

BUILDING SYSTEMS FOR AFFORDABLE HOUSING IN A DEVELOPING COUNTRY

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SUMMARY

The knowledge concerning availability, quality and cost of building materials, especially in the developing countries is limited. This applies also to the criteria influencing selection of suitable building materials and building techniques. Designs and instructions for housing construction are often with limited knowledge of the local conditions, cultures and choice of the people involved. The study of technical, social and economic consequences of the selected building materials and technology used is not properly done. There is a questionable tendency of transferring technology, normally from the industrialized world without considering appropriate modifications.

In order to improve sustainable construction, it is important to adjust and develop housing construction systems in accordance to the local conditions. By using the appropriate building materials and applying appropriate technology, building techniques can be modified and applied in order to meet low cost, affordability and environmental impact demands. Transferred technology should also be studied and applied accordingly, considering all the necessary modifications in order to meet the desired local demands.

This paper discusses building problems in most developing countries, focusing on building technology, in relations with the building materials used. Alternative building systems are also discussed. In order to achieve affordable housing, especially in a developing country, it is necessary to develop building systems which are cost effective, durable and easy to construct. The selection and application technology should, therefore, imply the use of both large-scale technologies and low cost small-scale technologies dependent on objectives in a given set of circumstances.

KEYWORDS: Affordable housing; Appropriate technology; Building materials; Building systems; Building technology

INTRODUCTION

General Situation in the Developing Countries

The great shelter problem in the developing countries is the shortage of affordable housing for the low-income majority of households in urban areas. This has resulted in proliferation of slums and squatter settlements. Accurate statistics on their extent are difficult to obtain, partly because of definitional problems and inadequate methods of data collection. Moreover, many city authorities undoubtedly underestimate the extent of inadequate housing, either because they ignore communities outside the city's administrative boundaries or because they do not enumerate them correctly. Even so, estimates indicate that in many cities in developing countries, 40 to 50 per cent of the inhabitants are living in slums and informal settlements. It has been estimated that 17 per cent of the world's stock of housing is made up of one-room shelters, of which some three-quarters are to be found in the developing countries. [1]

Most, if not all, developing countries experience rates of urban population growth far above their national population growth. The degree of urbanization is thus increasing. On average, more than 40 per cent of the population in the developing world are now living in towns and cities (Table 1). By the year 2000, there will be 16 metropolitan areas in developing countries with more than 10 million inhabitants. Moreover, in most countries urban poverty is increasing more rapidly than rural property. It is estimated that by the end of the century, 90 per cent of the poor in Latin America will live in urban areas. The figures for Africa and Asia will reach 40 and 45 per cent respectively (World Bank, 1993a).

Rapid urbanization has out paced the ability of local authorities and national governments to provide adequate shelter and basic amenities for the urban poor. Large slum and squatter communities live illegally on government and private land, especially in big cities. These communities lack or have inadequate provision of water, sanitation, roads,

Region	1960 Population (millions)	% of total	1980 Population (millions)	% of total	2000 Population (millions)	% of total	2020 Population (millions)	% of total
Africa	280	9.3	479	10.8	872	14.2	1,468	18.8
Latin America	217	7.2	361	8.1	546	8.9	735	9.4
East Asia	791	26.2	1,176	26.4	1,475	24.1	1,679	21.5
South Asia	877	29.0	1,408	31.6	2,074	33.9	2,686	34.3
Oceania	16	0.5	23	0.5	30	0.5	36	0.5
Europe (Inc. SU)	639	21.2	750	16.9	827	13.5	881	11.3
Northern America	199	6.6	252	5.7	297	4.9	337	4.3
Developing countries	2,074	68.7	3,313	74.4	4,845	79.1	6,446	82.4
Developed countries	945	31.3	1,137	25.6	1,277	20.9	1,377	17.6
World	3,019	100.0	4,450	100.0	6,122	100.0	7,822	100.0
Source: United Nations, Urban and Rural Population Projections 1950-2025: The 1984 Assessment (New York, 1986)								
Note: The figures for developed and developing countries are not sums of the above subregions since the classifications used in the compilation of the two sets of data are different.								

Table 1. The growth of world population by region, 1960-2020.

electricity and housing. Overcrowding and environmental degradation are common problems. The poor are often forced to put up their shack on steep erosion-prone slopes, close to overflowing rivers, mosquito-infected wetlands, along railway lines or close to sources of heavy air or water pollution. The health of the poor in these areas is evidently bad (WHO, 1992a). They live in an abject state where the future is measured day by day in search for food. Every day, they face the risks of diseases, injury and starvation in harsh and merciless city environments. It is difficult to estimate how many among the 1.6 billion urban dwellers in developing countries live in inadequate housing, with little or no provision of water, sanitation and other services. Case studies show that between 30 and 60 per cent of the urban live in illegal settlements, and in overcrowded and deteriorating tenements (WHO, 1992b). [2]

THE NEED FOR AFFORDABLE HOUSING

Existing Problems

The lesson learned during the site-and-service and resettlement programmes carried out during the 1970s and 1980s was that the

poor were mostly not reached (UNCHS, 1991c). One reason for this was the emphasis on cost recovery, or not keeping subsidies low, or not targeting them to the poor. Another important factor issue not taken properly into consideration, was the need of the poor to be close to their sources of income in the city centers. Thus, the poor often cannot afford to accept government offers. Furthermore, rapid urbanization led the non-poor to take over the (inadequate) supply of dwellings. In sum, government housing has generally been too expensive, had too little flexibility in use and was placed in unsuitable locations. Shelter is an area in which settlements are viably losing ground. Policies fail to respond to people's needs. There has thus been a general decline in shelter standards in the past decade. The commitment made by governments to the provision of affordable housing has been increasingly eroded by persistent economic and financial difficulties in nearly all developing countries. The result has been reduced public expenditures.

At the same time, the real price of building materials has typically risen rapidly. Not only the poor, but also other low-income families now find themselves in a cost-affordability squeeze regarding adequate shelter. The widening gap between construction costs and the ability of the poor to pay, creates a situation in which rising urban rents force the poor to move out to peripheral and unserved squatter areas. The exclusion of the poor from the loans results in the failure of plot beneficiaries to finish their dwellings. Insistence on sophisticated building standards effectively eliminates the possibility for the poor to use inexpensive local materials and traditional construction techniques which would allow a slower but real improvement of their shelter [2].

Defining Affordable Housing

So far, it has been difficult to define affordable housing, and there is no general universal definition. While low cost refers only to building systems and land development methods that are applicable to low-cost housing; affordable housing should generate images of "typical" housing that may be large or small, use inexpensive materials, products, and provide the amenities appropriate for or desired by the occupant. The affordability or lack of affordability is determined by the household income of the occupant rather than the cost of the house. However, the following explanations and definition by the U.S. government, can be modified and hence, adopted as a guideline for purposes of defining affordable housing in a specific region:

A decent home in a suitable living environment for every American family was professed as a housing goal in the U.S. housing act of 1949 and reaffirmed in the 1990 National Affordable Housing Act, with the added condition that the housing should be affordable. The gap between this goal and the U.S. reality has been and remains large, however "affordable" housing defined. Although affordable housing has no official definition, a widely accepted implicit definition is that monthly housing costs in adequate housing should be not more than 30 per cent of house-hold income. This is the rent payment standard currently used by the U.S. Department of Housing and Urban Development (HUD) for two of its major housing programs: public housing and the program called Section 8, which provides rental assistance. [3]

APPLICATION OF APPROPRIATE TECHNOLOGY

Established Concepts

The concept of appropriate technology was viewed as 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.

It was considered that, with widely divergent conditions in developing countries, no single pattern of technology or technologies could be considered as being appropriate, and that a broad spectrum of technologies should be examined and applied. At the same time, some developing countries were faced with considerable shortage of manpower resources; in some other cases, greater emphasis was essential in areas of urban concentration. The appropriate pattern of technological choice and application was essential in areas of urban concentration. 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. [4]

Technologies for (Low Cost) Affordable Housing

The critical components of the housing required by the low-income population are the roof, walls and building frame. Specific attention should be given to developing the availability of materials that would improve the durability of these components.

A correct understanding of the performance demands of various parts of building will help to limit areas of application of the more expensive materials and components, thereby reducing costs. Thus, to reduce the costs of walls, it should be possible to change the nature of the walls above 2-meter level and use perhaps unfired bricks, which cost less than half as much as burnt bricks or concrete blocks. It should also be possible to make unfired brick walls reasonably impact-resistant by applying a

suitable fibrous plaster to them.

Many alternative systems and products have been developed and are in use, but none so far developed have solved the problem of obtaining durability at a low cost. Asphaltic coir-fibre cement sheets, are still too costly for low-income group. [4]

Construction Techniques

There is considerable scope for bringing about improvement in conventional construction techniques that would minimize the use of costly materials without affecting the quality of construction. There are several components of conventional building structures where, usually, more expensive building materials are used than actually needed. The tendency to over-engineer is more common in conventional modern constructions. The techniques used in urban areas mostly utilize costly and scarce building materials, with no attempt to utilize locally available material resources, and rural houses are constructed with local materials with no attempt to improve their quality or durability. The suitability of construction techniques in the special circumstances of the developing countries will, however, depend largely on their linkages with locally available materials and skills, their employment potentialities and the savings they engender in the use of scarce and costly materials, as well as in construction time. [4]

Lack of Fundamental Knowledge

More than sufficient information on building materials and construction techniques for developing countries is available in the world today, but only very few people and least of all the local house builders have access to it. A house cannot be built without fundamental knowledge of building materials and construction. Unfortunately, appropriate building materials and technologies are generally considered to be simple enough to be handled by people without special skills or training. The poor results and even failures, have led to a great deal of criticism and to the general belief that appropriate technologies are "inferior technologies". It is, therefore, important to stress that a material that has failed or failed or performed poorly, was evidently not appropriate for that particular application or it had been produced and used incorrectly. [5]

Even though a number of African countries export timber, it is not much used as a building material in the continent. The main problems seems to be lack of enough knowledge of properties of wood. Wood in various forms has been man's most useful building materials until the comparatively recent innovation of metallic, and cementitious and other materials.

The problem with iron roofing sheets (Zinc Coated Corrugated Iron Roofing Sheets) is a tropical climate is not only its durability, but its unsuitableness as a roofing material. It has very high transmission compared with other traditional and other roofing materials, and it makes a lot of noise when rain falls on it. It is interesting to note that, corrugated iron sheets is scarcely used as a roofing material in the developed countries. [6]

Standards and Specifications

Developing countries, not having the advantage of established institutions which go with a developed construction sector, frequently suffer from the absence of any indigenous standards of codes for construction, particularly related to materials and workmanship. They seldom have the benefit of long experience of the operation of a building code. The usual pattern is to import and apply these codes, standards and specifications from one or other of the developed countries.

This often means that all small-scale housing construction is in fact, an exercise in erection without the benefit even of these imported tools. This absence of an indigenous code or standard coupled with poor or uninformed construction practice means that unfamiliar workmen execute poor structural and judgmental work. [7]

NEW BUILDING SYSTEMS

It is very essential to develop new building systems for affordable housing. These should be developed such that, they can contribute to the high demand of affordable housing for the low-income majority, especially in the developing countries. The systems should meet the following performance criteria;

- Low materials cost
- Low labor cost
- Fast building method
- Good thermal insulation
- Structural air tightness
- Insensitive to moisture and related damage

- Free choice of interior and exterior cladding
- Acoustical insulation
- Fire safety
- Low running and maintenance costs
- Adequate structural properties
- Durable
- Healthy and recyclable building materials
- Local and global environment impact

In the U.S., alternative construction systems which can be studied, modified and adopted in the developing countries have been developed. However, the following remarks should be observed:

Before adopting any alternative construction system for a home-building project, several factors must be considered. These factors constitute major barriers to the introduction of new building systems.

1. Before deciding on a specific system, it is necessary to check with the local building department to determine if the materials are acceptable under the local codes for building construction.
2. Since erecting the building requires a trained work force, it is important to determine if appropriately trained workers are available.
3. As construction proceeds, there may be a need for an additional quantity of materials due to loss or breakage. It is important to determine if an additional supply is available.
4. Once the shell of the home is erected, other tradesmen such as electricians, plumbers, and heating/cooling system installers must be able to function. It will be important to determine if the chosen building system impacts their ability to do their job.
5. After the home is occupied, the home owner will be faced with maintenance and repairs. Once again, the question arises of a work force skilled in working with the system and an adequate supply network for maintenance and repair materials.

Even is a number of problems may arise during the process of developing new and alternative building systems, the most notable one is the lack of familiarity. The inherent skepticism of using a new product that is new can inhibit its use. [8]

CONCLUSIONS

There is a need to promote new building methods and appropriate construction techniques. Improvements in the skill capabilities of local construction manpower and the adoption of appropriate construction techniques can expand the output capacity of the construction industry, minimize cost of construction and ensure quality output. Building materials which are produced with appropriate technologies, therefore, have to be prepared and used with the same skill and care as a high technology product.

For the production and application of appropriate technologies, planners in developing countries must recognize that appropriate technologies for the production of alternative building techniques and materials; and their use in construction, which may be relevant to most of the developing countries in their prevailing circumstances, do exist and provide viable options to the conventional materials as well as production and application techniques and methods. Urgent steps must be taken by the developing countries to identify, assess, select and use such alternative technologies and methods.

Governments should review the building regulations and standards carefully to avoid inhibiting the use of appropriate technologies in housing construction, especially for low-income groups. Standards should be flexible, varying according to application, as with single or multi-storey buildings, urban and rural areas. The formulation of a government policy for the development of the whole construction and building materials industry could contribute to the balanced development of this sector.

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