ECONOMICS OF LOW COST HOUSING

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Introduction:

The housing problem has its threefolds: social, physical and economic. The problem has been tackled through both the social and physical aspects with less emphases on the economic side. The economic aspect in housing could not be counted only in terms of money but also in utility, comfort and health. On the other hand the economic aspect in the housing problem depends on the initial cost of construction and public utilities as well as on the designed housing unit as a final product in the building industry.

The economy of housing has been always built on short planning terms. The nature of the housing problem does not constitute any more a short term process specially for the low income strata of population. In this case the housing problem becomes a socio-physical building process. The community development will become an intigrated item in the housing process. On the other hand building materials in the growing community will be considered as a public utility as that of water, sewerage and electricity.

Low cost housing problem is in the first place a socio-economic problem. The socio-economic aspect of the problem involves the following factors:

1. The limitations of the long term national investment in the low cost housing programmes.
2. The paying capacity of the inhabitants as related to renting capacity and size of savings.
3. The economic study of the building industry in relation to resources of raw materials, size of plant, production, storage, marketing and transportation.
4. The utilization of abundant manpower in the building process.

5. The economic utilization of local building materials in construction.

6. Management, site organisation and training.

7. The changing needs of the community.

8. The relationship between the cost of the housing unit based on the changing paying capacity and that based on the minimum housing requirements.

9. The initial cost of the building process w.r.t. road system, public utilities and building construction.

10. The economic affect of design and maintenance.

The object of this study is to examine the socio-economic aspects involved in each of the above factors in order to attain the different alternative approaches to the problem. These alternative approaches could then be examined with regard to the higher policy of the country which may affect the choice of the social groups, locations and priorities. The final housing programme could then be refined and implimentation measures could then be carried out.

Implimentation measures are taken in a series of stages of development together with a system of codes and regulations to ensure the process of construction. As any planning problem the continuous social and physical investigations may lead to some alternations in the process. Flexibility in planning in this case facilitates the process of adjustment or modification.

Due to the numerous variables involved in this planning process, it may be necessary to establish a computation system to give the alternative solutions to the problem. Such mechanism could be carried out within the functions of Regional Housing Research Centres to be established in the developing regions in the world. United Nations agencies could play a very important role in this aspect.

1. Limitations of long term national investments in low cost housing programmes.

Within the national investment plans the percentage of investment allocated for housing and public utilities vary from one country to the other. This percentage varies between 5% and 10%. The investment allocated for housing often constitutes a part of investments allocated for construction. In the case of U.A.R. the percentage allocated for housing is about 20% of that allocated for construction which is about 44% of the national investment. This means that 8.8% of the national investment is allocated for housing and public utilities. The percentage allocated for housing is about 7%.

This means that the housing policy is still considered as a physical or a constructional problem. It is true that other services related to housing are included in the activities of other sectors of the national economy. In comprehensive housing programme it is essential to intigrate all the related services in the planning process. This fact should then be considered when allocating the housing investment within the framework of a National Plan. The investment allocated for comprehensive housing programme should therefore include a portion of the investments allocated for public social services, building industry, education (other than school buildings), public health, local governments, guidance, public works and defence. Sometimes it may be essential from the strategic point of view to allocate a portion of the defence budget for special housing programmes.

Within the Nation Plan housing programmes, on the other hand, could not be divided into short term programmes according to fiscal years intending to build a certain number of housing units every year. The schedule of the housing programme should therefore cover a longer period divided into shorter periods according to the nature of the housing process.

Public and private housing programmes should be deferentiated within the national plan. It is always reasonable to control public

housing programmes more than that of private housing programmes which are bound to land ownership, the size of savings allocated for housing, the abundance of building materials and the size of State loan for housing. In most developing countries a great percentage of the budget of public housing programme is allocated for low cost housing. About 45% of the investment allocated for housing programme in U.A.R. is taken for public low cost housing to build about 73% of the total number of housing units.

The following table shows the distribution of numbers and value of the housing units to be built in urban areas for the three categories of income groups in U.A.R. (Pop. 32 millions) for 1967 - 68, (value in 1000 EL).

TABLE 1

Sector	Low Cost		Average Income		High Income		Total	
	No. Units	Value	No. Units	Value	No. Units	Value	No. Units	Value
Public	9467	2340	3355	2676	267	275	13098	5291
Private	12595	5630	6172	8667	112	336	19869	14633
Total	22062	7970	10510	11343	379	611	32967	19924

(This is beside a number of about 30000 housing units in rural areas between public and private sectors).

The above table shows that there is great proportion of the low cost housing units left for the private sector. This means that about 60% of the low cost housing units could hardly be included in a comprehensive housing programme. A great proportion of average and high income housing groups could easily fill the open gaps in the urban structures depending on the existing private ownerships, services and public utilities. On the other hand, private low cost housing should be included in the comprehensive programmes in order to reach the economic targets of the housing projects. This does not mean the exclusion of private ownership in low cost housing. A re-allocation system of ownership could

be applied in these cases. In this case it will be possible to raise the investments allocated for public low income housing and at the same time utilize the maximum savings from the private enterprises in low cost housing programmes.

With this consideration, the total investments allocated for low income cost housing programme in urban areas w.r.t. the national plan in U.A.R. (1967 - 1968) could be estimated in the following table providing an excess of 20% from other resources as explained before.

TABLE 2

Sector	Low Cost		Average Income		High Income		Total	
	No. Units	Value	No. Units	Value	No. Units	Value	No. Units	Value
Public	26474	9564	3355	2676	267	275	29986	12515
Private	-	-	6172	8667	112	336	6284	9003
Total	26474	9564	9427	11343	379	611	36270	21518

This means that the percentage of value allocated for public low cost housing programme has been raised from 45% to 76% while the number of public low cost housing units has been raised from 73% to 93% of the total number of public housing units.

Rural housing which is of the low cost category is to be treated within the agro-economics of the area whether under reclaimation or betterment. (The author has dealt with this study in the previous paper on the "Fundamental of Rural Housing" - December 1963).

Within the framework of National Physical Planning low cost housing could be located as self-sufficient housing groups or neighbourhoods inside the urban structure or in separate settlements as the regional planning policy can tell.

2. The Paying Capacity of inhabitants w.r.t. renting capacity and size of saving.

While the national investments in housing constitutes part of the initial costs of the housing programmes, the paying capacity of the inhabitants constitutes the running costs and return for the national investments. The paying capacity for the low income groups varies between 25% and 35% of the monthly earnings of the household. This is considered a high percentage of the total household expenditure. In a higher income group this percentage varies between 15% and 20%.

The paying capacity varies also from onelow income group to the other. The paying capacity also varies from one size of household to the other. Smaller households may afford a higher percentage. On the other hand it is reasonable to assume that the size of earnings increases with the increase of the size of household, but with a rate less than that of the increase in expenditure.

The expected change in the household structure will eventually affect the paying capacities as well as the housing needs. The changes in the household structure usually accompany the economic changes in the community. Industrial developments tends to cause increase in the percentage of smaller households decreases in the larger households.

The following table shows the changes in the size of households between 1947 and 1967 in U.A.R., and the relationship between the sizes of households in U.A.R. 1967 and in England in the same year.

TABLE 3

Size	1	2	3	4	5	6	7	8	9	10
Percentage U.A.R. 1947	1.7	6.2	11.2	14.7	15.7	14.7	12	2	23.4	←
Percentage U.A.R. 1957	8.8	13.3	14.4	15.5	14.5	11.9	8.7	5.5	3.1	4.0

Size	1	2	3	4	5	6	7	8	9	10
Percentage U.A.R. 1967	12.3	16.8	16.0	15.9	14.0	10.5	7.1	7.3	→	
Percentage England	3.3	18.1	7.2	15.0	12.3	10.0	→			

The paying capacity of the lower strata of employees or workers will constitute their renting capacity while that of artisans and smaller merchants willconstitute their saving capacities to be invested in housing. The average earning per household in the low income group could be classified as follows:

In U.A.R.: for low income group A, LE 10 - 15 per month
for low income group B, LE 15 - 25 per month
for low income group C, LE 25 - 35 per month

In Saudi Arabia: for low income group A, 200 - 300 S.R.
for low income group B, 300 - 500 S.R.
for low income group C, 500 - 800 S.R.

The saving capacity on the national level in U.A.R. is between 10% and 13%. If an average savings of 15% could be achieved for smaller artisans and merchants who earn in the average between LE 35 and 50 per month, the total savings in 5 years for them will vary between LE 315 and LE 450. These amounts could be estimated as an average of 33% of the total cost of the housing unit. This means that smaller artisans and merchants could participate by about 33% of the cost of their housing units while the rest 67% could be considered as a long term loan for 15 years. Larger private investment in low cost housing projects could also be built on these assumptions. The factors affecting the cost of the housing unit will be dealt with later on in this study.

In U.A.R. the size of the renting capacity in the housing programme could be estimated by reducing the percentage of expenditure on housing to 20%. This will help in raising the standard of living of the low income group and consequently their housing

conditions. The total size of the renting capacity could also be estimated so as to cover the housing costs in a period of 15 years. Costs of public services and utilities are to be covered by subsidies allocated in the national plans. The initial cost of the housing unit could be provided through housing banks considering this cost as long term loan for a period of 15 years with a low interest not more than 2.5%.

In U.A.R. the size of the renting capacity in a period of 15 years could be built on the following assumptions:

TABLE 4

Low Income group	income per month	% on housing	total in 15 years	interest	net value
A	LE 10 - 15	20%	LE 360 - 540	1%	LE 306 - 459
B	LE 15 - 25	20%	LE 540 - 900	1%	LE 459 - 765
C	LE 25 - 35	20%	LE 900 -1260	1%	LE 765 -1071

The economy of the construction of the total size of the housing unit could be based on the previous assumptions. The initial cost of the housing unit could be estimated according to the initial housing needs of each size of households. Flexibility in design and planning which will be discussed later in this study will serve the correlation between the housing needs of the household and their renting capacity.

Most of the land, public services and utilities could be subsidised by the Government at the early stages of construction. The total cost of public services and utilities constitutes 25% to 50% of the cost of the housing construction. In a pre-study case on low cost housing in Saudi Arabia, the author found that the average total cost per housing unit was about 24150 S.R. from which 13000 S.R. for construction, 2400 S.R. for public buildings and 5500 S.R. for roads and landscaping and 3250 S.R. for administration.

In all stages of economic assumptions there must be a full consideration for the stages of construction in relation to community development. The initial costs should always be kept to the minimum. Both planning and design concepts should be built to serve the economic criteria. This theory emphasizes once more the need for the intigra-

tion of all aspects in the housing study.

3. The Economic study of the building industry serving low cost housing projects:

The economic study of the building industry serving low cost housing projects is carried out in relation to resources of raw materials, size of plant, production, storage, marketing and transportation. The plant here may be fully mechanized, semi-mechanized, or even a manual. The plant in that sense constitutes the production centre of building materials and in some cases elements of construction.

The size of the plant, in any case, depends on the rate of construction in the stage of development. The plant in this case acts as one of the public utilities centres serving the community if we consider that the physical structure of the community is continuously built up together with its social and demographic structure.

The types of plants could be classified in the following categories:-

1. Plants producing building materials manufactured manually mainly stabilized bricks, cement blocks or the like. Plants in this category with less nuisance, couldbe placed in these vicinity of the new settlement under construction. Raw materials whether provided locally or transported from a reasonable distance could be stored on site at reasonable intervals according to the rate of production. Production could be intigrated with the building process as part of the whole building industry. In this case the plany may work on seasonal terms with the same manpower working in each process. Simple constructional elements could be layed on site. The plant could produce other building elements and woodwork.

The building industry in this case will be a public utility. It starts serving the initial stages of construction according to a pre-designed architecture. In due time the industry will serve the continuous and changing requirements or needs of the community. The building process will consequently be directed by both the local architect-planner and the social scientist in collaboration

with the members of the household benefited.

2. Plants fully mechanized or semi-mechanized and producing finished or semi-finished products. Plants in this category could be scaled according to the production capacity of their machines. On the other hand the cost of transportation of both the raw materials and the products will come as an effective factor in determining the location of the plants.

Considering the building industry again as a public utility serving the initial stages of construction as well as the following stages, the rate of consumption will consequently be increased and extended on a longer period of time. This means that the rate of delivering the products will also increase. In this case light transportation system will eventually be used and accordingly the size and weight of products will be decreased to the minimum. The building industry as such will constitute a light industry or a service industry.

The mechanized plants as such are expected to serve larger sizes of development projects. The size and location of the plants are determined within the planning study of low cost housing programme. Consideration should also be given to complimentary industries serving the housing programme specially in the initial stages of construction.

3. Plants of larger scale production: these plants could produce the heavy parts of construction, as lighting posts, pipes, prestressed constructional elements and the like. These plants constitute heavy industries which could be built within the regional level which may lay outside the ranges of this study.

In each of the three mentioned categories of plants the generating power as well as the size of manpower involved are ingrated factors in the overall economy of the building industry. The cost of manpower involved in the building industry serving low cost housing projects is an important factor which could be dealt with separately.

4. The Utilization of the abundant manpower in the building process.

The building industries in the developing countries is characterised by an unstable labour. Building industries in these countries lack both continuity and stability. This is because the products of these industries ends with the end of the building process. The building industries as such could not achieve the mobility necessary to meet the changing sites of construction. To achieve an established and continuous state for the building industry it will be necessary to secure the continuity of consumption. This would be achieved through the gradual growth of the physical structure of the community together with the social and demographic growth. The population in the case of low cost housing programmes constitutes an integral part in the building process.

It has been estimated, in U.A.R., that the cost of labour in the construction process constitutes about 35% of total cost of construction. In the case of low housing projects this is considered a high percentage. Several attempts have been tried to reduce this percentage to the minimum or in more precise words, to reduce expenditure on the manpower to the minimum by encouraging the population to take part in the construction process of their own housing units. The aided self-help system has been applied to many low cost housing projects all over the world. This system has been adopted in a new form as a co-operative building system specially in rural areas. The economic aspects of utilizing the abundant manpower varies in both urban and rural areas. In urban areas the labour force could be recruited all over the year on spare time bases. In rural areas the labour force is recruited on seasonal bases. This phenomenon will consequently affect the development programmes of low cost housing projects in both urban and rural areas. The recruited labour force in the rural areas will be more effective than that recruited in the urban areas. The proportion of the cost of manpower in the building process will also vary in both areas.

The economic target in that respect is not only to decrease the cost of manpower in the building process but also to increase

the participation of the inhabitants in the building process especially in rural areas. The initial cost of the low cost housing programme as such will include the cost of training the initial manpower to be involved in the building process. The status of the labour force will be different in reconstruction programmes than in establishing new communities.

5. The utilization of local building materials.

The utilization of local building materials could not be considered an economic factor in low cost housing projects unless the built up project proved to be economic. The abundance of one row building material could be affected by other factors which make it uneconomic in the building process or uneconomic to the other sectors of the national economy. Using the mud in the Nile Delta as a building material for rural housing may have proved to be economic before building the High Dam at Aswan which is expected to reduce the amount of mud by about 30%. The Ministry of Agriculture has already warned the Ministry of Housing for using any more large amounts of mud not only in rural housing but in producing red bricks. On the other hand, mud as a building material has proved to be uneconomic in the northern part of the Nile Delta where the subsoil water level is very near and the amount of the rainfall is considerably high. Local people use local weeds in a primative way as a building material which could be developed as an adequate way of construction.

The economy of local building materials is also affected by its way of production, way of construction and the way the local labour can handle it. Durability is another factor affecting the economic use of the local building material as well as surface treatment and maintenance.

This means that the economy of local building material should be examined on both local and national levels and on comparative bases for all different alternatives.

It is worthwhile to evaluate previous experiments in low cost housing. In rural areas in U.A.R. the cost of manufacturing

mud bricks could include the cost of straw, sand, earth, moulding, putting on edge, transportation of straw, water, supervision and general expenses. The cost of stone as building material could also include the cost of explosives and fuses, transportation, forge and other general expenses. The cost of any local building material could be analysed in the same sense. The cost estimates of the building material should be complimented by the cost of construction including the cost of labour.

6. Management, site organisation and training

To secure the economic target of low cost housing projects, a very efficient management should be established. Efficiency of management should be achieved through the least well trained personnel who can handle the work in minimum time and more administrative freedom. A continuous contact between the management and the inhabitant should be established through the architect and the social scientist. Management should be directed on site and record the progress of the different components of the scheme.

The management system is to be drawn according to the comprehensive study of the low cost housing programme. The programme will include the financing process, the building process and the priorities of benificiaries. The building process will cover the initial stage of construction and continue with the physical growth of the project according to the expected needs of the population in the future. (Planning and architectural concepts will cover that point). The initial stage of construction may include a training programme for part of the beneficiaries who may take over the execution of the programme through management, building and maintenance. At the conclusion of the initial stage of construction the new community could possess the self-control over its physical environment. Socio-architectural guidance should continue with the building and the maintenance process. Environment improvement as well is considered as an integral part in the building process.

On the national level pilot projects for low cost housing

may be executed on pilot investment in order to assess the sufficient standards for planning, design, management and site organisation. These standards on the other hand, will help the accuracy of any national housing policy to be planned in the future. A detailed and accurate recording for the pilot projects should be related to the type of communities benefiting from low cost housing programmes, whether in urban or rural areas.

Flexibility and freedom of management are essential to meet the changing community needs in the future. The management system acts as a control key to the economy of the project through out the building process.

7. The Changing Housing Needs.

If we consider the low cost housing programme a continuous process serving the community needs at the different stages of construction, this means that the programme is to be built on the expected needs of the changing community.

The housing needs at the initial stage will be based on the initial sizes of households to be accommodated. In low cost housing programmes the initial stage may be considered as a sheltering stage in order to reduce the initial cost of construction to the minimum. The sheltering stage may acquire a part of the total size of the housing unit. This is a matter to be considered in planning and design.

Housing requirements will then change through the different stages of construction. There will be a continuous increase in the size of small households while larger households are expected to be divided into smaller households. It is therefore necessary to examine the nature of the changing social circle. This circle depends on the marriage rate, fertility factor, birth and death rates in each sex and age group.

In a community of 1000 household the following structure could be found in U.A.R.

TABLE 5

Size of household	1	2	3	4	5	6	7	8 & more
No. of households (1957)	123	168	160	159	140	105	71	73

Marriage rate in U.A.R. (1960) was about 2 to 25%. Fertility factor is limited to females between 16 and 50 years old. Birth and death rates are related to each sex and age group in the different sizes of households. The natural rate of growth of the population is 2.7%. These factors will affect the rate of change in the structure of each size of household but the proportion of family structure may not change much. If we consider the general set up is constant the following changes may take place in 1000 households in one year assuming that 6 out of 128 persons get married every year.

TABLE 6

Size of household	1	2	3	4	5	6	7	8
Basic No.	123	168	160	159	140	105	71	73
No. of households	6 → 117 → 3							
		165 → 2						
	+3.3		158 → 1.5					
				157.5 → 1.2				
		+4.5						
					138.8 → 1			
			+4.3					
				+4.25		104 → 0.9		
							70.1 → 0.75	
					+3.2			72.25 → 6
						+2.8		
							+1.6	
								+2
Total No.	120.3	172.5	164.3	163.25	143.2	167.8	72.6	75

In a period of five years the following changes may occur to the same number of households assuming no changes in fertility factor, marriage rates, birth and death rates. The natural rate of growth of the population is taken as 2.7%

TABLE 7

Size of household	1	2	3	4	5	6	7	8
Basic No.	123	168	160	159	140	105	71	73
No. of households	30→93→15 153→10 +16.5 150→7.5 +22.5 151.5→6 +21.5 +21.25 134→5 +16 100→4.5 66.5→3.75 +14 +8 69.25→30 +2							
Total No.	139.3	190.5	181.5	180.25	156	119	79	75

In ten years the picture will be as follows for the same 1000 households consisting the natural growth of population.

TABLE 8

Size of household	1	2	3	4	5	6	7	8
Basic No.	123	168	160	159	140	105	71	73
No. of households	60→ 60→30 138→20 +33 140→15 144→12 +43 128→10 +42.5 95→8.5 +32 62.5→7.5 +28 +16 65.5→60 +20							
Total No.	156	213	203	201.5	172	133	87	93

The rate of change for all sizes of households could then be estimated for a community of 1000 households as follows:

TABLE 9

Size of household	1	2	3	4	5	6	7	8
Basic No.	123	168	160	159	140	105	71	73
Rate of Change	9.5%	2.2%	1.4%	1.0%	0.94%	1%	1.4%	1.1%

(These figures are considered as indications and are reliable to more accurate adjustment).

This means that about 48.8% of the families of one person will compose familieis of 2 persons in a period of ten years. About 17.7% of the families of 2 persons will compose families of 3 persons and 12.5% of the families of 3 persons will compose families of 4 persons in the same period. This is plus the natural growth of the population.

These figures indicate the nature of the changing structure of the community. Consequently they indicate the size of need for housing accommodation in the different stage of construction and accordingly the rate of production of the building industry. These figures also constitute a major factor in determining the financing programme of the low cost housing project.

8. The relationship between the cost of the housing unit based on the paying capacity and that based on the minimum housing requirements.

The total cost of the housing unit is estimated in two ways: The first estimate is based on the total paying capacity. The second estimate is based on the architectural design of the minimum housing requirements which suits the size of the household and the minimum cost of the built up square metre. The difference in plus or minus should then be adjusted in order to achieve the financial balance of the project. In the case of low cost housing projects the value based on the architectural design always exceeds that based on the paying capacity. This comparison could not give a fair result. It is assumed that in the case of low cost housing projects

the total building is not to be built in the initial stage when the paying capacity is estimated.

To keep the initial cost of the housing unit to the minimum, consideration should be given to the growth of the housing unit according to the growth of the household. This means that the initial stage for the housing unit to accommodate the smaller sizes of households will be msaller than that for larger sizes. On the other hand, the total size of the housing unit may be built in the initial stage in order to accommodate a large family which expects future division in its structure. The study shows that the rate of change in the structure of smaller households is higher than that in larger sizes.

In a previous study for low cost housing in an urban area the following areas have been based on the architectural design for the minimum housing requirements in three stage of construction. The average cost of the square metres has been estimated by LE 6/m^2.

TABLE 10

Type	1st stage		1st + 2nd stage		1st + 2nd + 3rd stage	
	area m^2	Cost LE	area m^2	Cost LE	area m^2	Cost LE
A_1	63	368	Full size	-	-	-
A_2	64	384	Full size	-	-	-
B_1	51	306	78	468	87	522
B_2	42	252	60	360	78	468
C_1	58.5	351	85.5	513	112.5	675
C_2	225	1350	Full size	-	-	-

(The estimated cost per square metre is derived from another architectural and constructional study).

The types of housing units are allocated for the different sizes of household in the low income groups as follows:

TABLE 11

Income group in U.A.R.	Small size	Type	Medium size	Type	Large size	Type
Low income group A	30%	Type B_2	33%	Type B_1	37%	Type C_1
Low income group B	30%	Type A_1	33%	Type A_2	37%	Type C_1
Low income group C	30%	Type C_1	33%	Type C_1	37%	Type C_2

The comparison between the cost of the housing unit based on paying capacity and that based on the architectural design for the minimum housing requirements could be shown in the following table for the same low income groups:

TABLE 12

			Cost/Size of households LE		
Low income groups LE	R.C.	Cost/paying capacities LE	Small size in stages	medium size in stages	large size in stages
A(10-15) /m	20%	360 - 540	252/360/468	360/462/522	351/513/675
B(15-25) /m	20%	540 - 900	368	384	351/513/675
C(25-35) /m	20%	900 - 1260	351/513/675	351/513/675	1350

According to the previous comparison adjustment could be carried out either by changing the paying capacity or changing the architectural design. In the previous case the paying capacity of low income groups B and C could be reduced to 15%. In the same time the paying capacity for low income group A is adequate for the architectural design of Type B_2, B_1 and C_1. The same methodoloty could be applied in a further detailed study according to more accurate figures.

9. The initial cost of the building process w.r.t. road system, public utilities and building construction

The economics of low cost housing projects can also be achieved from the physical plan of the community. Consideration is to be given to the land value, the area and capacity of the road

network and thelength and capacity of the public utilities (electricity, water and sewerage). On the other hand consideration should also be given to the correlation between the size of the community and the size of public services (schools, community centres, shopping centres, etc.).

One of the main objectives of the physical plan is to keep the initial cost of the road network, thepublic utilities, the public services and the building process to the minimum. This means that the initial stage of the four components constitute the initial stage of the project. There must be a continuous correlation between the four components during the planning process. The physical plan should, therefore, satisfy this correlation and in the same time provide the community life of a neighbourhood in the different stages of construction.

The size of the housing group is determined according to the size of the primary school which serve it. If the initial size of the primary school is 300 pupils and the optimum sizeis 450 pupils, this means that the initial size of the community will be 2000 inhabitants (with an average of 150 pupils per 1000). The second stage couldbe estimated by 2500 inhabitants and the optimum size by 3000 inhabitants.

To satisfy the organic correlation between the four components in the physical plan the growth of the housing group will be planned in a radial or linear s ense. The four components should be provided with the ample space to expand in an integrated structure. In the Arab settlement the growth of the housing group will be built along the pedestrianway or the backbone along which most of the communial services are consentrated. In this case the school and the open grounds will be built at the far end of the backbone of the housing group and not near the central area.

On the other hand, the economy of the physical plan could be emphazied by increasing the land use density at the initial stage of construction. The density could then be reduced gradually in the outward sense, this planning concept will help the full utilization of space as well as public utilities and public services at the first stage of development. This concept will eventually

keep the expenses of management and site organization to the minimum.

This planning concept will not only serve the economic aspects of the project but also the asthetic side and preserve the integrated character of the townscape through the different stages of construction.

10 The economic effect of design and maintenance

Besides the economic effect of the systems of construction and the building materials, architectural design has also its economic effect. In low cost housing, the design of the housing unit has a great bearing on the economic side. The economic aspect of the design means the full utilization of space as well as the architectural elements of the design.

In many cases the housing unit is designed within the two dimentional plan without much consideration to the third dimension and the cubic units of air per inhabitant. In the same previous study for housing units design it was found that type A of a floor area of 64 m_2 and a height of 3 m has a volume of 192 m^3. Type A_2 which accommodates the same floor area of 64 m^2 in two floors and a height of 3 m for the lower floor and 2.5 m for the upper floor has a total volume of 176 m^3 with 16 m^3 less than that of type A_1. Type A_2 saves more than 8% of the total cost of Type A_1.

The outer walls and openings play another part in the economy of design. The less the area of the outer walls the more saving could be gained from the design. Partition walls of sand bricks save another percentage of the total cost. Built-in simple furniture could be an economic factor in the total cost of the housing unit considering that the furniture will be provided by the inhabitants. Many other factors could be considered in the design of the housing unit to save more of the total cost.

Flexibility of design will be an effective factor in the economy of the housing unit if its growth will be related to the demographic growth of the household. The members of the household may later on take part in the building process. In this case the initial stage

of construction will function later on as an integral part of the total housing unit. In other cases the shelter may be built of a light mobile structure which could be used later on in other places after a considerable part of the housing unit has been built. This concept will eventually affect the initial cost of the low cost housing project specially in newly developed areas. The mobile light structure may shelter a Bedouin community before being integrated in the urban life of a town. The structure as such could accommodate the transitional period of the housing conditions of such population. On the other hand it also can accommodate the urgent needs for housing caused by floods, earthquake or the like.

The application of the modular system in structure has also its effect on the economy of the construction. The modular system may be applied to the architectural and the constructional elements as well as for the area units in the housing lots.

The utilization of the outer space of the housing units could also be an effective factor in the economy of the project. In a previous study for a layout of a group of low cost housing units it was found that the same area of land could hold a density ranging between 165.2 rooms per acre to 201.8 rooms per acre without affecting the efficiency of the open space.

On the other hand there is a great deal to save by means of continuous maintenance. The maintenance process has two sides; the first is related to the behaviour of the community in their housing environment and the other is related to the use of the building materials and the equipments. This means that it is not always the cheap material which is the most economic in low cost housing projects. A correlation could be established between the cost of building materials and the cost of maintenance.

Conclusion:

As a conclusion to this paper it could be recognized that there is a complexity of factors affecting the economics of low

cost housing. A computation system could be another factor for assessing the most economic setting for a low cost housing project considering the previous ten factors. International housing agencies could play a great role in solving most ofthe acute problems of low cost housing in the Afro-Asian countries. There is a great need for a Regional Housing Research Centre which can tackle these problems. The United Nations Agencies concerned could be of a great help in achieving this target by calling for peace through housing in the developing countries of the world. An International Housing Day could be again an encouraging factor for the Governments concerned to give more interest to their low cost housing problems.

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