban district of the CHT. These groups are - Marma, Murang, Bowm, Lusai, Tongchoinga, Tripura, Kheang, Khumi and Chakma. During the 16th century the ancestors of CHT ethnic groups first settled in this area (Hossain, 1993). Some anthropologists termed them as 'Mongoloid' people (Resely, 1891). Their social structure is patriarchal and patrilineal, although women play a major role in the household and economy. They believe that supernatural power creates them. Diversified religious customs exist in their community. Most of them are nature worshippers and animist, observed more than a century ago - "They worship the terrene elements and have vague and undefined ideas of some divine power which overshadows all" (Lewin, 1869). Some are Buddhists. Recently a few of the ethnic people have converted to Christianity. Although the hilly terrain is not favourable for agricultural activity, the people nevertheless have to subsist on agriculture by terracing and tilling the hillsides, since other

economic activities are not well-developed. On the flattened, terraced surface of the hills and also on gentle slopes, shifting cultivation is carried out, locally known as jhum. This is the main subsistence system of CHT ethnic society. Interpersonal relations, social institutions and customs relating to gender, family and clan have been developed on the basis of kinship and lineage system. Para (hamlet) is the intermediary administrative unit that consists of 10-50 households and led by a chief named Karbari. The para maintains the relation among individuals, families and institutions of the state. In the revenue system, para is under the mouza (neighbourhood) which is controlled by a 'Headman'. All Headmen are controlled by the circle chief named Raja (Monarch). Karbari, Headman and Raja are hereditary appointed posts. Every single group possesses an individual mother tongue, art and literature, mostly in verbal and folk forms.

1.8.2 Worldview, Rituals and Housing

Ethnic people view their world through beliefs on supernatural beings such as deb (god), debi (goddess) and debota (deity). Some deities control everything of their life including household and household-based activities. It is believed that these deities had roles in constructing houses in the prehistoric age. Even now, these beings are active within their household life. Existing pattern of their houses is believed to have been firstly introduced by these deities, mentioned in their text. They relate all things of their life with the divine. The profane life of ethnic people is in two worlds - para and hilly forests. Divine beings create these worlds. House is the 'core' of the para-centric world. Some deities are believed to stay in the para and are responsible for protecting the para or houses from attack of evil beings.

In the ethnic groups, it is clearly manifested as Haviland (2000) suggests: "Rituals is the means through which persons relate to the sacred; it is religion in action." Certain individuals are specially involved and active in dealing with the above mentioned deities and spirits through ritual activities. The majority of these rituals are either exercised in houses or household-orientated. One of the objectives of exercising these rituals is to activate the above spirits or deities for protecting households from attack by wildlife, calamities or hazards. Totems are used for denoting animal or plant apical ancestors of a clan. Ethnic people display totems in their houses. This has two objectives - firstly, to express their clan identity and secondly, to protect them and their houses from evil beings.

1.8.3 Land System

In the CHT area, land consists of forests, uneven hills and water bodies including natural fountains, canals, etc. Ethnic people use the land for jhum (shifting) cultivation, house settlement, gardening, etc. The Bangladesh government owns the land of this area. The chief of Bomang circle Raja is responsible for collecting land revenue on behalf of the state through the Headman and Karbari. Every couple is entitled to use 2-4 acres for jhum cultivation and has to pay Taka 5 as jhum kar (revenue).

1.8.4 Settlement and Housing Pattern

Due to their kin-based society, ethnic people follow a lineage system in knitting the family and constructing habitation. The members of one or two individual clans settle in each para. Clan indicates the unilineal descent group based on stipulated descent (Kottak, 2000). Their houses are internalised in the para. A para consists of 10-50 households or families. There are two types of families - nuclear (consisting of parents and children) and extended (including three or more generations).

The settlement pattern of this region is influenced by its topography. Since the CHT is sparsely populated, settlements tend to be scattered. Although settlements can be seen on top of hills, on slopes or in the valleys, ethnic people prefer to establish a para at the hilltop in deep forest having adjacent area of water bodies. Forming a para on the hilltop in forests is supported by their divine texts. This type of para is characterised as agglomerated habitation (Baqee, 1998), shown in Figure 1.34.

Because of the uneven terrain, houses are raised on bamboo or wooden posts to site them on the hilly terrain. Every family generally owns one house. The floor of the house is on a raised wooden or bamboo platform generally built at about 1.5-4.5 metres height from the ground (see Figure 1.35). These houses are locally known as machang ghor or tong ghor. The CHT ethnic people have used this type of house for centuries, in harmony with their ecology. Each house is divided into two main parts - balcony and inner portion. The typically long open balconies serve as a social area and also to carry out activities such as weaving with handloom. As per function, the inner portion is divided into several rooms that also vary from community to community, shown in Figure 1.36. It can be seen that ethnic houses often consist of up to 10 rooms. Each room is used for a specific purpose. In some cases, houses are divided by bamboo partitions into rooms when members of the extended family get married and require their own private space. For

example, if there are three married members in a family then there would be four rooms. Unmarried members or guests use the outermost room, which is also used for sitting or cooking (Shafi, 1997). The house is accessed by a wooden or bamboo ladder which leads on to the wide raised platform. The open space under the platform is used for rearing poultry, goats or pigs.

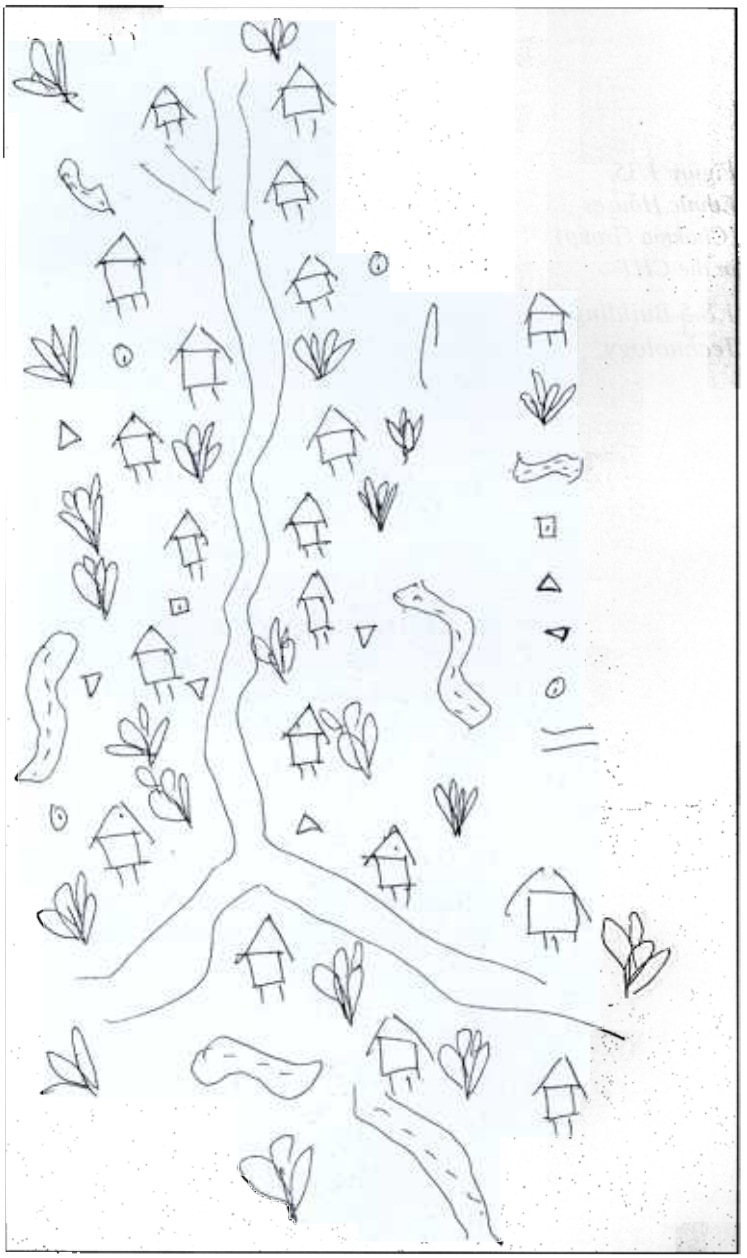

Figure 1.34: Mapping of Para Prepared with an Ethnic Community

Figure 1.35: Ethnic Houses (Chakma Group) in the CHT

1.8.5 Building Technology

As suggested by Handwerker (1981), technology "...is the realm of culture that most importantly defines the conditions to which individuals and social units adapt. Technologies link individuals and social units to the physical environment, and individuals and social units are linked to technologies through the activities... These activities constitute the functional niches of a technological system....". In the CHT ethnic communities, house building technology is a traditional system existing from generation to generation through verbal and practical transmission. Building technology includes three major aspects - knowledge, technicians and elements-tools. It is a 'science' of the community.

As with other aspects of their culture, ethnic people acquire knowledge on house building from their social institutions. They believe that many years ago the progenitors of their society took shelter on a hilltop in deep forest. They learn from this belief how to build houses. There is no professional group for constructing houses. They build their houses themselves. Various kinds of choppers are the main tool for constructing houses. Other than that they use spade, machete, axe, hammer, etc. For the main elements of the houses, ethnic people use the following raw materials, which are available locally:

Wood and bamboo for making platform, walls and posts;
Leaves of bamboo, wooden shingles, a kind of tall grass and hill reeds for roofing and thatching;
Cane and rattan for binding.

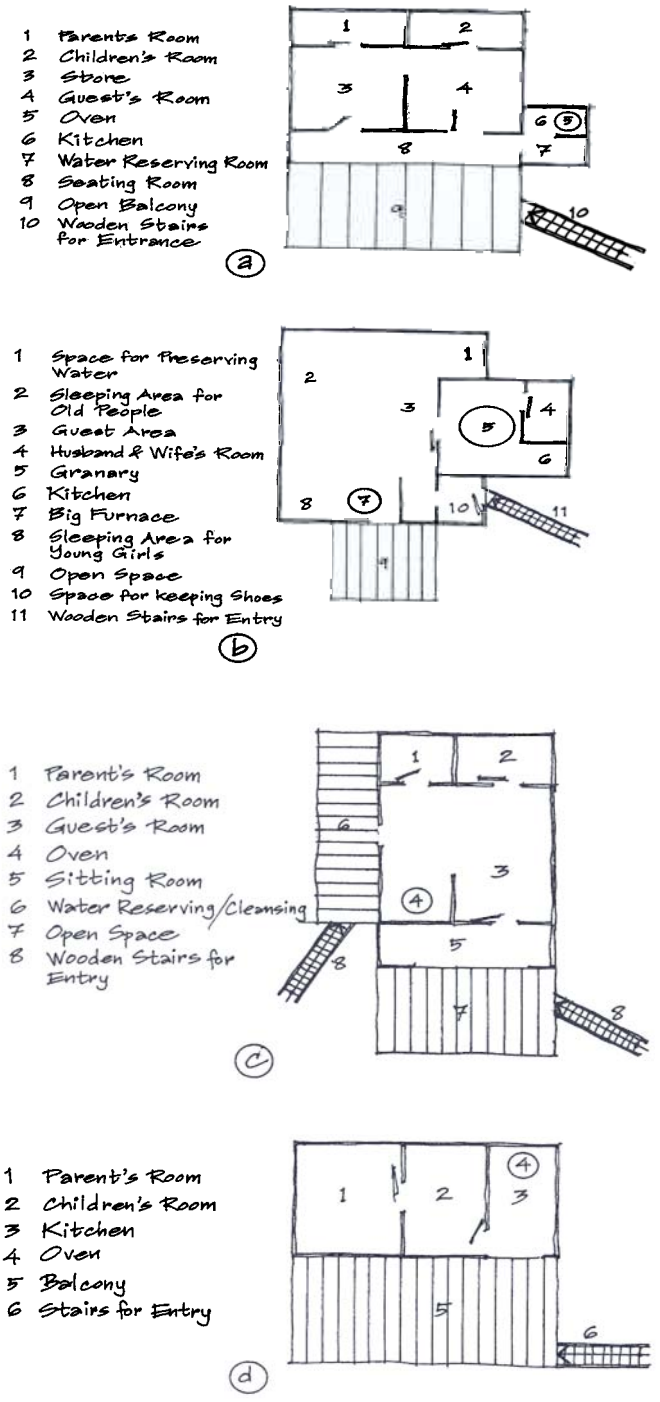

Figure 1.36: Layout of Ethnic Houses (Machang Ghor)
a) Marma Group b) Murong Group c) Tripura Group d) Chakma Group

1.8.6 Aesthetics

Aesthetics is a specialisation of ethnic houses. In the anthropological sense, it pertains to "appreciation of the qualities perceived in works of arts; the mind and emotion in relation to a sense of beauty" (Kottak, 2000). On the basis of this viewpoint of beauty the aesthetic aspects of ethnic houses can be described from three different angles, described as follows:

- Combination of elements: Several elements of houses at different points are framed with each other in rhythmic form. Posts, platform, roofing, hedge, etc. are made with elements where there is no maladjustment in their combination. Thus, externally, this projects harmony.
- Artistic works in wood and bamboo: Ethnic people sketch and cut the figures of birds, domestic animals, wildlife, flowers, trees, fountains, hills, etc. on the front side of houses, specially on windows or door frames and hedges of houses.
- Demonstrating 'beautiful' things: To make houses beautiful, dwellers display different types of apical of animal, trees and flowers with houses. After hunting, they make these with head, horn and skin of wildlife - tiger, dog, cow, snake, etc. Expressing the clan identity of house dwellers is another objective of displaying apical.

1.8.7 Usage of House

Mentioned earlier, the profane world of ethnic people is in two-life types - firstly 'para'-centric inner life and secondly hill/forest orientated outer life. In the inner life, almost all daily activities are performed within the area of houses. The house is used by its dwellers in ethnic communities for various purposes. During the whole period of the life of a person the house is widely used. The house area is used for resting, sleeping, enjoying conjugal life, guest entertainment, seating, cooking, preserving water, storing belongings, cleansing, perambulation, crop processing, husking, child caring, storing fuel wood, nursing and treating patients, etc.

The house is important as a post-marital residence. In CHT ethnic community two types of post-marital residence exist - uxorilocality (residence with wife's relatives after marriage) and virilocality (residence with husband's relatives). Practice of the first type is minor and temporary.

1.8.8 Adaptive Value

Adaptation indicates the process by which organisms cope with environmental stresses. Ethnic people cope with and adapt to the environment that is made of hills, trees, natural calamities, wildlife, etc. through their pattern of houses. For centuries they

have lived in machang ghor. Basically houses are the only shelter and ecological niche in their community. Due to the natural condition of their environment, ethnic people have to maintain close and balanced relations with the environment for survival, development and continuing the complete life system including houses and settlement.

In the CHT locality, ecosystem is developed by balancing the relationship between natural elements (hills, plants, forests, wildlife, fountain, rivers, etc.) and cultural traits. Housing settlement is one of the components of the ecosystem. Settlements and existing ecosystems are not threatening to each other. Ethnic people have their own indigenous technologies to build their houses within the given environment. They use locally available natural resources as raw materials for housing. They do not damage nature in collecting and utilising raw materials. Their lineage and kin-based habitation and housing are favourable for their subsistence system and modes of production. Ethnic houses have resistance capacity to protect the dwellers from hazards and natural disasters such as storms, floods, attack of wild animals, fire, etc. and have adaptive value to face any inimical situation. For example, ethnic people use bamboo leaves for roofing because they do not catch fire easily. This pattern of housing and habitation has adaptive value for survival and development of ethnic groups within a certain environmental and ecological niche.

Building machang houses on bamboo or wooden stilts is a traditional practice of the CHT ethnic communities. A reason is that the machang helps to protect them from attack of wildlife and snakes, and is suitable for coping with the environment and natural hazards; it gives protection from heat, cold and water run-off from the hillsides. It allows privacy and thus provides opportunity for enjoying family life.

1.8.9 Other Housing Typologies

Other than indigenous ethnic communities, there are also some Bengali settlers in the CHT with different housing typologies. Stilted machang houses are uncommon among this group and houses are instead built on mud plinths as done typically in the plains. Nonetheless, the use of local resources such as bamboo and mud creates buildings with regional character. An example of adaptation to local environment is found in houses built on hilly slopes that have large pitched roofs with very low eaves almost reaching the ground,

somewhat similar to a tent (Figure 1.37). This is done so as to resist strong winds on the exposed hillsides. These houses are very large with several rooms accommodating joint families, representing a cultural expression of joint family living patterns.

1.8.10 Importance of Ethnic Housing

In the developing national context of Bangladesh, CHT ethnic housing is one of the major cultural resources, which is in endangered situation. The influx of mainstream Bengali settlers is a source of conflict. This population group is traditionally not adapted to living in a hilly area and consequently hampering the balance with nature and the ecosystem so characteristic of the ethnic people. Deforestation of the wooded hills and over-exploitation of natural resources is rampant in many parts of the CHT.

The continuity of ethnic housing, an important component of ethnic culture, would ensure the cultural diversity and heritage of Bangladesh. Not only that, but ethnic houses contain the quality of sustainability due to the appropriate use of local resources for building and adaptation to the environment. As a representation of cultural diversity, the ethnic housing pattern of CHT should be studied widely; this could provide inputs into programmes for sustainable and environment-friendly housing.

Figure 1.37: House of a Bangalee Settler in the CHT
(continued on page 63)

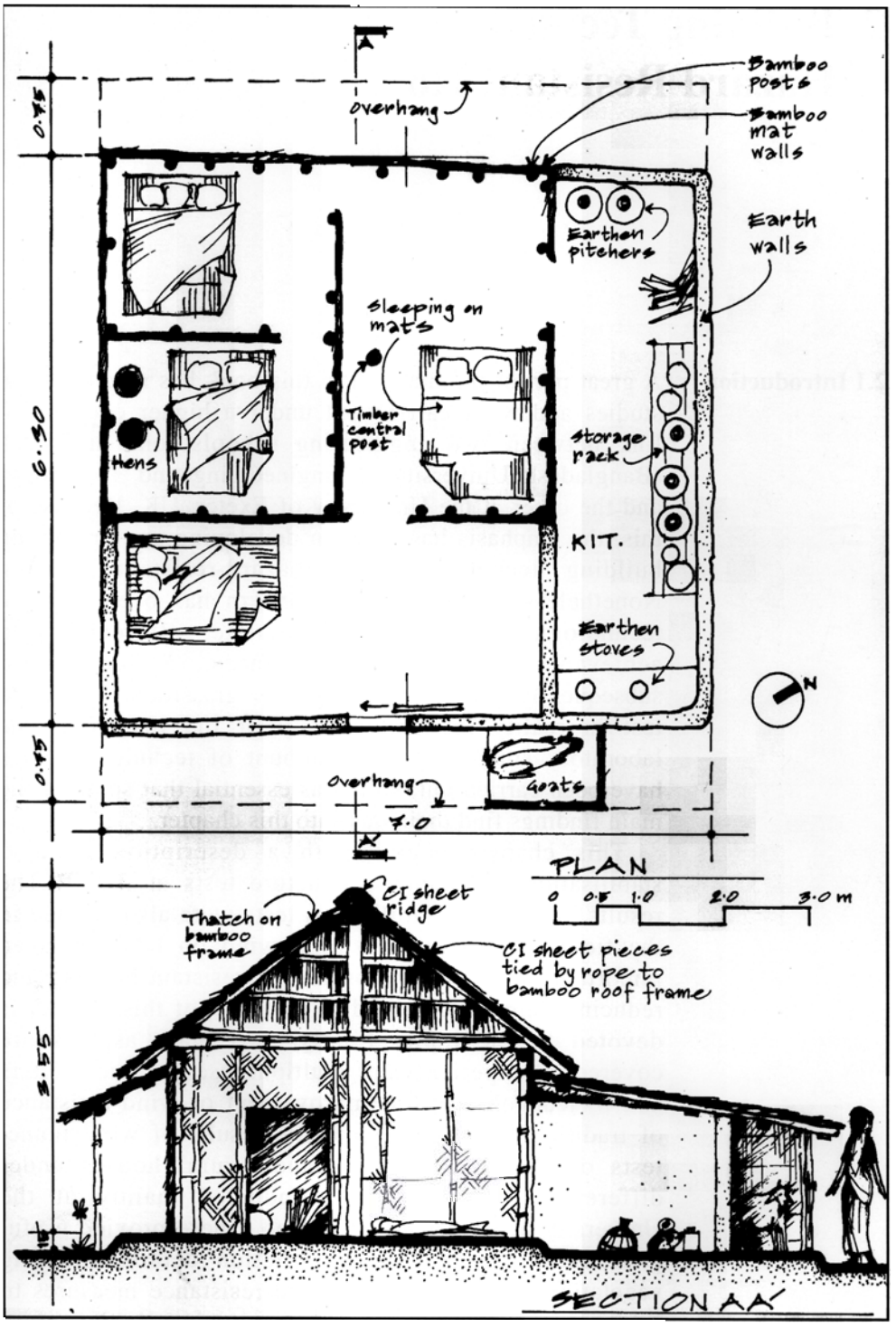

Figure 1.37: House of a Bangalee Settler in the CHT (continued from page 62)