S M Seraj, R L P Hodgson & J R Choudhury (eds): ISBN 0 9535078 15

SOME FACTORS GOVERNING CHOICES OF BUILDING MATERIALS IN RURAL BANGLADESH

R L P Hodgson, University of Exeter, UK
& M L Carter, Ove Arup & Partners, UK

Summary

Stronger homes can protect livelihoods as well as lives. This paper reviews the first of two Housing and Hazards studies into affordable techniques for strengthening Kutcha housing. A participatory survey identified the common building materials in use and obtained the views of a cross-section of professional and self-help builders. The second study is still in progress and is reported separately.

The factors which govern the choices of building materials open to rural low-income families are discussed. Those factors include tradition, building function, material cost, availability and access to skills. Suggestions are made concerning incorporation of such factors in the design of housing programmes in rural areas.

Introduction

Natural hazards such as earthquakes, winds and floods kill hundreds of thousands of people annually and destroy the property of many survivors. A stronger, safer built environment can thus protect both lives and livelihoods (Hodgson, 1995). There has been a lot of research into low-cost housing technology over the past 25 years but still the technologies are not widely used. The Housing and Hazards (H&H) Group was set up to explore solutions to the difficult problem of communicating affordable building technologies in rural areas.

The first H&H studies have been made in Dinajpur District in the village of Sundarban. Hodgson and Carter (1999) described the context of the studies and Figure 1 shows the location of Sundarban village which has a population of 7,000 (1991 Census) and covers an area of 10.4 sq km. It is planned that experiences from the Sundarban projects will guide affordable housing programmes elsewhere in Bangladesh and other countries. Carter (1997) has given a detailed account of the first H&H project and has presented the findings of surveys of house geometries and materials used in the study village. A second study is still in progress and is described in an accompanying paper in this Seminar (Magne, 1999).

This paper summarises Carter's observations and discusses the factors which guide individual homeowners' choices of house form and building material.

Typical Kutcha housing in Sundarban

54 houses were surveyed in 5 paras at different locations around the village.

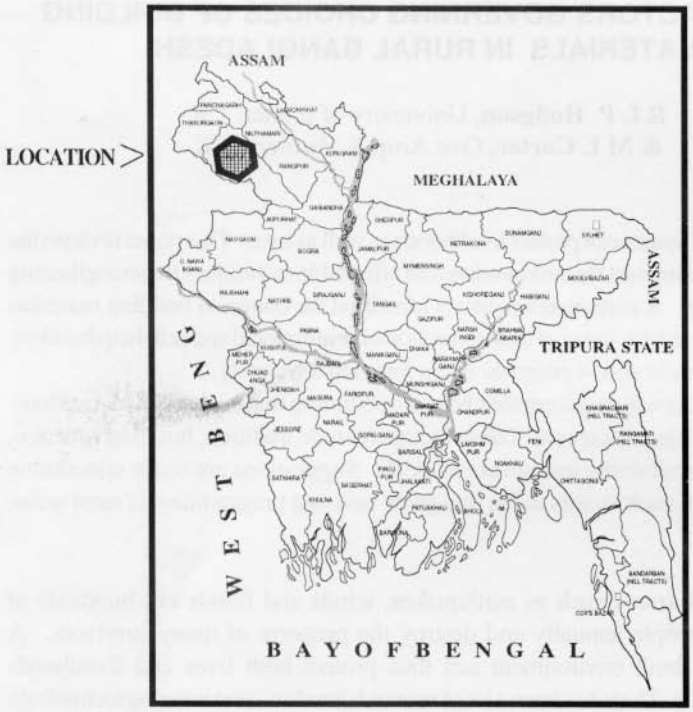

Figure 1 : Location of study area

There was a surprising variation in architecture and methodologies used, even within this fairly small area. Figure 2 shows graphically the materials used for walling and those used for roofing. Broadly, about half the houses had layered mud walls and just over half had some form of thatch. However, the combinations were not predictable so there are at least four common combinations with subsets of each depending on which of the four styles of thatching had been used, the techniques used for bamboo construction and so on.

In plan, the single-roomed houses conformed fairly closely to a length/ breadth ratio of about 1.6. However, individual structures ranged in length from 3.2 metres to 5.5 metres. Multiple-roomed houses were similar in width to the single rooms but longer. One aspect in which there was little variation was that of orientation; typical village homes are arranged around a square courtyard and almost all dwelling houses faced south

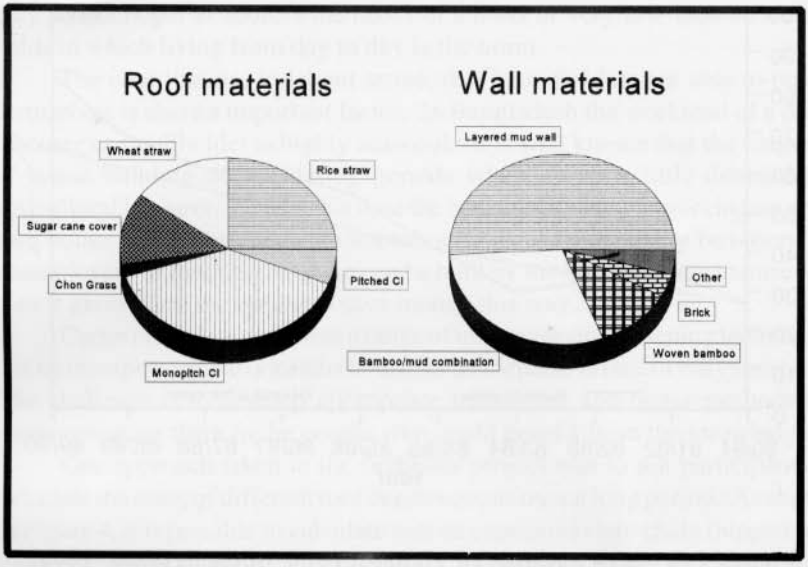

Figure 2 : Distribution of construction methods used in Sundarban

The houses surveyed were all relatively young with nearly half being less than 5 years old. Only one exceeded 20 years. This finding probably reflects the poor durability of most untreated kutcha building materials as much as it does the problems of exposure to natural hazards. It should be noted that flooding and high winds do occur in this area and regularly destroy dwellings, although the exposure is lower than in the coastal belt.

Why change traditional methods?

It can be argued that the range of structural forms described above represents generations of experience of living in Bangladesh's hazard prone environment. Houses destroyed by cyclones or floods are rapidly rebuilt (as seen in October 1998). Why change tradition?

The main reason why the coping mechanisms of previous generations are not now so effective is that pressure on the production potential of the land has caused the price of basic materials to rise faster than other prices. Ahmed (1999) illustrated this for the example of bamboo (Figure 3). Thus, each disaster reduces a family's capital and increases its vulnerability to future hazards. Increasing the resilience of the home could help to stem or to reverse that trend.

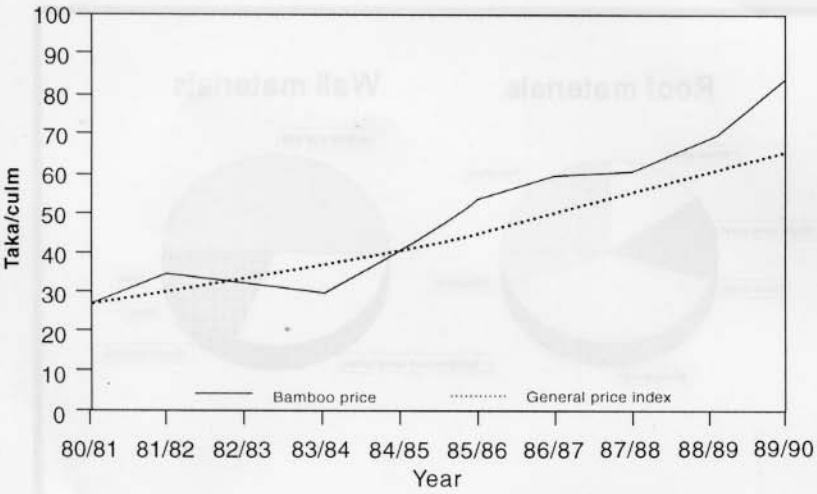

Figure 3 : Cost of bamboo vs. General Price Index (Ahmed, 1999)

In fact, one of Carter's findings was that innovative householders do experiment with modified techniques and with modern materials but in Sundarban there was no mechanism for sharing experiences in such a way that others might also benefit. Hodgson and Carter (1998) have described the participatory workshops which Carter developed to assist in spreading indigenous knowledge more widely throughout the village.

What is meant by "Low-Cost"

As noted above, the cost factor is becoming increasingly significant to low-income households. Kutcha housing encompasses a broad range of costs. Whilst a small mud walled house with thatched roof could be built for as little as 1,500 taka (with significant labour input from the householders), a similarly sized bamboo frame and mono-pitch iron sheet (sapra) roof costs around 5,000 to 7,000 taka to build complete. This is a large sum to a daily labourer earning, say, 30 or 40 taka per day.

Many models of low-cost housing have been proposed. Some were summarised in presentations to the first Housing and Hazards Workshop. Islam (1996), for example, quotes typical costs in the range 15,000 taka to 24,000 taka (or 1,400 to 2,000 taka per square metre). While these model houses undoubtedly have an important part to play in developing housing for the rural poor,

they do not begin to address the needs of a mass of very low-income households in which living from day to day is the norm.

The contribution, in labour terms, that householders are able to put in themselves is also an important factor. In Bangladesh the workload of a daily labourer or smallholder is highly seasonal. It is well known that the majority of house building occurs during periods where there is little demand for agricultural labourer. During this time the opportunity cost of working on ones own house is very low since the householder would most likely be otherwise unemployed. If low-cost housing can be built by the householders themselves then it gives them the option to save money this way.

Carter (1997) reported that a range of important strengthening techniques can be incorporated into a kutcha house for an increase in cost of only some 8%. The challenge is to develop appropriate techniques and better methods for communicating them to the people who could benefit from the knowledge.

One approach taken in the first pilot project was to ask participants to calculate the costs of different roof constructions over a long period. As shown in Figure 4, it is possible to calculate that an expensive char-chala (hipped) cgi roof could be cheaper over 25 years (since it is more or less maintenance-free) than the cost of replacing a cheap thatched roof every two to three years. Generating this type of awareness is a big challenge for rural programmes.

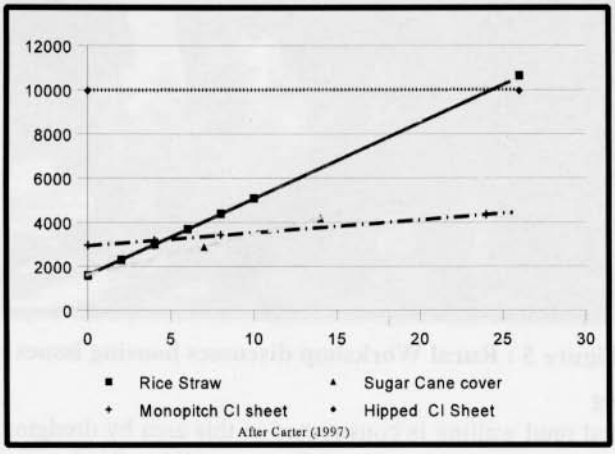

Figure 4 : Life-cycle costs of rooves (as discussed in rural workshops)

Prioritising shelter

House construction and maintenance are long-term activities. Personal observations (Hodgson, 1995) and Carter's village workshops, while not conclusive, have demonstrated that many rural people would put income generating activity and the purchase of food well above house maintenance in their list of priorities. The potential savings of money from early maintenance are often either unappreciated or ignored due to lack of money. This means that essential maintenance is often not done in time to mitigate the ravages of the monsoon period.

How do people choose and use their building materials?

Individual house-holders will have individual shelter strategies, depending on their particular circumstances. The diversity of anecdotal evidence available shows that any housing development programme should be designed flexibly to allow participants to incorporate as many individual requirements as possible (Figure 5). It was noted above that many different kutcha building options are exercised within even one village area. It is valuable to consider why next door neighbours in apparently similar circumstances may have completely different homes.

Figure 5 : Rural Workshop discusses housing issues

Mud walling

Layered mud walling is constructed in this area by dredging cohesive mud from ponds or river banks and building up a solid wall in layers about 150-200mm thick (Figure 6). The mud itself may be free but the householder will have to pay to transport it, since not all muds are sufficiently cohesive for walling. Thus, people who have access to suitable mud on their land or who can

afford the transport can opt for the more durable mud walling. One interesting example given by Carter (1997) was of a rickshaw puller. This is a normally poorly rewarded occupation and yet the respondent could afford mud walls because, to him, the transport was free. Any neighbour would have to buy his services!

The very cheapest that a house could typically be built for is 1500 to 2000 Tk for a mud house with a thatched roof. To achieve this the householder would need to build the house themselves and only buy materials and hire labour for the roof. Mud is commonly applied to the wall by hand. This encourages the use of mud of a fairly weak, wet consistency with consequent problems of shrinkage as the wall dries. The poorly compacted material is also easily burrowed by rats and termites.

The combination of mud and thatch was recognised by participants in the Sundarban workshops as providing an even internal environment throughout the year; cool in hot weather and warm in cold weather.

Figure 6 : A practical exercise in mud wall-building

Brick

Brick construction is normally beyond the means of low-income households in the study area. One exception is the area nearby a brick-making field which has long since become disused. However, many old bricks remain scattered around which are collected by house-builders as they are turned up and eventually used. One can imagine that the amount of time taken to find enough bricks of sufficient quality to build a wall would make such a task attractive only to families who lived in the immediate vicinity and could find a few bricks here and there in their spare time. This accounts for the small proportion of brick dwellings recorded by Carter's survey.

Bamboo

Bamboo is the cheapest, most easily transported building material. Houses made of bamboo can be extended easily when more money is available later and so it is the choice of those on the lowest incomes. However, the poorest people can afford only the thinnest bamboo which may last only one or two years. Poor quality bamboo framing is liable to be associated with walls made of bamboo-mat or jute-stick panels which not only have poor durability but also give limited protection against the monsoon rains.

However, whilst a mud house should take 3 or 4 months to build if built properly, a bamboo house can be built in a much shorter time. In an extreme case a young man who needed a house before he could marry built one in 5 days using a bamboo frame and prefabricated bamboo matting bought at a market in town. This could be an important advantage in some circumstances.

People are well aware of the limitations of bamboo, particularly in respect of insect attack and its poor resistance to rotting. A common form of seasoning is to immerse the bamboo culms in ponds for a period of 2 to 3 weeks. This results in dilution of the contained sap and reduces future insect attack but the precise benefits have not been quantified.

Examination of old houses by Carter (1997) found that the bamboo stems embedded in some had lasted for over 20 years without significant deterioration. This led to some thought as to whether modern practice provides an inferior material. Currently, bamboo is normally cropped after about five years' growth. Proximity to rice paddies will result in bamboo growths being enhanced by the artificial fertilisers used thereon; this may, at first, appear an attractive by-product of modern agriculture but rapid growth usually results in a less dense, weaker material. These effects have not been investigated in depth; further studies into such hidden by-products of the current emphasis on food production are urgently needed.

Bamboo splits easily and is therefore difficult to joint by normal carpentry methods. Nails do not hold tension for long before pulling from the culm. Frame joints are therefore commonly held together using jute cord or other natural binders which decay rapidly. Creepers may be used in forest areas but are not seen in Sundarban village. Hasan (1985) has recorded the typical framing details of village houses.

Timber

Timber is normally too expensive to feature in kutcha houses. Very few low-income households will have access to cheap supplies; even timber which grows on their land must be put through the expensive processes of seasoning and sawing to make usable sections.

Thatch

Four different types of thatch are used in Dinajpur District. Traditionally, Chon Grass was used for its low cost, straight stems and relative longevity. However, this material was not cultivated for any other reason and, since the "green revolution", the sites where it grew have been put to rice cultivation. It is now very hard to obtain.

Rice straw is the most readily available thatching material but the rapid-growth of high-yield rice varieties means that much of the straw available now is of very poor quality and rethatching is needed at one to two-year intervals.

Wheat is also commonly grown in the District. Wheat straw is widely used elsewhere in the world for thatching (see, eg. Harding and West's paper in page 79). The stems are straight and provide improved resistance to rainwater penetration, compared with rice straw. However, it is not available until quite late in the house building season which deters many from using wheat straw, even in this area. Even more durable and almost as popular as wheat is the outer leaves, or covers, of sugar-cane. The large plantations of sugar-cane in Dinajpur District produce covers almost as a by-product. It is more difficult (and hence costly) to use as thatch but it can give twice the life-span of the other materials.

Corrugated iron sheet

Corrugated galvanised iron (cgi) sheet roofs are widely prized for their longevity. They also act as important repositories of savings in that sheets can be resold in future times of hardship and replaced with cheaper thatch. The most common type of cgi construction among low-income households in Sundarban village is the *sapra* roof. Nearly 40% of the houses inspected had these in which the cgi sheets are trapped between two frames of bamboo and mounted in a single slope at a shallow angle. Pitched roofs of this type of construction have been noted in North East India but so far not in North Bengal. An important factor in this construction is that the sheets are not nailed or damaged in any way; this enables them to retain their value as a hedge against hardship for much longer. It also makes them more vulnerable to removal by strong winds.

The breakdown in cost of a house of this type (*sapra*) is quite revealing. Typically, 20% of the cost is bamboo, 60% is CI sheet, 5% other materials and the remaining 15% is taken with labour costs. This type of construction is popular largely because it uses the minimum amount of CI sheet possible; even so, over half the cost is taken up by purchase of this expensive commodity.

Incremental construction of homes

Because of the high cost of house building, an incremental approach may often be adopted. Many householders with *sapra* rooves express the hope to

one day be able to afford the additional CI sheet to convert the roof into a hipped structure which is both more durable and of a form which is traditionally more respectable. Houses are often built with it in mind to include additional features at a later stage when funds allow. For example it is possible to convert a verandah from thatch to CI sheet or to add thatched covers around the perimeter of a mud walled house to protect it from the direct impact of rain. One householder had struck a bargain on a pile of bricks. Although not enough to build a house he saw it as a worthwhile investment and expected to buy the remaining bricks required in a few years' time. The adaptability of kutcha housing cannot be more vividly illustrated than one example of two brothers who initially shared a large single-roomed mud walled house. As their families grew they wished to move into separate rooms. Being some distance from suitable mud they knocked down their existing house, reconstituted the mud and with it built a new two-roomed house.

Homestead forms

No overview of rural housing in Bangladesh (or anywhere else) would be complete without consideration of the organisation of the homestead around the house. Hasan (1985) comments that "traditional attitudes towards different domestic activities still dictate the space organisation of a rural house (in Bangladesh)" although he does point out that population pressure was already changing those traditional attitudes. The extent of the typical rural family group was reducing as children were being forced to move away to urban homes.

Nonetheless, the needs for privacy, secure compounds for agricultural activities and for housing junior family members still today dictate a courtyard-centred homestead with various buildings around the perimeter. Thus, many houses still develop linearly, one room at a time as the needs grow, and the rectangular single room with a central door and length to breadth ratio of 1.6 remains the basic unit of kutcha building.

Summary and suggestions

The factors governing choice of building materials are diverse and lead to a large variety of building forms even within a very small area. Although the choice is largely cost driven there are social and geographical factors which cannot be easily quantified. Even the cost of materials and construction will vary from family to family depending upon their location, assets, expertise and available time.

Developing low cost housing for Bangladesh should not be seen as a project to design a low cost house. It should be seen as a process which enables householders to make more informed choices and to share housing knowledge and expertise within their communities.

For that process to be effective, it must incorporate professional technical expertise in a readily understandable form and in such a way that villagers can quickly obtain appropriate answers to sometimes complex technical questions. This will require multi-disciplinary coordination across the boundaries of technology, sociology, economic and anthropology sectors.

A good start could be made by implementing the first recommendation of the 1996 Housing and Hazards Workshop, to establish coordinating bodies. The link between BUET and Exeter could provide the nucleus for such a body.

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***Note:** The report on the first Housing and Hazards field study can be obtained from the Group in UK. Contact Dr Robert Hodgson at the address given at the front of this book*