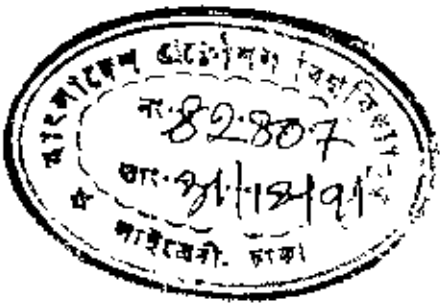
INSTITUTIONAL ASPECT OF THE CHOICE OF TECHNOLOGY
AN APPRAISAL OF LOWCOST HOUSING IN BANGLADESH

MURP Thesis



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INSTITUTIONAL ASPECT OF THE CHOICE OF TECHNOLOGY
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ABSTRACT

The ingredients of technology, and factors of choosing housing as a technology are discussed in this thesis. Due emphasis is given on the appraisal of affordable lowcost housing in Bangladesh. The objectives of the study were to critically examine the range of opinions to set National standards, to determine constraints and to identify criteria for the proper development of lowcost housing, especially for lower income groups.

In this study, characteristics of housing technologies, origin and growth of technology institutions in Bangladesh and their institutional aspects are analysed. Moreover, due emphasis is given on the philosophical background of housing institutions and their interrelationships with development indicators. For the study, both the primary and secondary sources are used.

In the conclusion, there is a proposal for the formation of a National Body, which would operate to successfully implement an integrated housing policy, incorporating all other existing and proposed sectoral and National policies, to provide lowcost, decent and affordable housing to the lower income groups of the population.

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ABBREVIATIONS

AAAS	American Association for the Advancement of Sciences
ACI	American Concrete Institute
ASTM	American Society for Testing Materials
BBS	Bangladesh Bureau of Statistics
BIDS	Bangladesh Institute of Development Studies
BSTI	Bangladesh Standards and Testing Institution
CIB	International Council for Building Research and Documentation
CSC	Commonwealth Science Council
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CUS	Centre for Urban Studies
CWPC	Cold-drawn steel wire prestressed concrete
DII	Dhaka Improvement Trust
GOB	Government of Bangladesh
HBFC	House Building Finance Corporation
HBRI	Housing & Building Research Institutute
HSD	Housing & Settlement Directorate
IAT	Institute of Appropriate Technology
NCST	National Council on Science & Technology
NGO	Non-government Organisation
PPH	Physical Planning and Housing
PPWSH	Physical Planning, Water Supply and Housing
R&D	Research and Development

SMA	Statistical Metropolitan Area
UNESCO	United Nations Educational Scientific and Cultural Organisation
UNIDO	United Nations Industrial Development Organisation
USDA	United States Department of Agriculture
WASA	Water Supply and Sewerage Authority
W/C	Water-cement

CHAPTER 1

CHAPTER 1

HOUSING INSTITUTIONS IN BANGLADESH AND THEIR EVOLUTION

1.1 INTRODUCTION

Housing is a basic human need. Secure shelter represents a basic human right. On October 24, 1970 the United Nations General Assembly adopted the following declaration on the International Development Strategy for the Second United Nations Development Decade :

> "Developing countries will take steps to provide improved housing and related community facilities in both urban and rural areas, especially for low income groups. This will also seek to remedy the ills of unplanned urbanization and to undertake necessary town planning. Particular effort will be made to expand low-cost housing in both public and private programs on a self help basis, and also through cooperatives, utilizing as much as possible local materials and labour intensive techniques. Appropriate international assistance will be provided for this purpose".(UNESCO Committee on Housing, Building and Planning,1973,report of the Secretary General.)

Lowcost housing is clearly a high-priority program for all countries in the world. Population growth, urbanization, and the attendant growth of slums and squatters all contribute to the urgency of the problem. The need for new housing alone is so staggering that, according to the

estimates by the United Nations Centre for Housing, Building and planning, the demand for construction of all kinds during the last half of the twentieth century will exceed the total volume of building throughout the whole of human history. Their 1973 report on world housing concludes that the conditions continue to deteriorate at an alarming rate.

Bangladesh Constitution declares 'shelter as one of the rights of her citizens'. Like almost all developing countries, housing situation in Bangladesh has never been satisfactory due to results of iteration of forces like high density of population over a limited quantum of land, vast population pressure, low level of income of the people, very limited natural resources and developing economy of the country. To understand the problem it is imperative to examine the problem in context of National Development Policy/strategies in Bangladesh as was stated in the preface to the Second Five Year Plan (SFYP) document,

> "We have very little choice but to mount a vigorous efforts to secure a rate of growth in per capita income, to ensure basic needs to our people and initiate construction of urgent social and economic infrastructure for sustained growth. (Government of the Peoples Republic of Bangladesh,1980,Second Five Year Plan, Preface by the Minister for Planning).

Economic development generally reguires a great expansion of the urban labour force, and if adequate hygienic housing and public facilities to serve the enlarged population are not provided, urban household living

conditions, instead of becoming better, usually become worse. The inundation of metropolitan cities by monsoon flood water with migrants influx from the countryside creates problems that inevitably result in personal, social, economic, institutional ethnic and political tensions.

Under macro-economic growth model assumptions, large scale investment in housing is considered unproductive and economically unwise. Hence emphasis is given on low-cost housing in both developed and developing countries. The severity and magnitude of the problem are pronounced in our country. Hence the Government must adopt and implement appropriate policies and priorities for human settlement and housing, inter and multinational cooperative research and development programs must be initiated and coordinated to search for solutions to the multifaceted complex problems of providing affordable housing for the entire nation, especially for the weaker section of the population who are unable to own or rent minimal essential shelter. The argument for technological research and appropriate institutional network rest on the presumption that many unknown or little-known efforts are being made in this field with too little, any in many cases, no interchanges of problems and potential solutions.

Although several institutions have responsibilities for attacking the problem of lowcost housing for the lower income group of the people, no significant achievement has been made. On this background, I like to investigate the

role of technology selection in low-cost housing and to check the possibility of establishing a net work of cooperating institutions to rationale and to optimise utilisation of resources for the low-income group in a variety of socio-economic environment.

1.2 TYPES OF HOUSING INSTITUTIONS

Different institutions, both Government and Non-government, are working in the different aspects of housing in Bangladesh. Lowcost housing is a major objective of all the Government commitments after liberation. In Bangladesh, lack of coordination amongst different organisation is one of the major institutional weakness. Because institutions responsible for policy formulation, planning, design, implementation, monitoring, management and evaluation of shelter, accommodation and services programs are fragmented and uncoordinated.

In the urban areas multiplicity of agencies in the field of housing and building and urban services located sectorally in different ministries has led to a situation which is confusing, to say the least. Management of urban affairs in a fast growing metropolitan centre is always a formidable challenge. Yet it is recognised that the system can better respond to public demand if it is unified and attempts, simple in nature, are to be made to bring the concerned ministries into a policy level forum where

sectional policies and programs contributing to urban shelter, services and infrastructure can be periodically reviewed and dovetailed or synchronized to achieve maximum coordination.

A list of housing institutions along with their functions are shown in figure 1.

1.3 HOUSING SITUATION IN BANGLADESH

Generally housing situation in our country is not satisfactory. Basically the entire country is made of 68,000 villages. Except cities like Dhaka, Chittagong and Khulna other urban centres have rural features in them. At present we have 14.785 million housing units among which only 13.81% are situated in the urban areas. A breakup of housing units is shown in the following table.

Table No. 1

CLASSIFICATION OF DWELLING UNITS IN URBAN AND RURAL AREAS.

Area	total	household %	Pucca	%	Semi-Pucca	%	Kutcha	%
Urban	2.042	13.81	.321	2.17	0.167	1.13	1.554	10.51
Rural	12.743	86.19	.095	0.65	0.155	1.05	12.493	84.49
Total	14.785	100.00	.416	2.82	.322	2.;18	14.047	95.00

Source: Bangladesh statistical Year Book, 1986.

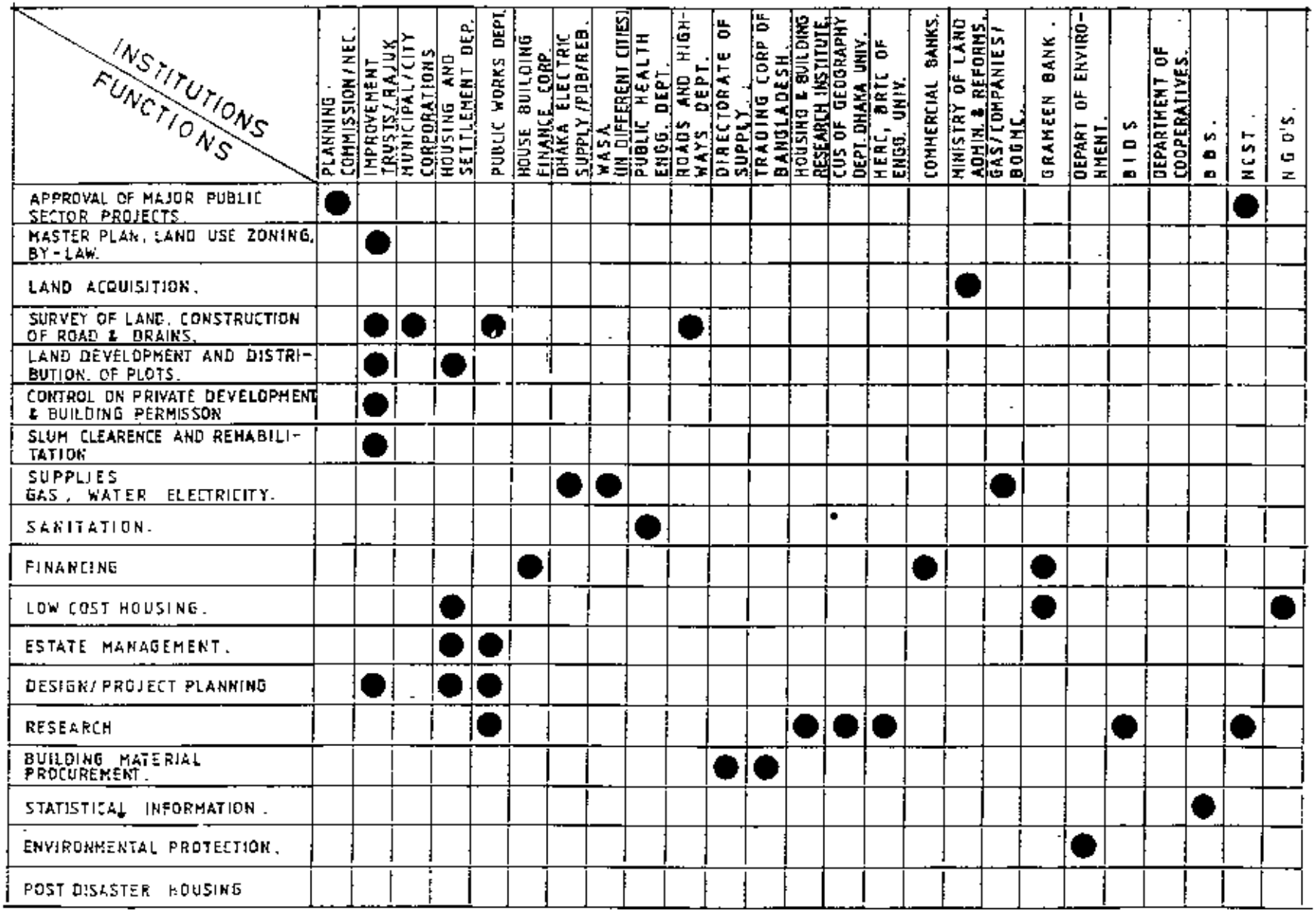

Figure 1: HOUSING INSTITUTIONS IN BANGLADESH.

We have 2.25 million newly added people as a result of an annual population growth. From 1940 to 1981 in just 41 years; the population of the country was doubled. At the rate of present national population growth, it will take only 28 years to double again to 179.8 million. At present, we have four divisional cities (including the capital Dhaka), 64 district towns and 460 upazilla centres. These urban centres contain 0.05 million to 7.0 million people and in total around 15% of the national population. The urban population was 14.1 million while that of rural was 75.9 million in 1981. The metropolitan cities of Dhaka, Khulna and Chittagong received most of the rural migrants. The table below shows a statistical picture of increase in population, dwelling units and occupancy rate between 1974-1981.

Table No. 2

INCREASE IN POPULATION, DWELLING UNIT AND OCCUPANCY RATE BETWEEN 1974-81.

		1974	1981	Percent increase
Urban				
Population	(000)	6,273	13,228	111
Dwelling Units	(000)	1,036	2,042	97
Occupants/Dwelling Unit		6.05	6.48	7
Rural				
Population	(000)	65,204	78,892	13
Dwelling Units	(000)	11,543	12,743	10
Occupants/Dwelling Unit		5.65	5.80	3
Total				
Population	(000)	71,477	87,120	22
Dwelling Units	(000)	12,578	14,785	18
Occupants/Dwelling Unit		5.68	5.88	4

Source: BBS Vol.1987

Projections indicate that by the turn of the century one third of the country's population will be in urban area.

The housing situation in our country can be broadly divided into two categories, such as; (i) Rural Housing and (ii) Urban Housing.

THE RURAL HOUSING SITUATION: In the rural areas, where more than 80% of total population live, most of the housing units (about 80% of the national total) are structurally 'Katcha' and are easily damaged or destroyed by the ravages of floods, cyclones and tornadoes.

The bulk of the construction in the rural areas used to be accomplished with materials like bamboo, wood, grass, thatch etc. In the past these materials were in abundance where there were thin settlements and the construction and maintenance of thatched houses did not prove a serious problem. With the growth of population the areas which used to grow these materials are now badly in need for the production of food and feed and as such these materials have become scarce and that the cost has gone considerably up, making not only the basic construction difficult but also its maintenance. In many areas where there is considerable rainfall the cost of construction of such thatched huts and their maintenance over some reasonable period today compares favorably with regular pucca construction, with such

materials as bricks, cement, M.S.Rod etc. In many areas Corrugated Iron sheets are used as roofing and walling materials which need less maintenance cost, but the basic cost of such construction is also high enough. In the areas, which are affected by cyclone, corrugated iron sheets prove to be dangerous at the time of cyclone. The construction procedure with these materials is not simple either.

Housing and rural poor: Although opinions differ as to whether provision of housing alone is an answer to the solution of the problems of the rural poor, there is no denying of the fact that when floods or cyclones either wash or blow away the flimsy structures of the rural poor, they tend to sell whatever they posses and track to the cities in search of shelter and employment. Post-disaster relief and rehabilitation efforts by Government and NGO's providing shelter and food, clothing, Medicare etc. prevent the poor families from leaving their rural habitat and flocking to the towns and cities where provisions of shelter and assimilation of their labour and skill in the urban milieu is much more costly. In human terms an uprooted family is a social burden which the nation can ill afford to bear.

Government's efforts in replacement of flood and cyclone affected housing in the rural areas have in the recent years been substantially supplemented by the NGO's both on outright grants and on loan basis. The NGO's have by now contributed almost 120,000 units as part of their flood

relief and rehabilitation programs especially after the unprecedented floods in eights. Under the cluster villages programs aided by the EEC the Governments plans to build 20,000 units of shelter in 1989 for the rural landless families. All these are perceptibly bringing about a qualitative change in the rural housing situation.

Perception of Rural Families : A field survey in 1979 [1.3] and study of the existing condition of "Rural Housing in Bangladesh" results:-

- 10%, 20%, 34% and 5% of the rural families perceive shelter problem as the primary secondary, tertiary and little or no problem respectively.

- 40%, 10.5%, 12.5% and 37% of the families perceive food and clothing problem as the primary, secondary, tertiary and little or no problem respectively.

The main problems affecting the rural housing seen in Bangladesh may be enumerated as follows:-

- About 30% of the rural families do not have their own homesteads, they live in izmali (Shared), mortgaged or rented homesteads.

- In most of the homesteads (63.3%) built-up area is inadequate (below 2000 sft) compared to the average size of the families (6.5 members). This causes overcrowding and affects the quality of life and living in a rural homestead.

- 80% of the rural structures are of Katcha

construction, of temporary nature and most of these (68.3%) are of physical conditions which may be described as moderate to poor.

- 31% of the homesteads have no latrine facilities while only about 14% of the homesteads have pucca latrines. The rest of the homesteads (55%) have what can be described as Katcha latrines. Coupled with this about 70% of the homesteads do not have any drainage facility and these are indicative of the poor standard and practices of health sanitation and hygiene in the rural communities.

- Only a small percentage of rural families (5 to 15 percent, varying with the regions) perceive their housing as a problem of any serious concern although the survey shows that most of the families have been living in conditions much below the minimum levels of acceptable standards in terms of house structures, space, privacy, health hygiene and sanitation requirements, community facilities and services. This suggests a lack of awareness of a distorted sense of perception on the part of a large section of the rural population. It is also interesting to note that irrespective of education in family, only the families with higher income perceive shelter problem as the number one problem.

Interestingly, though not surprisingly, the poorer section of the rural populace do not perceive shelter as their number one problem, majority (53.4%) consider it to be their third major problem. A large number of families in the

upper income group, though living in better structures, consider shelter as their number one problem. This perceptional difference between the rich and poor has very significant implication in the rural area in Bangladesh.

THE URBAN HOUSING SITUATION: Housing condition in urban areas is more complex and multi-dimensional than that in the rural areas. There are fast rising population, increasing gap between the demand and supply of housing and related services, acute congesting and the environmental degradation associated with the proliferation of unplanned 'bustles' and squatter settlements. These are causing rapid deterioration of socio-physical environment and law and order situation. According to an estimate of the World Bank there were 1.9 million units of housing for the estimated urban population of 11.8 million in 1980. In the year 2000 A.D. the urban population is likely to be 31.1 million demanding 5.287 million additional housing units.

The role of the housing companies, property developers etc. has acquired a visible dimension with the construction and sale of 4,000 flats in Dhaka City in the last couple of years. Though catering to the housing demands of higher income groups their contribution deserves positive recognition and appropriate policy support from the Government.

PROBLEMS OF SLUM AND BUSTEE DWELLERS IN URBAN AREAS : The marginal settlements like 'bustees' have been growing up

in all urban areas, especially in Dhaka, Chittagong and Khulna city areas. Inadequate access, lack of proper sanitary facilities, open space, parks, playgrounds schools and acute congestion are the main characteristics of the 'bustees'. These inadequacies in social and community facilities have been deteriorating further over time with fresh arrival of rural immigrants and the building activities carried out by private individuals in unorganized manner. The solution to the growing problems of slums lies in upgradation and rehabilitation, not in slum clearance. City/Municipal Corporations and Pourashavas are required to prepare realistic development plans for access and community service with the aid and assistance of relevant national agencies, NGO's, local leaders and community development workers.

Along with 'bustees' the problem of squatters poses serious problems and dilemma for the Government and this is a phenomenon prevailing in many major cities in the developing world. The upgradation approach in 'bustees' cannot be a standard solution to squatter problems. We have also to recognize that squatting will be a continuous phenomenon in the urban scenario. Only overtime with rapid socio-economic development and vigorous implementation of housing projects adopting the Area Development strategy, the towns and cities will be able to arrest the phenomenon and eventually eliminate it.

Following measures can be taken up to solve the urban housing problems:

1. In Bangladesh the estimated annual increase of urban population is about 3.58 times the population growth rate. The rate of increase in housing is far lagging behind the rate of increase in urban population and as such the housing situation has become more and more complex. In solving the problem, the capacity for investment and the availability of building materials and construction workers must be taken into consideration first. Then we must narrow down the gap between the rate of increase in population and the rate of increase in housing.

2. Since actual housing demand is usually much lower than the need for housing it is always difficult to give satisfactory relief to the housing problem. The housing needs in economically influenced commercial sector may be fulfilled by giving technological assistance and supplying building materials and to let them build by their own saving. The social needs may be fulfilled by the following Schemes:-

- Promotion of housing schemes by which they can afford the rent within their means.

- Promotion of self-help housing schemes with assistance of Government help by way of materials.

- To develop sit' and service schemes so that they may help

themselves to build their own houses.

3. For efficient management of the urban immigrants, the following tentative steps may be effective:-

- Decentralisation of the urban areas.
- Creation of job opportunities in the rural areas.
- Minimization of the rural-urban wage disparity.
- Development of the rural areas.
- need for a national survey.

4. There is scarcity of building materials in the present housing system. To solve this, building materials should be produced locally and made more easily available for construction.

Current National Housing Trends: The housing conditions of Bangladesh need to be improved. Housing stock is inadequate. Structural quality is poor. Number of occupants per dwelling unit is higher than it should be and conditions of tenure need to be revised. The housing stock increased by 18 percent between 1974 and 1981, while population of the country during the same period increased by 22 percent. This has resulted in an increase in occupancy rate from 5.7 persons per dwelling unit in 1974 to 5.9 persons in 1981 (Table-2). Rapid urban population growth resulting both from natural increase and rural-urban migration have combined to create a serious housing problem in the urban areas of Bangladesh. During the period from 1974 to 1981 urban population increased by 111 percent and urban housing stock by 97 percent. While the corresponding increase in rural areas are much less the shortfall in the growth in the

number of dwelling units has resulted in the increase of persons per dwelling unit in both areas.

1.4 HOUSING PROBLEMS AND INSTITUTIONS

Housing and related services problems are closely linked with institutions working in this field. But lack of proper linkage amongst them acts as a negative catalyst for proper policy guidelines, planning and management of housing problems both at urban and rural levels of the country.

During the second five year plan it was envisaged that

> "a comprehensive approach will be made for the development of Skilled manpower, acguisition and adaptation of foreign technologies and development of technologies suitable to the conditions of the country."(Chapter PPH)

But due emphasis was not given on the institutional framework and interagency coordination in general and in the housing sector in particular . Also, the reasons for not implementing technology development programmes (housing as being a technology) envisaged during the First Five Year Plan were not clearly understood.

Without designing and consequent implementing coordinated approach in the institutional level, a set of new measures were recommended during the SFYP (1980-85) (Second Five Year Plan, Pxii - 26). Which were as follows:-

a) Establishment of an Institute of Technology and Engineering Consultancy.

b) Establishment of separate design offices at engineering enterprises.

c) Establishment of closer linkage between research establishment, engineering academic institutions and industry.

Unfortunately the above programmes were not implemented during the plan period.

For coordinating all scientific and technological works in the country, the National Science & Technology Policy was adopted in 1986, where 'Housing and Public works' was identified as one of the thrust areas in which R&D was needed. (Science and Technology Division, 1986, National Science and Technology Policy).

Also a National Committee on Science and Technology was formed vide a Cabinet Division Resolution in 1983. (National Science and Technology Policy, P 16 (Annexure -A)) with the following composition:-

1)	Head of the Gov't	Chairman,
2)	DCMLA	Vice Chairman,
3)	Minister for Commerce and Industry	Member,
4)	Minister for Works	Member,
5)	Minister for Health and Family Welfare	Member,
6)	Minister for Agriculture	Member,
7)	Minister for Education	Member,
8)	Minister for Local Gov't and Rural Development	Member,
9)	Secretary, Cabinet Division	Member,
10)	Secretary, Industries Division	Member,
11)	Secretary, Education Division	Member,
12)	Secretary, Local Government Division	Member,
13)	Secretary, Health Division	Member,
14)	Secretary, Agriculture Division	Member,
15)	Member, Planning Commission, dealing with Science and Technology	Member
16) - 22)	Seven eminent Scientists including the Chairmen of Atomic Energy Commission and BCSIR	Members
23)	Secretary, Science and Technology Division	Member-Secretary.

But in the housing sector, in particular, no such noble venture was done for proper utilisation of related institutions in a coordinated manner. Even the draft Housing Policy was not approved yet. A functional relation of different institutions in housing was given in 1.2.

1.5 EMERGENCE OF RESEARCH INSTITUTIONS IN HOUSING:

Human history is the history his continuous efforts for the betterment of his life and environment. Consequently the emergence of Research (either institutional of fragmented) dates back to prehistoric times. However, specific Research Set-up in the geographic part of our country bears the history of nearly 4 decades. The Provincial Government of East Pakistan set up a 'Housing Committee' in 1961 to take stock of the Housing problems of the Province and to suggest

measures for solving the same [1.7]. This committee submitted the draft report in September, 1961. The report contained a proposal for the establishment of a 'Building Research Centre' in Dhaka. The committee opined

> "in order to cheapen the cost with due regard to comfort and durability, research is necessary. The use of indigenous materials, and prolonging their durability should be found out by research. The trend of research differs from country. Each country we have got our problems which are not solved in other countries. Heavy clay material has been found to be the basic material for our houses in East Pakistan. So our main aim should be to cheapen its cost, especially of bricks and also to carry on research to find out clay tile for roof coverage and floor. In some part of our Province we can even go for earth wall or sun-dried brick wall, but for this, non-erodable type of plaster should be found out for protection against rains. For the internal partition, bamboo can be used for the wall, but it should be found out by research how the durability can be increased. As we have already said, in urban areas multistoried building should be our aim. Research should be made to cheapen the cost of the aggregate, and to decrease the load light weight aggregate should be found out. In rural and semi-urban areas where we can go in for one storied building, we may use bamboo, canes, straw, CI sheets and timber and it should be the aim of research to find out some sort of materials to protect these things from fire. If bamboos and timber are treated with some solution to make non-inflammable, then we may be able to use these materials without any apprehension....."(Ali, 1961, PP 20-21).

The Building Research Centre was established afterwards and was under the Housing & Settlement Branch of the Works Department. Initially 5 Research Divisions were proposed, namely:-

1. Information and Documentation Division,
2. Structural Engineering Division,

3. Building Materials Division,
4. Architecture Division with Efficiency and Comfort of Building, and
5. Resource and Productivity Division.

After independence, a full-fledged 'Housing & Building Research Institute' was established in 1977 by abolishing the erstwhile 'Building Research Centre.' Other related Research and Academic Institutes, which were established in the country, have been discussed in Chapter 2. A remarkable progress in the research areas was the inclusion of following fields as the thrust areas by the National Science & Technology Policy. (Science and Technology Division, 1986, National Science and Technology Policy).

1. Housing & Public Works,
2. Small Scale and Rural Industries,
3. Energy,
4. Transportation, and
5. Scientific and Technological Education including provision of interactions and coordination among educational institutions, R&D Organisations and industries.

1.6 OBJECTIVES OF THE STUDY

a) To critically examine the existing definitions, opinions recommendations to set National Standards regarding the meaning, definitions and scope in Bangladesh showing the 'lowcost' attitude.

b) To attempt to determine the constraints in the development of the existing concerned institutions in the field of lowcost housing.

c) To identify criteria for determining the positive aspects of proper development for housing for low income communities.

1.7 OUTLINE OF THE METHODOLOGY

a) Literature survey: An elaborate literature survey on the subject, especially the works done at home and abroad, was carried out for better understanding and representation of the problems.

b) Data Collection: Data was collected from primary and secondary sources.

c) Data analysis and processing: Statistical methods were applied for analysing the data.

CHAPTER 2

CHAPTER 2

CHARACTERISTICS OF HOUSING TECHNOLOGIES

2.1 HOUSING AS A COMPLEX TECHNOLOGY

Housing does not mean shelter alone but it comprises of shelter along with the services and community facilities. Housing is an expression of complex technology, whose area of concern describe the areas of professional interest in housing/settlement technology and the availability of information in interest areas.

An international team (Goodman, 1974, pp-334-'6) identified 29 areas of interest which are as follows:-

1) Housing Documentation/Statistics,
2) Housing Research Types,
3) Indigenous/Rural Housing,
4) Cooperative Housing,
5) Self-help Construction,
6) Construction Materials
7) Construction Methods and Management,
8) Architectural Design,
9) Climatological Aspects,
10) Housing Policy and Legal Aspects
11) Housing Management
12) Demographic Aspects,
13) Social and Health Aspects,
14) Economic Aspects,
15) Financing Methods,
16) Ecological Aspects,
17) Energy,
18) Sanitary Engineering,
19) Urbanization,
20) Regional Planning,
21) Rural Planning,
22) City Planning,
23) Community/Neighborhood Planning,
24) Education/Community Development,
25) Squatters and Marginal Settlements,

26) Land Reclamation,
27) Appropriate Technology,
28) Agricultural Development, and
29) Traffic and Transportation.

On the otherhand, a relationship can be drown among different disciplines of professions and policy programmer concerned with housing following an AAAS (American Association for the Advancement of Sciences,1985, pp-2) publication. The associated fields and Professions are:-

1) Engineering,
2) Operations Research,
3) Computers and Informatics,
4) Environment and Energy,
5) Science,
6) Management of Technology,
7) Philosophy and History of Settlement,
8) Administration,
9) Law,
10) Resource management,
11) Science, Technology and Society,
12) Economics,
13) Public Policy and social Science, and
14) Industrial Management.

2.2 ADVANTAGE AND DISADVANTAGES OF DIFFERENT HOUSING TECHNOLOGIES.

What are the types of technologies?

Before answering this question, we are to search for what technology is. Broadly speaking,

> "Technology can be defined as the application of a scientific fact or principle for some useful purpose".(Francis and Mansell, 1988, pp-1).

Civilisation and technology are closely related.

> "The history of technology is the story of man's long and painful efforts to control his material environment for his own benefit".(Encyclopedia Britannica, 1970 ,Vol 21 P.750,)

During the passing of time technological developments are creating obsolence, which are process obsolence and product obsolence and their main causes are:-

i)"Economic (Changes in the relative prices of resource used in production, and changes in living standards);

ii) Technical (Developments in the technologies in use);

iii) Social (Changes in living practices of people, linked with living standards or with changing attitudes to work and leisure.) The characteristics of technologies generally interact with one another in a dynamic system", as Stewart illustrates in diagrams.

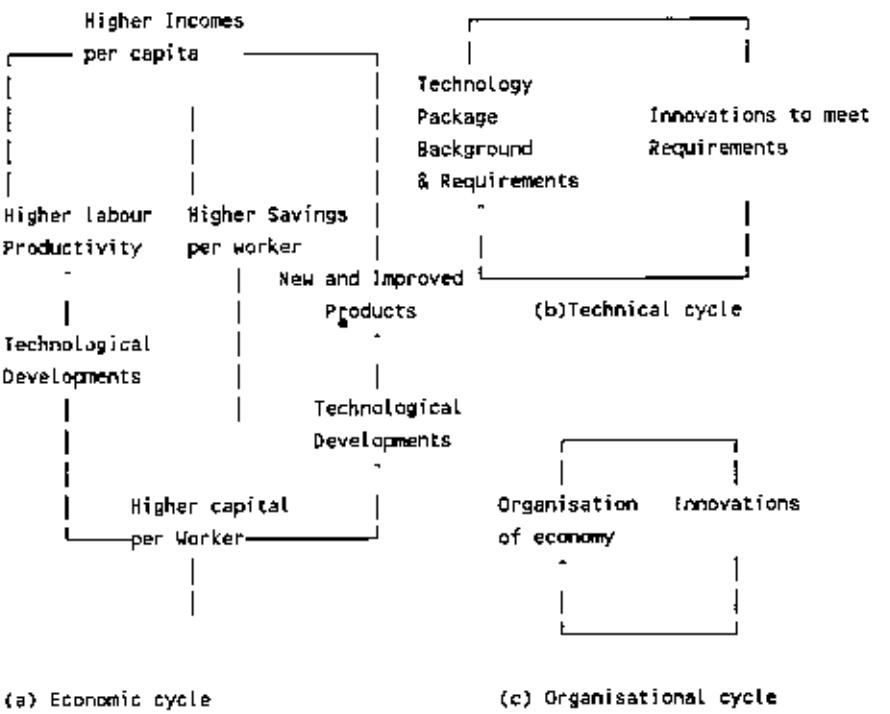

Fig.2: Technological Developments in a Dynamic system (Stewart, 1978)

To assist in this process of selection of an appropriate technology for a particular situation (as for example: housing), it may be useful to distinguish different classes of technology , which may be described as `low' `intermediate' and `high' technologies. But there are various reasons which areas in classifying and choosing technologies for particular situation, they are broadly follows:-

1) Climatic differences,
2) Organisation of Production,
3) Income levels (of adopters),
4) The skills of workers,
5) Differing Patterns of demand.
6) Social reasons.
(Stewart, 1978,Technology and Underdevelopment).

Following Schumacher (Blond and Brings, Small is Beautiful) the basis of distinction would be based on the amount of capital investment required to equip and support are work place, because this quantity is directly linked to the amount of employment created in a certain fixed amount of investment, a crucial factor is the planing of all developing countries. But there are also other important differences amongst them.

(a) Low technology : At the end of the scale are the low technology methods, which can roughly be equated with the exiting village technologies. Its characteristics are:

i) Cheap to establish.
ii) Large base.
iii) Use of local resources.
iv) Well adopted use by the individual or by a small family group.

v) Produced goods are suitable for use in the immediate vicinity.

vi) Labor-intensive, hence, relatively inefficient use of labour, raw materials and goods etc. e.g., traditional lamp brick burning techniques are intermittent and more use of fuel etc.

(b) High technology: On the top of the scale are the high technology methods. Its characteristics are:

i) It includes vast majority of imported production technologies.

ii) Its methods are suitable for large scale, dense, mostly urban markets, where income levels are relatively high and where the infrastructure are well developed.

iii) Largely capital intensive

iv) Labour saving, and creates very little employment opportunities.

For example, the replacement of bricks and mortar building methods by concrete and steel-based industrialized building techniques, which has been advocated and attempted in some developing countries to try to alleviate the urban housing shortages, has not only reduced on-site employment, but also introduced new types of skilled manpower which could only be found outside the country. In many cases such schemes have turned out to be expensive failures.

(c) Intermediate technology: Between the two ends, it is possible to identify a middle level, which involves of higher level of capital investment than that of traditional technologies, but substantially lower than that of the current technologies of developed countries. This technology, until recently, been rather

little promoted in most developing countries, it was commonly supposed that imported high technology methods provided the quickest means of developing countries to obtain high technology methods/processes.

Sometimes it is also called appropriate technology. The most balanced view on this type of technology was given at the UNIDO International Forum on Appropriate Industrial Technology held in 1978:

> "The concept of appropriate technology was viewed as being the technology mix contributing most to economic, social, and environmental objectives, in relation to resource endowments and conditions of application in each country,. Appropriate technology was stressed as being a dynamic and flexible concept, which must be responsive to varying conditions and changing situations in different countries.
>
> The appropriate pattern of technological choice and application would need to be determined in the context of socio-economic objectives and a given set of circumstances. The selection and application of appropriate technology would, the before, imply the use of both large-scale technologies and low-cost small-scale technologies dependent on objectives in a given set of circumstances".(UNIDO, 1978, Monographs on Appropriate Industrial Technology).

Technology, to be appropriate in a particular situation, should:

(a) "Meet the technical requirements of the situation by:

1. Using local materials and power sources;
2. Where possible, making use of and building on locally understood technologies;
3. again where possible, using techniques already

proven locally or elsewhere, to avoid failures for technical reasons;

4. if the aim is a product, ensuring that it is produced in acceptable but not unnecessarily high quality, and in quantities adequate for the intended market, existing or potential; that it is reliable in operation, low in maintenance costs, and simple to repair; and that transport facilities for bringing it to consumers are adequate;

5. where appropriate, ensuring that local requirements of climate or geography are meet.

(b) meet the social requirements of the situation by:

1. Involving the local people as much as possible in its development and introduction (ideally, responding to a locally felt need);

2. Using existing or easily developable skills and avoiding difficult, costly or time-consuming retraining;

3. Offering, on continuing basis, greater or expanding job prospects;

4. Creating jobs with intristic interest, as far as possible;

5. Minimising the need for movement of labour;

6. Encouraging regional and rural development ;

7. If in productive industry, minimising social or cultural disruption by increasing production and productivity gradually, in small steps;

8. Doing as little damage as possible to the physical environment;

9. Waiting disturbance to or violation of local customs, traditions and beliefs;

(c) meet the economic requirements of the situation by;

1. Being in live with the general requirement that for productive industry, investment per workplace should be limited to about 5 times the per capita income per annum, and for other uses of technology should be as low in investment and running costs as possible;

2. Minimising in particular the need for investment requiring hard currency;

3. Yielding a product competitive in price with resulting from the alternative choices of technology;

4. Ensuring that the use of the investment is competitive with local, regional and national development plans;

5. Integrating the producers more into the national monetary system;

6. Ensuring that the main economic benefit goes to the people concerned as a whole, and not to a new class of middlemen, or to foreign investors";(Francis and Mansell, 1988, pp-45).

In case of housing technology, the characteristics may be described as:-

1. Participation of consumers (especially villagers and low income urban settlers) in the development and implementation programme is the vital necessity for success of low cost housing and environmental projects. Decentralized administration and local Govt. bodies can play the central role to create the institutional attitude amongst the users.

2. Help of social welfare organisations, social workers and educated youths of the target group accelerates implementation.

3. Rural and urban handymen or semiskilled and skilled workers who actually build the houses have significant role to play.

4. Acceptability, adoptability and limitations of low-income group people have to borne in mind while choosing the technologies and materials for demonstration. The required level of confidence builds up gradually and is generally based on the success of a technology or an idea.

5. A study of merits and demerits of local materials and traditional construction technologies, needs to be conducted before proposing modifications in existing system or introducing new technologies. The living habits, socio-economic conditions and cultural values associated with particular material and construction system should not be disturbed, as far as possible.

6. The finances available for such programme are generally inadequate at individual consumer's level. Financial institutions of the country need re-orientation in order to change their roles for developing more effective mechanism and easily dispersion of loans and grants to help development of low-cost housing programmes.

7. General education should include emphasis on the need of better housing conditions, environmental improvement and conservation of energy. Examples of local success stories and their impact on society should be quoted.

8. Low-cost housing technology should be given wider publicity through mass media like radio, television and films. For dissemination of information other means like publication of technical notes, information bulletins, leaflets, booklets, special publications and digest in local colloquial, holding of seminars, workshops, exhibitions, get together, experimental demonstrations in different areas, and training programmes should also be resorted to.

9. Housing technology centres or regional offices of relevant research institutes should be established to propagate the results of research and solve the problems.

10. Success stories of implementation of research and development (R&D) projects and programmes generate a greater confidence in them. Such should also be circulated amongst the neighbouring regions/countries.

11. The technologies identified for use in other countries should be documented in the form of a manual. The traditional technologies available is different countries and their improvement should be included in such manual.

2.3 TECHNOLOGY CHOICE FOR LOW COST HOUSING

There are definite connections between social organisation and building technology choice. And characteristics of building technologies vary with

1. organisation of production.

2. Level of and distribution of income(of the section of population for whom the technologies are meant). and

3. Various technical factors.

Moreover, it is well established fact that the existing forms of social organizations, especially the socio-cultural values pervading in society as a whole, play a vital for successful choice and application of appropriate technologies in housing sector.

A quarter in the concerned experts in housing accept that the built environment can be considered as a kind of code, a system of communication of ideas through symbols; Thus, traditional values and ideas about social organisation are manifest in building built according to traditional principles. While modernizing ideas of social organization are indicated by buildings built by modern methods. Many developing countries today provide opportunities to observe this principles at work; in many of the large cities of ancient origins, for example Cairo, Teheran, Lahore, Delhi, Beijing, old buildings of traditional construction, still often highly appropriate to the climate and resources of the country, are being replaced by buildings of modern construction, largely indistinguishable from those of the industrialized countries, often using imported materials and skills,and usually needing, large quantities of high-grade energy to maintain habitable conditions.The urban

environment created by buildings of this type has destroyed the environment of the traditional urban society, and parallels the destruction of the values and social organization of the traditional society, and its replacement with the values of the industrialized world. The strength of these values, both traditional and modern, exerts an enormously powerful influence on the choice of building materials through the third world. Indeed, the poorer a society is, the greats the symbolic significance of materials and techniques appears to be perhaps because of the lack of alternative means of displaying status and position.

Modern designs using a cheaper, simpler more rational technology along with the lines have frequently been met with apparently unaccountable obstruction, rejection and even frustration of efforts. Mr. Lauric Baker, an architect of fame in Kerala, India, reports similar difficulties and frustrations for working towards a simpler, cheaper housing using a variety of radical cost reducing techniques. However, his approach directly contradicted the dominant set of values in society, in which a house symbolizes, the wealth and position of their poor owners.

The demonstrations in different less developed countries can and have encouraged a new generation of technologists(engineers, designers and architects etc.) to believe in the possibility of cultural diversity rather than uniformity, and in an integration of the best in both

traditions and technological opportunities.

A better realization of related sociopsychological factors would lead us to provide our poorer people with lowcost houses.

2.4. PERFORMANCE OF HOUSING TECHNOLOGY INSTITUTIONS IN DIFFERENT COUNTRIES

In the world many Institutions are functioning with specific aspect of technology choice for their needs as well as for promoting international cooperation. A list of the focal point institutions of international repute in this field are given below (CIB,1967, Problem of the programming and management of building research,pp-30):-

Table No. 3

COUNTRY	FOCAL POINT INSTITUTE
Australia	Division of Building Research, CSIRO.
Canada	Division of Building Research, National Research Council(NRC)
China(PRC)	Academy for Building Research
Czechoslovakia	Vyzkumny Ustav Vystavby a Architektury
France	Centre Scientifique et Technique du Batiment
Germany	Deutsche Bauakademie
Hungary	Institute for Building Science,ETI
Indonesia	Directorate of Building Research
Iran	Tehran University
Israel	Building Research Station, Israel Institute of Technology

Korea	Korean Institute of Science and Technology
Netherlands	Institute of Housing Science(IHS), Rotterdam
Norway	Norges Byggforkninginstitutt
Poland	Institute Budownicta
Singapore	National University of Singapore
South Africa	National Building Research Institute
Spain	Institute Eduardo Torroja de la construccion y del cemento
Sweden	Statens Institut for Byggnadsforskning
Thailand	Asian Institute of Technology
United Kingdom	Building Research Establishment, Department of Environment
U.S.A.	Office of Housing Studies, Deptt. of Housing & Urban Development,
	Centre for Building Technology, National Bureau of Standards,
	Experimental low-cost Construction Unit, Centre for Shelter Studies, Florida University
	International Institute of Housing Technology,.California State University
USSR	Research Department, Gosstroi USSR

Source : CIB Report 10

Other than developed and industrialized countries, we may speak of the Asia-Pacific countries, and most particularly the SAARC countries. In the Asian countries, which were initially involved in the Technology Development Institute were in a position to play a key role in the development and implementation of cooperative programmes. They were unique in these areas because they bad the

capability of doing the necessary research, taking promising results through the development stage, and bringing them to public and private agencies in a position to implement them. Indeed, the research institutes could actively be engaged in the implementation process. The participants were from the Philippines, Thailand, Korea, Indonesia, India & USA. Their focus were on the following objectives :

1) To exchange experiences and to generate innovative concepts in low-cost building materials and designs for housing,

2) To explore cooperative endeavours in the low-cost housing research and development areas.

3) To exchange information on country peripheral problems related to low-cost projects.

4) To provide specific guidelines for a workshop on lowcost housing materials and design concepts.

Now, let us concentrate our discussion on neighbouring countries along with Bangladesh. A list of the focal point institutes in the SAARC countries is given below:-

Table No. 4

COUNTRY	FOCAL POINT INSTITUTE
Bangladesh	Housing & Building Research Institute (HBRI)
Bhutan	None
India	Central Building Research Institute (CBRI)
Maldives	None
Nepal	Ministry of Works
Pakistan	Building Research Centre
Srilanka	Building Research Institute

In Bangladesh, the national focal point institute is the Housing & Building Research Institute,Dhaka. It is an

Autonomous Body under the Ministry of Works. It has a total manpower of 148 Personnel including 54 qualified researchers, R&D activities are now being executed through 4 Research Divisions, Such as:-

1) Building Materials Division,

2) Structural Engineering and construction Division,

3) Soil Mechanics and Foundation Engineering Division,

4) Housing Division.

Achievements: Inspite of early set back, the Institute has been able to develop techniques/materials and obtain valuable results from its R&D in the field of building construction which have been able to attract public attention and R&D activities have been directed towards the cost reduction of building materials. Improved methods of production of traditional materials, development of new or substitute materials and utilization of industrial and agricultural wastes have been given specific attention.

Research in construction techniques have also been directed to effective savings of conventional materials like cement, steel, timber and improving the durability and performance of the building, enhance the speed of construction and hence lower the cost of that. Simultaneous emphasis has been laid to improve traditional building techniques and quality of available building materials.

In addition, the Institute has been rendering valuable services of testing of building materials and soil to

general public and private construction agencies and Govt. and semi-Govt. Organisations in order to economise safe and better building foundation and construction. To highlight a few achievements some examples are stated below:-

1) Generation of ferrocement technology for roofing elements in place of conventional slab.

2) Prefabrication has been, to some extent, successful where centering/shuttering have been largely eliminated.

3) Development of roofing sheets from paper and boards made of water hyacinth.

4) Development of process for making pozzolanic cement using rice husk ash.

5) Development of improved technique of earth construction by soilcement/soil lime/asphalt blocks in place of ordinary mudwall.

6) Helping in the design of typical low cost houses for Rural Housing Credit Scheme of the Bangladesh Bank.

Table No. 5

LIST OF THE LOW COST BUILDING MATERIALS/ COMPONENTS DEVELOPED BY THE HOUSING & BUILDING RESEARCH INSTITUTE.

Serial No.	Name of Materials/ elements/components	Benefits/ Replacement of	Where to use	Cost Savings in Comparison with Conventional ones(%)
1.	Stablised Soil Blocks	Burnt clay bricks	wall Construction	20
2.	Pozzolana Cement	Portland Cement	Replacement of Cement	20
3.	Treated Bamboo	Untreated Bamboo	Walls, Roof	30 For longer life
4.	Ferrocement channel	RCC Slab	Roofs of 1 storied/low rise building	20
5.	Ferrocement Folded Plates	CI Sheets	Roof	30
6.	FC L Panels	CI Sheets	Roof	20
7.	FC Chowkat	Timber (good)	Door/Window	30
8.	FC Water tanks	RCC/GI tanks	Water Resservoir.	30
9.	RCC Hollow Column/ beam	RCC/timber/columns /beams	For small houses	30
10.	Packet House (10x10)	Alternative to timber poles	Skeleton of a house	35

Jamilur Reza Chowdhury Committee Report (1986, pp-25) on the evolution of activities of the Housing and Building Research Institute suggested the following measures for the

use of technology developed at the HBRI by other agencies and users:

i) In-depth assessment of various technologies developed and tested at the HBRI using the following criteria:

   a) Availability of materials (with emphasis on input of indigenous material)

   b) Ease of fabrication and transportation,

   c) Labour input with their skills levels necessary for quality control,

   d) Ease of maintenance,

   e) Cost.

ii) Constructions of prototypes not only at HBRI but also at selected District/ Upazilla headquarters.

iii) Preparation of design and construction manuals for each type, showing the typical working drawings and bill of quantities.

iv) Training of Engineers and Architects from different organisations and also of skilled construction workers.

v) The frequent occurrence of natural disasters in Bangladesh, Usually followed by intensive rehabilitation efforts, provides the HBRI with an opportunity of introducing new disaster-resistant housing technologies.

vi) Encouraging entrepreneurs to undertake manufacture the innovated building components so that there would be a gradual transfer of technology to the private sector constructions also.

INDIA: CENTRAL BUILDING RESEARCH INSTITUTE(CBRI) Roorkee.

It is an autonomous body under the Council of Scientific and Industrial Research (CSIR). It has built up a

high level of technical expertise , over 3 decades, in almost all fields related to building Science. It has 8 Research Divisions and 6 Extension Centres.

Table No. 6

DIVISIONS	EXTENSION CENTRES
1. Building Materials	1. Ahmedabad
2. Soil Engineering	2. Bhopal
3. Efficiency of Building	3. Calcutta
4. Building Process, Plant & Productivity.	4. New Delhi
5. Housing & Planning	5. Hyderabad
6. Education & Health Building	6. Trivendrum
7. Fire Research	
8. Rural Buildings & Environment.	

Expertise available at the CBRI are given below:

1) Characterisation of raw materials, natural resources, agricultural and industrial waster using modern physio-chemical and instrumental techniques.

2) Development of process technologies in the manufacture of new and improved building materials. This activities relate to the manufacture of bricks, tiles, cement, lime, paints, timber- based products, bitumen, plastic etc.

3) Design developments of plants, machinery for new building materials.

4) Preparation of techno-economic feasibility and project reports for materials.

5) Design development of residential, educational, health and commercial buildings.

6) Preparations of development proposal for human settlements.

7) Preparation of urban development and slum upgradation programme.

8) Design development of farm and rural buildings.

9) Design development of grain silos.

10) Cut off wall construction for control of seepage for agricultural and irrigation works and for water storage in desert/dry areas.

11) Building design taking environmental conditions and building operations for higher productivity.

12) Building cost planning, economics and planning, programming and construction management.

13) Energy development, utilisation and conservation.

14) Testing of building materials and components.

15) Sanitation (rural- urban).

Table No. 7

TECHNOLOGY DEVELOPED IN DIFFERENT COUNTRIES, WHICH ARE RELATED TO LOWCOST HOUSING

1. Fixed dome Biogas technology	India
2. Fixed & floating dome Biogas technology	India, China
3. Low cost roofing	India, Bangladesh
4. Tile manufacture	India, U.K.
5. Flooring	India
6. 'Wire- con' technique	Srilanka
7. Bamboo	Srilanka, Bangla-
8. Aided Self- help housing	Srilanka
9. Soil Stabilization	Srilanka, U.K.
10. Ferrocement roofing	Bangladesh, Thailand.
11. Wood Preservation	Papua New Guinea
12. Pole Construction	Papua New Guinea
13. Low cost sanitary system	India, U.K.
14. Low cost binding material	Bangladesh, India
15. Industrial waste utilization	Pakistan, India
16. Mud construction	Bangladesh, India, Egypt, Sudan.
17. Cold drawn steel wire prestressed concrete	China

Source: Mainly the Commonwealth Science Council(CSC) Technical Bulletins, U.K.

CHAPTER 3

CHAPTER 3

ORIGIN AND GROWTH OF TECHNOLOGY CHOOSING INSTITUTIONS IN BANGLADESH.

3.1 INSTITUTIONS (PRE-INDEPENDENCE)

During the Pakistani period, the Central Govt. in fact, was not interested for rapid and sustainable growth of appropriate institutions especially of helping the lower income people of the country by adopting, choosing and disseminating appropriate housing technologies.

Till the late 50's urban housing in the public sector consisted only of public servants housing and some plot developments in the metropolitan cities under the communication & Building Department (C & B) in 1958, a special Housing & Settlement Wing was elevated under the same Department initially to cater for planned resettlement of refuges. This Organisation developed 17 housing estates and constructed 26,000 nucleus houses and about 10,000 housing plots mostly for displaced persons. Moreover, the Building Directorate, Public works Department, the Autonomous Bodies and the Urban Development Agencies, tried to construct a number of houses and flats and developed some housing plots.

The Housing and settlement Wing of The Building Directorate was elevated to a full-fledged Directorate in 1970. As a constituent part of the Housing & Settlement Directorate, a centre entitled `Building Research Centre' was set up in sixties. Housing loan schemes established in 1950 (Ali, H.T.,1961) and House Building Finance Corporation was established in 1956.

Some lower cost houses were early done by the Public Works Department at the rehabilitation projects at Mohammadpur and Mirpur, Dhaka. Dhaka Improvement Trust (DIT) was established in 1956 with a purpose to control the private developments and to prepare schemes for proper development. It is interesting to note that one of the major assumptions for the preparation of the First Master Plan of Dhaka was that the then existing population would continue to increase at the rate of approximately 1.75% per annum, which proved to be not true in course of time (Minoprio, 1960, PP-3). The First Master Plan of Dhaka was adopted in 1959, but very little care was focussed on cost-reduction planning approaches for low-cost housing/housing for lower income people.

Though few organisations were functioning (under both the Central and Provincial Govts.) very little effort/stress was done on Research and Development (R & D) activities for the lack of adequate funds and appropriate policy and guidance from the top.

3.2 INSTITUTIONS (POST INDEPENDENCE)

After the liberation war, the housing & Settlement Directorate (HSD) was re-organisationally set-up, in order to deal with the problems of rehabilitation and relocation of thousands of victims of the war, in 1972. To enhance private sector housing development, House Building Finance corporation (HBFC) was reorganised in 1973. The purpose was to promote construction of private houses by providing soft loans. Housing & Building Research Institute (HBRI) was established as an Autonomous Body in 1977 for promoting the R & D activities in housing, especially low cost housing, by the better utilization of man, material and information resources. The objectives for the establishment of the HBRI (Ministry of law and Parliamentary Affairs, GOB, 1977, Housing & Building Research Institute Ordinance, P 3-4) were as follows :-

1. To promote technical and scientific studies and research on various problems of building construction and building material industries and of human settlements as a whole;
2. To study the availability, development and utilization of indigenous building materials;
3. To promote new and better uses of commonly used building materials;
4. To encourage adoption of quality control measures in building construction;
5. To initiate actions for the improvement of technology, method of planning and designing of building construction and maintenance works in the housing sector;
6. To develop inexpensive and new materials and technology for building construction through pilot projects;

7. To initiate research programme and case studies in the field of housing and building research in cooperation with the National Council for Science and Technology and other research institutes and Universities;

8. To evaluate its research activities and to initiate actions for adoption of research results;

9. To initiate fellowships and scholarships for the purpose of encouraging research and technical and scientific studies in the field of housing and building construction;

10. To train research personnel and technicians for the purpose of carrying out its research activities;

11. To provide for consultation and advisory services in the field of housing and building research;

12. To disseminate latest knowledge on the problems of housing and building constructions;

13. To publish regularly research reports, research bulletins, technical reports and other reports on the work done by it.

During eighties the Bangladesh Bank, through the Commercial Banks, started a Rural Housing Credit Scheme, for low-cost houses (e.g., 250 and 425 sft) with soft loans. But the result is not encouraging.

Large scale lowcost housing (through brick-vaults) programme of estimated cost of Tk. 305 crore was proposed by the Planning Commission in 1978 (Planning Commission, GOB, A proposal for construction of 60,000 Housing Units in Seven Years). The Physical Planning Division of the Commission, considering the merits and demerits of lowcost housing, made a proposal for building 60,000 such units over the period 1978-85. 10,000 of these were planned to be multi-storied permanent flats; 40,000 semi-permanent housing units and

10,000 semi-permanent single roomed hostel units. The proposal was placed for the consideration and subsequent approval by the Government of Bangladesh. But the programme was not finally implemented.

During the First Five Year Plan (1973-78), Tk 272 crore was allocated in the public sector for the development of physical infrastructures (including housing and Govt. employees accommodation) and Tk. 270 crore (ie., 99.22%) was spent. The Two Year Plan (1978-80) provided an allocation of Tk. 250 crore, ie., 8% of the total plan layout of Tk. 3261 crore and Tk. 241 crore (ie.,7.71%) was invested for the physical facilities development. Physical achievements fell short of the target because of the following causes *(Planning Commission, GOB, 1978, The Two Year Plan (1978-80)* such as :

- Cost of construction materials,
- Institutional Weaknesses, and
- Lack of adequate policy support.

The policy to encourage multistoried buildings in the private sector through cheap credit has been receiving comparatively less support of fund allocation since 1981 after 4 years of starting, when there was a short lived building `boom'. The second Five Year Plan (1980-85) allocated a sum of Tk. 820 crore against which Tk. 739 core (ie., 92.38%) was utilized. An additional Tk. 319 crore was invested for the physical infrastructural developments at the Upazilla Centres. During this period a few Govt.

buildings utilized lowcost construction techniques and materials, e. g., portions of Araihazar Upazilla Complex (15,000sft), Shaheb Bazar Shopping Complex Rajshahi (42,000 sft), and class Four Govt. Employees Flat Building at Badda, Dhaka (9,700sft) were built using HBRI elements/techniques.

However, the main problems encountered in the course of implementation of the SFYP *(Planning Commission, 1980, PPHWS, pp-326)* were *inter alia*, as follows :

- Resource Constraints
- Technology Choice
- Regulatory Problem and Inter Agency Coordination
- Land Acquisition and its use.

Some academic research set up have also been established for related research, for example : Housing & Environmental Research cell (HERC), BUET, Dhaka; Centre for Urban Studies (CUS) of the Dhaka University, Dhaka, Banqladesh Institute of Development Studies (BIDS) etc are worth mentioning. Bachelors and Masters/Research thesis/dissertations of the related Engineering, Architecture and Planning Departments of the BUET, BITs and of the Faculty of Agricultural Engineering BAU etc give emphasis on topics related to housing research. Some other organisations, such as : Institute of Bangladesh Studies (IBS) of Rajshahi University, Academy for Planning and Development, Dhaka; Forest Research Institute, Chittagong

etc also are engaged in doing research on relevant aspects of housing, building and socio-economic inter relationships.

Different voluntary and Non-Governmental Organizations (NGOs) are working on lowcost housing and public health/environmental programmes; among which *Rangpur Dinajpur Rural Service (RDRS), Terre Des Hommes, World Vision of Bangladesh, Proshika Manobik Unnayan Kendra* and *Grameen Bank* are worth mentioning (Ministry of Local Government, Rural Development & Cooperatives, and HBRI, 1987).

3.3 PHYSIOGRAPHIC REGIONS AND HOUSING TECHNOLOGY

Bangladesh, generally speaking, is a flat deltaic plain formed of old and new alluvium. The settlement pattern and housing practices of the people is closely interlinked with the physiography of the country. The areas of old alluvium are located high above the general level plain, while the areas of new alluvium lie in the flood plains of the modern rivers. As the whole country is intersected by a network of rivers, the areas covered by recent alluvium are very large. The river-bank levees are high, and the land gradually slopes inland away from the levees. The tracts of land lying between two rivers are shaped into furrows, and in many cases may form elongated "beels" or swamps.

The country can be divided into 7 physiographic regions (Chowdhury and Zaman, 1976 pp-51) such as :

- Piedmont plain,
- Barind and Madhupur Tracts,
- Central Valley Flat Plain,
- Moribund Delta,
- Coastal Areas,
- Haor Basin, and
- Hill Tracts

Characteristics of settlement patterns can be broadly classified as follows such as :

i) Nucleated Settlements in high flat land,
ii) Scattered and built on artificially raised lands,
iii) Linear along the river levees
iv) Scattered and inslated in offshore islands,
v) Highly dense clusters on artificially built mounds,
vi) Sparsely built homesteads in hilly areas, and
vii) Urban settlements etc.

The burning problems with housing practices and settlement pattern in different physiographic regions are mainly :-

i) Very high population density and low land/man ratio,
ii) Climatic hazards and natural disasters,
iii) Environmental degradation.

According to the Housing census, Pucca roofing is for 21% urban houses against 1.5% for rural ones. Household in dwelling units by material of wall and roof by residence,

1981 is given in appendix. This is interesting to note that model houses, both urban and rural, have bamboo walls; but for rural areas material is grass or leaves, thatched, rice/wheat straw or palm leaves.

Analysis of the district data show important differences amongst regions/districts. Dhaka district has 23% of all the pucca houses in the country, as it is expected for the inclusion of Dhaka city 13.8% of the houses have pucca walls in Dhaka district against 6.1% of the houses in Bangladesh. Other districts with more that 10% of the houses having pucca walls are Kushtia (12%), Khulna (11.4%) and Jessore (10.4%). Chittagong has 8.1% houses with pucca walls including chittagong city. Districts with the proportion of pucca-walled houses were below the national average are Bogra (3.6%), Rangpur (3.4%), Barisal (3.1%), Mymensingh (2.4%), Tangail (1.3%) and Putuakhali (1.0%). In lieu of brick of concrete the more substantial houses in some parts of the country use corrugated iron sheets for walls and more commonly, for roofs. In the country as a whole only 8.5% of houses have CI sheet walls, but 38.8% have CI sheet roofing. Districts with the above average proportion of houses with CI sheet walls or roofs are : Patuakhali (20.5% walls, 32.9% roofs), Barisal (17.7% walls, 40.7% roofs), Dhaka (16.4% walls, 46.9% roofs), Comilla (15% walls, 52.9% roofs), Mymensingh (11.7% walls 37.9% roofs) and Tangail (10.12% walls, 57.5% roofs).

The extensive use of CI sheets in confined to a belt from Jamalpur to Patuakhali, somewhat closely related to the main jute belt. The areas where irrigated farming is extensive, more substantial houses are also seen.

In the higher and drier western part of the country the proportion of pucca and mud-walled houses is higher than in the rest of the country. In reality, mud-walled houses are the model type in Rajshahi (56%) and Bogra (50%). There is a high proportion of mud-walled houses in Dinajpur (39%), Kushtia (37%), Jessore (30%) and Khulna (28%) districts. In all districts, except Rajshahi and Bogra, bamboo-walled houses with thatch (straw, grass, leaves) roofing predominate.

In rural areas 96% of the houses are owned by the dwellers, whereas in urban areas the proportion is 55%.

The spatial aspects that emerge form these may be summarised below :

(a) The western part of south Bengal and most of North Bengal has the most substantial housing, but the low proportion of shops indicates the lower commercial activities.

(b) Central Bengal and Eastern South Bengal areas relatively solvent than East Bengal as they have a higher proportion of houses with CI sheet. In this aspect Comilla and Western Noakhali district are similar to Central Bengal.

(c) Patuakhali has a relatively high proportion of good housing due to the income from surplus rice.

(d) The high proportion of CI sheet housing in Faridpur is due to previous income from jute.

(e) Though 48% of the urban housing is of durable materials (bricks, CI sheets, timber). as ,ie. as 40%

has bamboo walls and 23% has thatch roofs. This is a clear reflection of the poverty of the people of that area.

Main problems identified from the Housing census Reports and from different studies can be summarised below such as :-

i) Socio-economic and political disparities among different regions,

ii) Mass poverty,

iii) Poor literary rate,

iv) Inappropriate technologies, and

v) Absence of effective machinery for planning.

3.4 INDIGENOUS MATERIALS AND HOUSING TECHNOLOGY

Building materials, particularly indigenous materials, play an important part in all considerations of low-cost housing for low to middle-income people. The approach to this complex topic depends upon the objectives to be attained. Indigenous materials either new or potentially available must be used to the maximum possible extent in order to keep costs down, avoid draining of limited foreign exchange, and provide local employment. Furthermore, the methods and techniques of construction should use these materials in such a way that semi-skilled and unskilled labour, mostly on self-help or aided self-help basis, can be used to construct the required housing; which would, in turn, reduces costs, provides more employment, and at the same time impart at least some training in allied skills.

Here materials are described to meet these requirements, which are almost locally available and are used now; or are available now but not widely used, or are potentially available. Among the first group are soil, wood, bamboo, reeds and thatches, naturally-occurring cementitious materials, and combinations based upon them. In the second group are such materials as portland cement & sulphur etc. In the last group are the plastics and related polymeric materials.

Only the first group materials are abundantly available in Bangladesh. The approach to be taken here is to explain, briefly and simply, the basic properties of these materials as they seem from their structure. No attempt at detailed completeness is made, rather it is hoped that with some insight into the properties of the materials, new ideas will be generated with respect to ways to use them that will lead to the provision of low cost housing.

b) Soil :

It is probably the most widespread and abundant material of construction. It is in many ways both the easiest and most difficult to employ. Since soil of some sort covers practically the land surface of the earth, and is readily dug and moulded, it is understandable that it should be among the most ancient building materials, and still most widely used.

In recent times, the potential of soil as a building material has been, to a great extent, underestimated, which accounts for two reasons. Firstly, the enormous variety of naturally occurring soils has made specification for any particular set of properties difficult, and engineers and architects have therefore tended to prefer the more predictable manufactured materials; secondly, many soils in their untreated state lack strength and dimensional stability, and this has led to the belief that soil is a generally inferior material of shorter life and requiring high maintenance, not to be used for buildings of any significance.

Natural soil is extremely variable, and by no means all of it is suitable for construction, even for small dwellings. The properties depend upon the construction technique(s) employed, the need of the dwellings and the local climatic conditions.

Methods:

Methods differ in degrees of advance preparation and methods of placement.

(a) Wattle and daub:

A framework of posts and poles supports a matting or other assembly of reeds, sticks or bamboo, soil mixed with water to the proper consistency for easy placement is plastered to both sides. A variant consists of a double wall with the interspace filled with mud. In either case, as the

soil dries it is likely to shrink and cause cracks which must be filled and repaired. Because erosion caused by rains must be protected by wide overhanging roofs and an applied surface coating. Fairly constant maintenance is to be expected.

Cobwall:

This method, goes by a variety of names, either uses dug from a pit near the construction site, or consists of a mixture to obtain the characteristics. It is kneaded and trodden with water, formed into balls. The balls are placed and pounded into a solid mass. The soil is applied in courses, each course being left to dry about one to three days before the next course is applied. As the wall becomes higher, the workman sits aside it so no scaffolding is needed.

During drying, cracks are occurred which are repaired with more mud. As it is true of wattle and daub, the material is subject to erosion by rain and should be protected by wide overhanging roofs and by a surface layer.

Poured adobe:

Like portland cement concrete, adobe may be cast monolithically between forms. the soil is mixed with water to a more plastic consistency, and may have straw or other binder added. The mixture is shoveled into the forms. Evidently, the wetter the mix, the greater the tendency to

shrink and crack upon drying. If the material is placed in courses, straw reinforcement may not penetrate and intermingle with previously placed courses if the latter have began to dry. While the placement is easier than cob, the forms themselves add to the cost. They are most practical, and is true of forms generally, when they can be re-used, with minimum alteration and repair, a number of times to justify the cost. Adobe bricks or blocks have long been widely employed. Sizes, composition, and methods of manufacture and construction vary from place to place.

Rammed Earth :

Cast adobe and rammed earth are similar in that both use forms, but here the soil is rammed into place. it requires heavy movable forms that can be shifted along the wall. Generally two forms are used, one for the straight portions of the wall, and one for corners.

Most sandy loam is usually employed, placed in thin layers within the form and rammed down with tamper. Composition and moisture content must be carefully controlled to proper consistency. Because it is relatively dry and heavily compacted, rammed earth to shrink and crack less and is more resistant to erosion than many other soil walls.

Detailed discussion of soil and its mechanics is the concerned with soil mechanics. But the following aspects are to be understood, which are soil types, constituents,

physical properties etc. Stabilized soil can be used as a positive catalyst for low-cost housing in Bangladesh.

Wood:

It is a familiar material found in virtually all parts of the world, versatile, and relatively easy to fabricate. Present statistics (FAO) show that the majority of timber grown is used as fuel. Indeed, due to the high cost of energy, there is a resurgence of interest in different forms of wood utilization.

Wood's high strength and toughness relative to weight make it attractive, but its susceptibility to destruction by a number of agencies militate it. The problem is to utilize its advantages and reduce its disadvantages.

Wood is classified in various ways. In Bangladesh, a great share of timber production comes from the Sunderbane, Chittagong, Tract areas, Sylhet, Madhupur and Bhawal jungles.

In structural timber the orientation of the grain significantly affects strength. Knots cause local deterioration of grain direction and therefore loss in strength. Engineering timbers are graded on considering diagonal grain, knots, checks allowance for dimensions, duration of load and a suitable factor of safety.

Bamboo:

Bamboo and the related family of reeds and thatches are the oldest and most widespread building materials in the tropical and sub-tropical regions of the world. It is used widely for house construction, especially in rural areas and villages.

According to FA McClaure (USDA) :

> "The greatest concentration of bamboos and the highest development of bamboos and the highest development of their use are to be found on the southeastern borders of Asia and on adjacent islands. This area extends from India to China on the mainland, and from Japan to Java among the islands. Some 20-odd species of bamboo have been reported from the little known flora of Africa, and many of these are used by the native peoples for house construction.
>
> Many of the recorded species are very imperfectly known, and some flora of the world probably totals more than 700 species, classified in about 50 distinct genera".

Growth:

Although most bamboo grows in forests and is naturally propagated , commercial plantations are now common in Bangladesh. Bamboo is a grass like woody plant. New trunks, known as culms, are formed annually in clumps growing out of the spreading rhizomes. Generally, the culms grow to their full height in 4 to 6 months of the first growing season. Culms vary widely in height and diameter. Once full height has been reached, signification of the walls of the culms takes place during the subseguent years. Full maturity is

usually reached in five to six years or even more.

Rice husk ash cement :

Rice is our principal crop and the annual production is about 136 lakh tons. Out of it, 20% of husk is produced during milling; which contains 42% cellulose 20% lignin, and 18% silica. The contained silica may find its use in the building materials. Under controlled ashing 20% silica can be produced which are reactive. It is estimated that about 5.4 lakh tons of rice husk ash (RHA) would be available per annum. Considering the above factors, production of RHA cement will be made effective. Rice husk is burned at critical temperature and grounded to fine powder (Passing 200 sieve). This powder is blended with lime or pozzolana cement to produce the cementitious binding material. The pozzolana cement, thus obtained, is compared with ASTM standard (of cementitious materials) and is found quite suitable for all type of construction work and able to stand in all conditions. It may be used as or good material for low-cost housing in Bangladesh. Engineering properties of cement is given in appendix-A.

Ferrocement :

To optimise use of the properties of conventional materials in recent years ferrocement technology has been emerging as a branch of concrete technology. The work of many researches all over the world has established that the

properties typical of ferrocement properly belong to a concrete or cement mortar in which the reinforcing steel is sufficiently subdivided to give a useful flexural capacity without sufficient cracks. The appeal of ferrocement is largely attributable to its low cost and the ease with which low skilled personnel can work effectively with the material. Much of the success of ferrocement is attributed to its use where significant part of load is resisted by membrane forces; R & D activities have been continuing for finding possibilities of optimising its use with reinforced concrete. Ferrocement elements, such as folded plate, channels for roofs F.C. door/windows etc., have suitably been used in lowering the cost of housing.

Current values of composition and properties of ferocement is given in appendix-B.

Recently different new materials/techniques have being popularised in many developed and developing countries, such as fibre reinforced concrete, different forms of composite construction, and in particular cold-drawn wire prestressed concrete (CWPC) etc.

CHAPTER 4

CHAPTER 4

STUDY OF INSTITUTIONAL ASPECTS

4.1. INTRODUCTION:

It is important that the problem is not left with the impression that the choice of technology is simply a matter of making correct decisions or sensible programmes on the basis of technical and socio-economic data. It is a general experience everywhere that the opinions and prejudices of a building's users, and of the concerned community, about the type of material to be used will exert a very strong influence over the choice of material, often to the extent of dictating in some detail how the building will be built or the technology will be used. The choice will also depend on institutional factors, such as bye-laws and standards or the requirements of financing agencies which may either dictate or prohibit certain forms of construction. The existing organization of the housing industry, the size, type and capability of the builders and their own interests will be another constraint. And this factors will all be powerfully affected by the system of education and the training of builders and craftsmen and of the building professionals themselves, and by the values prevailing in society as a whole.

4.2. HOUSING INSTITUTION AND LOCATION :

Location exerts an important effect on the choice and adoption of technology and its dissemination and implementation by the ultimate users.

Govt., Autonomous, Semi-Autonomous and Private Organisations are generally situated in cities and lower-income people have, in reality, little or almost no access to them. Therefore, institutions are to be decentralized Upazilla System and the local bodies, both at rural and urban level, are to be successfully utilized for the dissemination of technologies and reversal drawing of problems to the Institutions for solution through Research & Development.

Indeed, the strength of the institutional as well as social pressures which affect choice of technology has led many recipients to argue that no significant change can be made in the type of technology chosen in any society as a whole, or in other words, a more appropriate technology can only follow a social revolution. It is the view of many authors that a great deal can be done in every country to improve the choice of technology, to make better use of resources and to stimulate higher employment within the existing framework of the society, by understanding the choices available, by improved education and so on. The general improvement in living standards which would result from such a relocation of resources would itself constitute or contribute towards a social revolution.

Nevertheless, the powerful social forces which affect technology have to be understood and taken account of; and if new or untried technologies are to be proposed, then the methods by which these new technologies are to be introduced must be given as careful consideration as the details of the technology itself. To borrow an analogy from the computer world, the `software' (man power training, organization methods, and legislation etc) must be considered alongside the `hardware' (materials properties, performance and Building & services designs): both form an inseparable part of the technology. Technologies which are small scale, capital saving and labour-intensive will naturally tend to require `software' very different from more sophisticated large-scale technologies and attempts to introduce such technologies without the development of appropriate software may result in failures.

Selection of sites for institutions and organisations (for Research and Development, material procurement, construction etc.) should be carefully done. The planning of institutional set-up should be done without much destruction of the environments of the locality, and at the same time economically.

4.3 METHODS OF ORGANISATION

Many building materials are almost exclusively manufactured in large industries, and are either imported or produced on a national scale, and supplied to the building industry through a network of local building materials

suppliers. The local decision- making can do to affect these industries, and the question of the support to them is nationally important. Of greater interest to the designer are those materials produced in smaller-scale local industries from local raw materials and for local use. Bricks, tiles and lime are commonly produced in such industries. This method often fails to lead to any technological development and thus this method is unsuitable for the introduction or rapid expansion of a technology.

4.4 INTERRELATIONSHIPS

The institutions are to be concerned with adapting, innovating and diffusing low-cost construction materials and design concepts for low-income family housing units in different socio-economic environments. The major objective was to enhance the capabilities of concerned institutions to develop their R & D programs more effectively through collaborative study and exchange of common problems and solutions than by working alone.

The institutions are to be interrelated for cooperating in the work as partners on the necessary research and development. They would work primarily, but not exclusively, with the production of housing as part of the formative processes in the development of human settlements. Clearly, the system of influences and constraints outlined by them strongly affects the production process.

The prime objectives are :

(1) The provision of better housing, and

(2) The reduction of costs, through action-oriented research and development by research institutions in co-operation with other bodies associated with houeing. Utilization of local materials and skills, innovative designs, and application of the most appropriate technologies are central problems. In-country linkages with national housing authorities, developers, construction industries and financial institutions are essential.

CHAPTER 5

CHAPTER 5

PHILOSOPHICAL BACKGROUND OF HOUSING INSTITUTIONS

Most of the recent studies and works of low-cost housing provision in developing countries have identified three major sources which are termed as:

i) public,
ii) private and
iii) popular sectors.

These are the factors which affect the background of appropriate institutions on housing. The resources available to each of these varies greatly, as do their goals, producing constructing modi operandi in meeting the requirements of different conditions, especially lower income environments.

The policies which are recognized as two distinct housing policies are the backbone of housing institutions. The first one is policies towards housing and primarily involving macro-level decisions. Within the broad philosophical framework, as outlined in fig.-2, policies towards housing are determined by attitude towards, and nature of, urbanisation and rural-urban migration. These attitudes may very from positive encouragement of urban growth to legislation opposing it, thus affecting a whole

investment strategy for balance between urban housing development.

The different influences on government development priorities determine the overall dimensions of public housing investment. The concentration of attention on policies for housing has given rise to the approach where it is regarded as an end in itself rather than as a means to the broader goad of eradicating or alleviating poverty. In order to assess the present situation the following figures sets up a main sources of housing currently open to the urban poor.

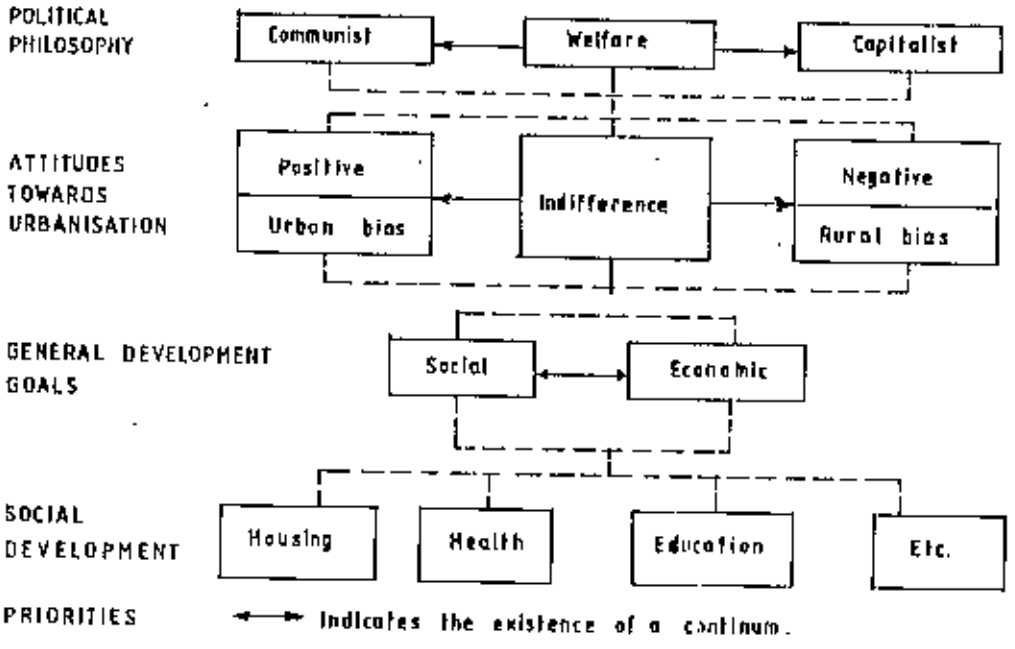

Fig.3 Housing policy framework .

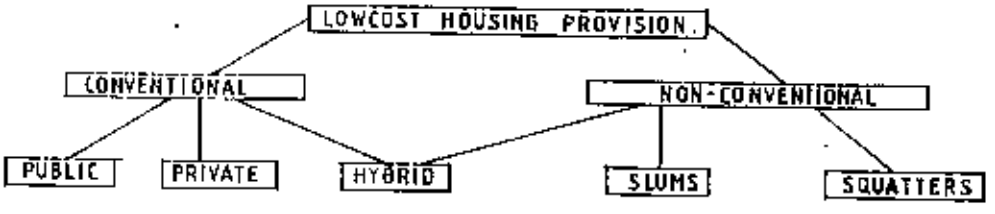

Fig.4 Typology of housing provision for the urban poor .

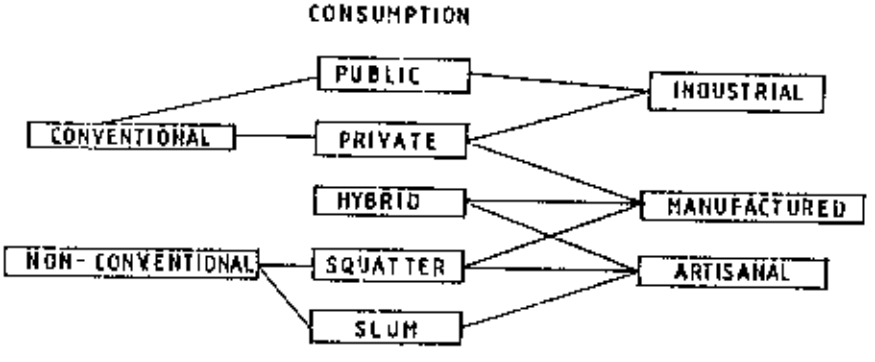

Fig 5 A housing typology based consumption/production models.

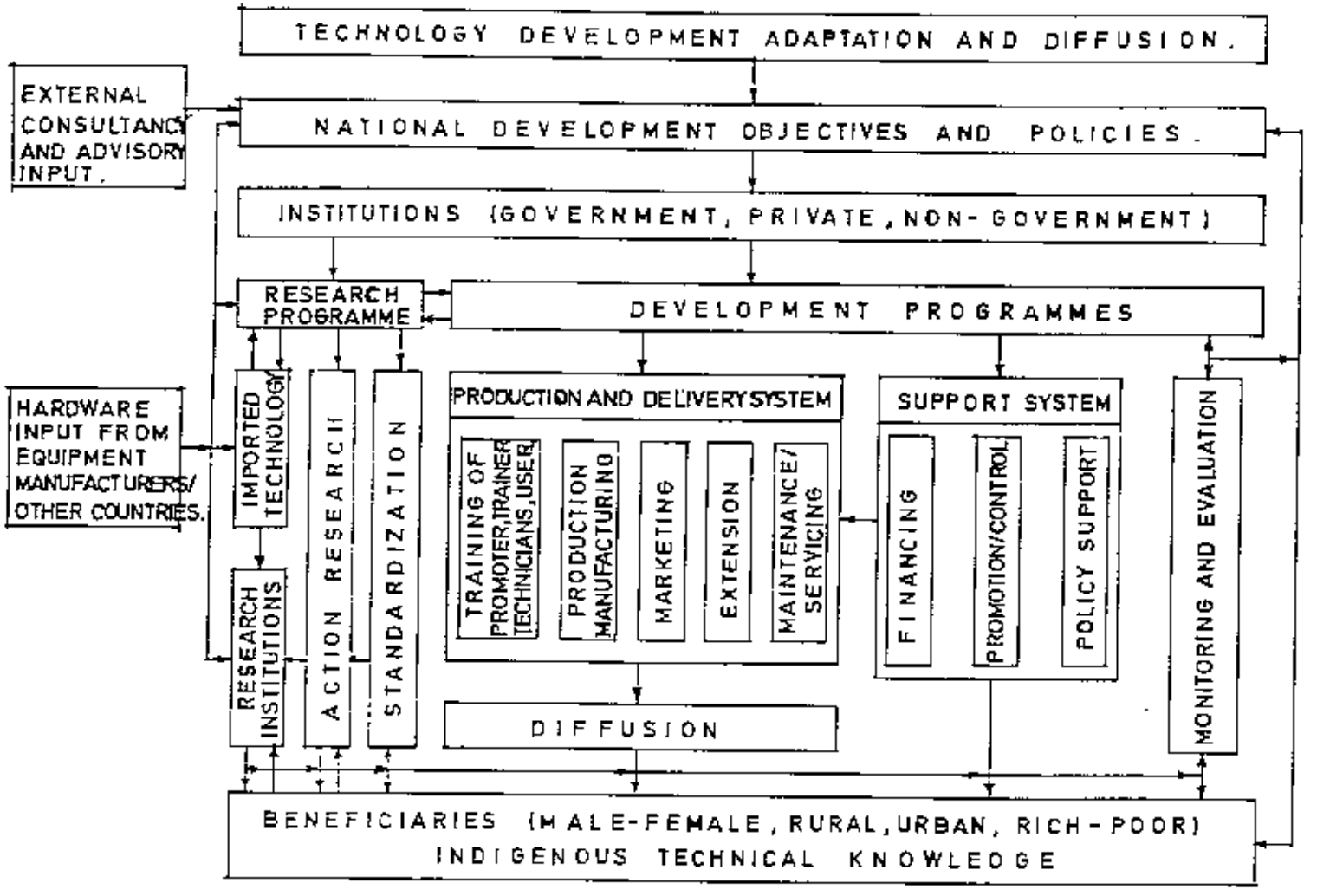

FIGURE 6: ACTION DIAGRAM FOR DEVELOPMENT ADAPTATION AND DIFFUSION OF TECHNOLOGY IN BANGLADESH.

CHAPTER 6

CHAPTER 6

HOUSING INSTITUTIONS AND DEVELOPMENT

6.1. MIGRATION PATTERNS AND HOUSING NEEDS

Smith (1972) has started, on housing economics,that

> "Rural-urban migration is at the heart of the problem. Economic development generally requires great expansion of the urban labour force and, if housing and public facilities to serve the enclosed population are not provided, the migrant house-hold's living conditions, instead of getting better, may get worse." (Dwyer, 1972, PP 152)

The first factor is that while rural-urban migration is generally viewed as the heart of the problem, other directional stream may be equally if not more important. Although the setting of `urban' definition has been done, the definition if rural-urban locations is a crucial consideration.

Secondly, it is argued that urban/rural categories are not always the most helpful ones with which to assess the impact of internal migration. Bangladesh can be viewed as comprising of centres and periphery in spatial economic terms and modern and traditional sectors.

Thirdly, characteristic of importance when assessing the links between migration and housing needs is the varying degree of permanence of the change of residential location.

Fourth characteristic concerns the age and life-cycle stage typical of a particular migration stream and implications for family housing as against the rental of rooms on barracks for solitary migrants.

Whether the greatest rates of immigration are in urban or rural areas or (both), the demand for shelter is perhaps the most crucial apart from that for food. As Beier has noted:

> "In city after city, casual inspection are shows that a large part of the savings of the poor, their effort and their hopes, are tied up in housing that cannot be improved easily..... The poor can only afford to live in such conditions, ... transferring resources through public housing schemes, for example, is not or feasible alternative. In many cases conditions in these settlements are better - or at least no worse than rural areas from which the settlers come." (Beier, 1976, B31)

This view point is important because low-cost housing schemes tend to raise real incomes, which attracts more immigrants, and causes greater housing problems. The solution may be to facilitate self-help housing to a much greater extent in metropolitan areas and to switch low-cost housing programmes to rural areas and small towns. This would both take account of the existing demand in such areas, indirectly divert some potential urban immigrants and helping development in a slow way.

6.2. HOUSING AND PLANNING

In Bangladesh, Like other development countries, an approach involves the provision of serviced sites on which the poorest can build the kind of shelter which they can afford.

There are many objections which must be met that improved housing will lead to an increase in urban migration rate. It is doubtful if housing is a major factor giving rise to migration; certainly in Bangladesh cities many of those who migrate find no form of shelter at all.

A housing policy should contain the following elements:

a) The aim should be to improve the housing of the whole urban population.

b) A supply of cheap building sites according to a planned layout should be available.

c) Residents should be allowed to build their own houses at a standard which they can afford without aiming at some ideal standard.

d) Given the above basis, every effort should be made to help people to improve their housing by self help basis.

e) Existing settlements should be redeveloped with as little disturbance to houses as possible.

Building throughout the whole actual and potential urban area should be brought under control.

Local initiatives, but if it is lacking, official guidance is necessary. The Upazilla system is the ideal to meet peoples needs, not a remote bureaucracy or bureaucratic technocracy. Extreme flexibility in administration is

essential if a balance is to be struck. It would find acceptance, the opportunity for participation in its affairs and an outlet for peoples creative energies.

6.3. HOUSING AND HEALTH

Health and comfort are the inseparable ingredients of planning for housing, both for rural and urban areas. Edwin Chadwick's (Flinn,1965) report asserted that disease and poor expectation of life were mixed with bad housing, overcrowding and poor water supply. It is not wise to say that health means only freedom from diseases. For man, it means the opportunity, within his allowed span, enjoyment in his environment. Skoda, JD et al reported in ` The impact of sanitation in Bangladesh' (Pacey, 1981, PP-33) that a country-wide survey was made throughout Bangladesh covering water usages and sanitary habits, diarrhoeal morbidity, and related factors. The purpose of the study was two-fold, such as:

a) To assess health benefits of target population group on an institutional basis, and

b) To assist planners in preparing future programmes.

The work was done in the field by the UNICEF representatives and by the staff from the Ministries of Health, Social Welfare, Local Government and Cooperatives. From the survey it was found that a great majority of people 79% were obtaining drinking water supplies from ground water

sources, 52% of the households used tubewells, 27% used dug wells and the remainder used surface water. In every socio-economics groups, tubewell water users had a lower morbidity than others. The report emphasised that

> " Preventive health measures (water, sanitation, and hygiene practices) appropriate ..... need to be developed and provided. In this respect, rural Bangladesh, with population densities approaching or exceeding urban densities in some countries, has a special need." (Pacey, 1978, PP-34)

Therefore, the housing institutions need to be integrated or coordinated with the health agencies to safeguard health and hygiene of the population. Moreover, there should be restrictions in using health-hazardous building materials in housing construction. For example, asbestos products should be banned by law.

6.4. INVESTIGATION INTO INSTITUTIONS DEMAND FOR TECHNOLOGY

The general focus for the demand of appropriate Institutions on technological innovations in the low-cost housing field depends on careful consideration to a number of economic and socio-political factors:

1) Reduction of the cost of an acceptable housing unit, considering building materials, design concepts and land use.

2) Creation of a significant number of new jobs through the net effect of technological innovations in the combined building material and construction industries.

3) Consideration of the attributes of the people concerned, so that the final product is both useful and usable.

4) Provision of low cost water supply and waste disposal systems for public health control measures.

There may be an Institution to be formed, where each of the segments of low-cost housing technology would on the following aspects:

1) The proposed Institution should be envisioned as a resources, which implies that each contributing discipline should deal with the aspects of housing with which it is most familiar.

2) Each discipline should emphasize what is unique to his area, or to his project or to any combination thereof.

3) Particular attention should be given to those aspects of region specific project areas which can be applied directly, or adopted to other countries.

4) Attention should be devoted to problems and activities, particularly in the context of common problem areas and kinds solutions being generated to solve these problem areas. for example, each discipline should give some attention to the necessary interdisciplinary linkages between R & D institutes and policy making/implementing group such as Planing Commission and Construction industries.

The Lack of coordination amongst the existing institutions/organisations, Lack of information flow and multiplication of research efforts etc. demands for establishing and appropriate institution which would be one of catalyst, coordinator and researcher. This may include (1) convening miniconferences and workshops to provide a form for effective exchange of results, news and views, (2) providing necessary inputs regarding new research ideas on

low-cost construction materials and design concepts, and a strategy for developing regional/interdisciplinary linkages with various groups from public and private sectors concerned with the housing problem,(3) initiating cooperating evaluation of Research and Development activities cooperative agencies and (4) implementing plans for relevant exchange of information within agencies concerned.

6.5. DETAILS OF INTEGRATING THE INSTITUTIONS

Linkage establishment is a priority stage in the development of appropriate Institute. It must be able to:

1) Institute a contact with other sources of knowledge concerned in a field of human interest.

2) Investigate their systems compatibility with other Research systems.

3) Identify `common' information transfer capabilities which could be utilised as initial channels for exchange of R & D information.

4) Decide on the need for the development linkages with other Inetitutions/agencies.

Development of integration amongst Institutions will depend on the following working aspects, such as:-

1) Adaptation of building industry to the local context:
   a) Physical context,
   b) Social and cultural context,
   c) Economic context.

2) Technical possibilities and limits of materials.

3) Quality control - Standards and regulations context.

CHAPTER 7

CHAPTER 7

THE ROLE OF HOUSING INSTITUTIONS

7.1. INTRODUCTION

The housing situation in Bangladesh has never been satisfactory. The majority of dwelling units are temporary, sub-standard, unsafe and over-crowded. The ancillary physical, social and economic facilities and services essential for the development of healthy and harmonic country life are highly inadequate both in the urban and rural areas. The role of housing institution for the innovation, adoption and choice of the appropriate technology is great and priority must be given to the low cost housing for lower income people.

We have a large back log of low and middle income group housing. The current need is to restore the balance in rural and urban housing development towards the needs of the low-income groups before we can even be able to cope with substantial improvement of the living conditions of the urban poor. Traditional rural housing, which has been taken up in the area by the villagers themselves and where the public sector play any significant role apart from providing some services and facilities, should be improved by Research and Development activities. Institution are to be coordinated for more work towards cost-reduction technologies.

7.2. THE EMERGENCE OF AN APPROPRIATE INSTITUTION

Without proper institutional framework mass participation can not be ascertained. And as because housing is a giant task; it must be solved with the proper participation of people both at rural and urban level. Without appropriate strategy and plan, both long range and short range, housing problems can not be tackled. In this world of complex nature, specialization and division of labour is very essential. Governments in practically all developing countries are committed to some form of development policy; and usually such policies have among their stated aims the new creation of new employment opportunities especially at unskilled levels, and a reduction in import-dependence through greater utilization of local resources. Bangladesh Govt. is trying to improve the conditions of the `bottom' section of people through different policies and programmes. The labour-intensity, its greater range of alternative technologies and skills, is often recognised as an important sector for the realization of these aims. Some Governments in few developing countries have been very active in trying institutionally to promote indigenous technologies, among them China, India, Tanzania; while other governments have taken less attitude and have as a result become heavily dependent on technological imports from the more developed industrialised countries. The means by which the government can act in support of indigenous building research organizations; through international aid

cooperative systems; and through industrial development organizations, especially for small scale industry.

There remains no building standard for the whole country; and some existing standards do not cope with the capability of the lower income group of people. Rural housing scheme approved designs are also above the reaching level of the rural poors. Standards are vital to the promotion of new or improved building techniques, because they provide an officially sponsored agreement between producer and user, which can give the user some confidence that the product being bought will have a satisfactory performance. But there has been a tendency for standards in many developing countries to be copies of those in use elsewhere without having taken the differences in condition into account.In Bangladesh engineers generally use the ASTM and ACI codes. Differences in climatic conditions and lack of adequate testing facilities are the two differences that are generally overlooked, and such differences can make national codes irrelevant. In Bangladesh , the Bangladesh Standards & Testing Institution is working on simple conversion of developed-countries codes into owns, without carefully and analytically considering the problems of our own environments. Exceptionally,the Indian standards institution is the good exemplary institution which have examined the range of existing local building materials, and its building materials standards, though over-optimistic about the possibilities for inspection supervision, quality control and routine testing , and omitting most types of

local soil walling for proper consideration, are at least a step in the direction of nationally appropriate standards, which could usefully be adapted for use elsewhere. Therefore, there is a great importance of considering local climates,regions materials etc. Properly for specifying proper guidance for the housing sector, more specifically the low-cost housing in Bangladesh.

Building Research Institutes have a vital role to play in the promotion of new materials suitable for local conditions. Research on the properties, performance and development of materials, especially indigenous materials, is only one of their roles; in order to get their new ideas beyond the laboratory and into a highly conservative industry, they need to carry out different promotional programmes. They must actively seek entrepreneurs to apply the research by mass advertising, issuing simple literature, and running training programmes, etc, and they must be involved in setting standards committees bringing together researches, developers, manufacturers, suppliers, consumers and public organizations to lay down performance requirements. Some institutes have also established network of regional centres which can work as centres for display and as well as for builders and designers on the choice of technology, techniques and materials. The Central Building Research Institute (CBRI), Roorkee, India, is one of the oldest and most successful of these research institutes, and its stock of publication goes over 30 years is a valuable

record of efforts to develop appropriate technologies. Housing & Building Research Institute, Dhaka, though being the only National Institute in this field, made a little impact on the building industries of the country and also for developing appropriate technologies for urban & rural housing for many set backs. This is certainly due to a lack of funds, facilities and trained qualified researches, as because the annual budget for this Institute is only Tk. 40,00,000.00 ie., 0.13% allocated for housing and physical planning sector. But an over-concentration on laboratory research, multiplication of similar projects, and a reluctance to engage sufficiently in research on production techniques or in active extension programmes.

At present National Council on Science and Technology (NCST) which is upgraded from the erstwhile Committee on Science and Technology is the highest policy making body headed by the Honorable President as its Chairman, the responsibilities of the council as have been outlined in Science & Technology policy are stated below (NCST, 1986, PP-3).

(a) Recommend national policies on science and technology

(b) Recommend priorities to specific research programmes undertaken by various agencies and assess the extent to which results are put to actual use.

(c) Suggest measures for coordination of scientific research and development activities

(d) Recommend approval to research plans and programmes

(e) Such other matters as may be considered relevant by the Government.

For effective implementation of the science and technology policy the NCST has formed a consultative committee on "Technology Transfer" with the following responsibilities:

(a) To ascertain country's technology demand and capabilities

(b) To provide recommendations in the preparation of technology plan.

(c) To render advise on the type of technologies to be imported in the country.

(d) To provide direction for the diffusion of imported technology and to recommend policy measures necessary for the same.

(e) To advise on any other matter demand necessary for the Govt. on technology transfer.

One may infer that technology policy

> "cuts several policy areas of a nation, it is not a compartmentalized policy, but rather goals and programs in many areas, makes use of a variety of intervential mechanisms, operates through many departments of the Governments and use universities, industrial firms and non-profit institutions". (Haque, 1987, PP-1.4)

Bangladesh Govt. can act through education and training programmes to enhance the work of coordination. Thus, it has the great necessity for the establishment of an appropriate institution through which research and development works can be expedited, extension programmes can be more successfully implemented and it would be possible to create a positive flow of performance for the low-cost housing in the country.

7.3 POSSIBLE REASONS FOR THE FORMATION OF A NATIONAL BODY

The reasons are briefly stated below :

1) To direct our efforts and resources towards the short-term objective of partially off-setting demand and evaluation of the programmes for framing long-term policies and strategies.

2) To coordinate the existing institutions, in the allied field of research, development, extension, implementation, manufacturing, supply and use of house building materials, for the rationale use of national resource, to create more jobs by taking labour-intensive technologies using local materials etc.

3) To stop or prevent the multiplication of research and development activities regarding low-cost housing and building materials and techniques at various levels, e.g., research institutes and even implementing agencies etc.

4) To set standards depending on the local conditions (environment, regional differences, employment scope, indigenous materials etc.) for the controlled development of settlements and built-environments both at urban and rural levels.

5) To educate skilled professionals for the better understanding of the problem, systematic research efforts, through which a channel of required manpower can be developed.

6) To work as the heart for international and regional cooperation for adopting, choosing, and disseminating the up-to-date knowledge of scientific information on the topics related to housing and building, especially the low-cost housing technology.

7.4 SUGGESTIONS

The proposed National Body may be formed as like as the National Council on science and Technology is formed. The policy should incorporate all exiting National policies (such as National Science & Technology policy, Import Policy, Industrial Policy, Land Policy and the proposed Housing Policy & Environmental Policy etc.).

CHAPTER 8

CHAPTER 8

CONCLUSION AND RECOMMENDATIONS

The need for the policy of providing low-cost and affordable shelters for the people, especially the lower income groups, was stressed in most of the major policy statements of the government of Bangladesh, and yet in fact very little happened on the ground.

Therefore, much emphasis is to be given on the appropriate technology and the proper institution dealing with it.

The following measures are suggested for future planning development and growth of the proper technology choosing institution in Bangladesh considering the huge demand for housing for the population living both in urban and rural areas for increasing per capita income, employment generations and to ensure the optimum utilization of man material and information resources for the purpose.

1. `Lowcost' housing is a relative term and it will vary from time to time and place to place etc. what is low cost to one person may not be so for others. Generally, low cost housing will indicate the housing affordable to the people having the annual income equal to the average national per capita income. Finally, the proposed National body would set a National standard and provision would also be ensured to amend it from time to time if requirement arises.

2. For better development it will be necessary to bring our pattern of consumption into the line with realities of environment, ecological balance and the global resources situation. Resources and Energy must be received or extracted from our men and materials. The need for development for the proper Institution requires the coordinated contribution of our Planners, Administrators, Social scientists, Engineers, Architects and Economists in a befitting manner.

3. For the present housing situation proposal for revising the organisational set up of the existing R & D institutes such as Housing & Building Research Institute must be considered, so that in future the Govt. may adopt the National Housing policy.

4. To better study, process, policy and implementation the National Housing council may be formed with the nucleus on the National Council on Science and Technology (NCST) with the help of Planning Commission, Housing & settlement Directorate, House Building Finance Corporation and the other related agencies.

5. Manpower development and training facilities would be given the top priority for the choice and development of technology and its ultimate dissemination to the users.

6. Appropriate financing would be provided to the lower income group people for the approved low cost houses. Low cost Housing Credit Scheme would be given the top priority in the House Building Loan sanction. A Housing Bank may be set up (like India) with a sizable initial capital to advance lower cost Housing loans on appropriate terms and conditions.

7. Decentralization of housing institution should be done to initiate, conduct, organise, assist and disseminate Research and Development activities especially on low cost housing technologies giving due consideration to regional features and differences etc.

8. The huge manpower can be utilized as an asset rather than a liability through measures of spatial and social restructuring, a stimulation of

initiatives and allocation of specific responsibilities and most appropriately through training and education.

9. As far as materials are concerned, research would be carried out to make such resources acceptable as well as accessible to the poorer strata of the population.

10. Policy and measures are to be taken for periodic monitoring and evaluation of the Research and Developmental activities in the Low cost Housing technology field through appropriate (Monitoring and Evaluation) means under the proposed National Housing Council.

APPENDICES

APPENDIX A

Table No. 8

PHYSICAL PROPERTIES OF PORTLAND CEMENT AND BURNT CLAY POZZOLANA CEMENT

Sample	Specific Gravity	Normal Consistency	Final setting time
PC	3.06	23%	210 minutes
SPC	2.96	26%	220 minutes

Table No. 9

COMPRESSIVE STRENGTH

Sample	PC (%)	Pozzolana (%)	w/c ratio	Ratio of Cement & Sand	Compressive Strength			
					3 days	7 days	14days	28days
PC	100	-	0.49	1:3	2520	2610	3248	4580
SPC	70	30	0.56	1:3	2408	2519	3078	4604

Source : HBRI Chemical Testing Laboratories.

APPENDIX B

Table No. 10

FERROCEMENT – CURRENT VALUES OF COMPOSITION AND PROPERTIES

Wire mesh reinforcement	Wire Diameter	: $0.020 < d < 0.062$
	Type of Mesh	: Chicken Wire or square Woven or welded Wire galvanized mesh.
	Size of mesh Openings	: $\frac{1}{4} < m < 1$ inches
	Number of mesh Layers	: Upto 12 Layers per inch of thickness.
	Fraction volume of Reinforcement	: Upto 8% in both directions corresponding to upto 40 pounds of steel per cubic foot of concreate.
	Specific Surface of Reinforcement	: Up to 10 in^2/in^3 in both directions.
Intermediate Rod Reinforcement if used	Rod Diameter	: $1/2 < d < 3/8$ inches
	Grid Size	: $2 < G < 4$ inches.
Typical mortar composition	Portland cement	: any type preferably with 10% Pozzolana.
	Sand to Cement Ratio	: $1 < S/C < 2.5$ by weight.
	Water to Cement Ratio	: $0.4 < W/C < 0.6$ by weight.
	Recommendations	: Fine sand all passing U.S. sieve No. 8 and having 10% by weight passing No. 100 with a continuous grading curve in between.
Composite Properties	Thickness	: $3/8 < t < 3/2$ inches.
	Steel Cover	: $1/16 < c < 1/8$ inches.
	Ultimate Tensile Strength	: Up to 4,000 psi.
	Allowable Tensile Stress	: Up to 1,000 psi. based on permissible average crack width of less than 0.002
	Modulus of Rupture	: Up to 6,000 psi.
	Compressive Strength	: 4,000 to 6,000 psi.
	Elastic Modulus	: in compression 3×10^6 psi in tension after cracking = 0.8×10^6 psi.

APPENDIX C

Table No.11

DISTRIBUTION OF HOUSEHOLD BY SOURCES OF DRINKING WATER AND RESIDENCE, 1981.

Area	Total House-hold	Tap Water	Tube Well	Pond/ Shallow Well	River Stream/ Canal
Bangladesh	100	3.6	53.1	37.5	5.8
Urban	100	26.2	54.1	17.4	2.3
Rural	100	--	53.0	40.7	8.3

Source : Population Consus, 1981, BBS

Table No. 12

PERCENTAGE DISTRIBUTION OF HOUSEHOLD BY SYSTEM OF LATRINE AND RESIDENCE, 1982

Residence	Total	Flash Toilet (Muni-cipal Sewe-rage)	Flash toilet (Septic tank)	Muni-cipal Sewe-rage latrine	Sani-tary	Other arran gement	None (Open field bush)
Bangladesh	100.00	0.52	1.04	1.04	3.55	44.94	48.91
Urban	100.00	3.64	7.66	8.11	21.05	46.35	13.20
Rural	100.00	0.11	0.17	0.11	1.25	44.76	53.60

Source : Population Census (Sample Survey), 1982, BBS

Table No. 13

DISTRIBUTION OF HOUSE HOLDS BY USE OF LIGHTING FACILITIES, FUET USED AND RESIDENCE, 1982

Lighting Fuel Facilities	Bangladesh	Urban	Rural
Percentage of household Using lighting facilities			
Kerosene	93.06	55.52	98.03
Electricity	6.56	44.34	1.59
Others	0.12	0.22	0.11
No lighting facilities	0.26	0.12	0.28
Total	100.00	100.00	100.00
Percent of household using fuel facilities			
Straw leaves cowdung	71.75	19.54	78.61
Husk	0.20	0.93	0.11
Wood	23.50	50.43	19.97
Kerosene	1.87	18.79	0.30
Gas	1.40	11.71	0.04
Electricity	0.33	1.62	0.17
Other's	0.94	1.98	0.80
Total	100.00	100.00	100.00

Source : Population Census (Sample Survey), 1982, BBS.

Table No. 14

AVERAGE FLOOR SPACE IN SQ. FT. PER STRUCTURE BY RESIDENCE AND USES, 1982.

Residence	Total Structure	Living Structure	Separate Kitchen	Store House	Cowshed	Other
Bangladesh	245	288	185	168	205	209
Urban	282	326	134	218	194	269
Rural	242	284	188	167	205	205
SMA'S						
Chittagong SMA	381	424	203	175	253	326
Dhaka SMA	271	305	78	337	190	234
Khulna SMA	296	345	100	121	304	200
Rajshahi SMA	237	307	84	134	114	124

Source: Population Census (Sample Survey), 1982,BBS.
Note: SMA Stands for statistical Metropoliton Area.

Table No. 15

HOUSEHOLD IN DWELLING UNITS BY MATERIAL OF WALL AND ROOF BY RESIDENCE, 1981.

Roof Material	Wall Material				
	Total	Straw bamboo	Mud Unbrunt brick	C.I Sheet/ wood	Cement/ brick
			National		
Total household	14785048	9370581	2957239	1718691	738539
Straw, bamboo	8769875	6720353	1933904	95410	19308
Tiles	350723	73447	214230	29955	33091
C.I Sheet, wood	5248878	2576781	809105	1593326	269666
Cement	416472	———	———	———	116472
			Urban		
Total household	2041933	1075182	223846	255139	487766
Straw, bamboo	818931	689467	108830	11619	9015
Tiles	55787	20159	18057	6774	10797
C.I. Sheet wood	846124	365556	96959	236746	146883
Cement	321091	-	-	-	321091
			Rural		
Total household	12743115	8295399	2733393	1463552	250771
Straw, bamboo	7950044	6030886	1825074	83791	10293
Tiles	294963	53288	196173	23181	22294
C.I. Sheet wood	4402754	2211225	712146	1356580	122803
Cement	95381	-	-	-	95381

Source: Population Census, 1981, BBS.

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