AN APPROACH TO ECONOMICAL ANALYSES OF RESIDENTIAL DEVELOPMENT WITH REFERENCE TO EGYPT

BY

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INTRODUCTION.

Egypt, the United Arab Republic, is passing through a period of great evolution. Country-wide constructional projects are required in the near and the far future to cope with the aim of raising the standard of living of the people and the progress of the country. This realises the importance of the construction industry and its role in the progress of the country.

Housing represents the biggest single section of the construction industry. The importance of housing arose from the fact that housing conditions affect the hygienic, cultural, and social conditions of its residents.

Although most of the funds should be directed to fulfill the country's developmental plans of the productive section of economy, yet great capitals of money are invested on house building. The aim of the housing programme is to solve the problem of shortage of housing and to provide suitable, healthy and well constructed houses. Masses of houses were, are, and will be built. From the fact that the limited capitals of money must be fully expended in a way to fulfill the building of the greatest-good number of houses, the imporance of the economy of residential development arose. The aim of the economy of residential development is not to build with the cheapest costs, but to build with the lowest possible costs the adequate residential buidings, and to arrange them and their environment in a manner suitable for the people for whom they were built.

The aim of this study is to find an approach to economical analyses of residential development. For this aim the different main forces which directly or indirectly play their role in the economic appraisal of a residential development were investigated.

Chapter I. to Chapter IV. is a general survey of Egypt, its population, and housing and town planning characteristics, which are the basic point from which this investigation could be started.

In Chapter V. the importance of the construction industry and its role in the economy of a nation is pointed out.

Chapter VI. shows the effect of the systems of construction on the costs of residential buildings.

In Chapter VII. the role of the most important non-economic forces which directly or indirectly affect the residential development, its planning and design, and hence its costs were studied.

The direct factors which affect the costs of residential development were determined in Chapter VIII.

Finally, in Chapter IX. an economic investigation of the costs of a neighbourhood unit was made with the aim to show the relationship between gross densities and the changes in the costs of the neighbourhood unit and the costs of its different elements.

Due to the lack of the necessary data for calculation the Hungarian unit costs of the different elements of a neighbourhood unit were used for the

completion of this investigation. Of course, the final results, in numbers, are not valid for Egypt, but the general trend of the results of this investigation, in my opinion, is useful. The aim of this investigation was not to find real costs, but to study the trend of the change of the costs.

Later on, in Egypt, when the necessary data will be available, a modification of the cost results could be made.

CHAPTER I.

THE LAND OF EGYPT.

General Survey.

Egypt, the United Arab Republic, occupies the north-eastern part of the continent of Africa, and is bound by the Mediterranean Sea in the North, Sudan in the south, the Lybian desert in the west and the Red Sea, the Gulf of Aqaba and Palestine in the east (Fig. 1-1).

Egypt is geographically divided into the following four parts:-

1 - The valley of the river and the Delta, or Upper and Lower Egypt, which represent 4 per cent of the total area of the Republic;
2 - The western desert, which represents 68 per cent of the total area of the Republic;
3 - The eastern desert, which represents 22 per cent of the total area of the Republic;
4 - The Sinai peninsula, which represents 6 per cent of the total area of the Republic.

The total area of the republic is 1,002,000 square kilometres, the area excluding the deserts is 35,500 square kilometres with a cultivated part of 24,500 square kilometres (Table 1-1).

The land of the Delta is of high fertility, except its northern parts. Irrigation is completely depending on the Nile water. The 24,500 square kilometres of cultivable

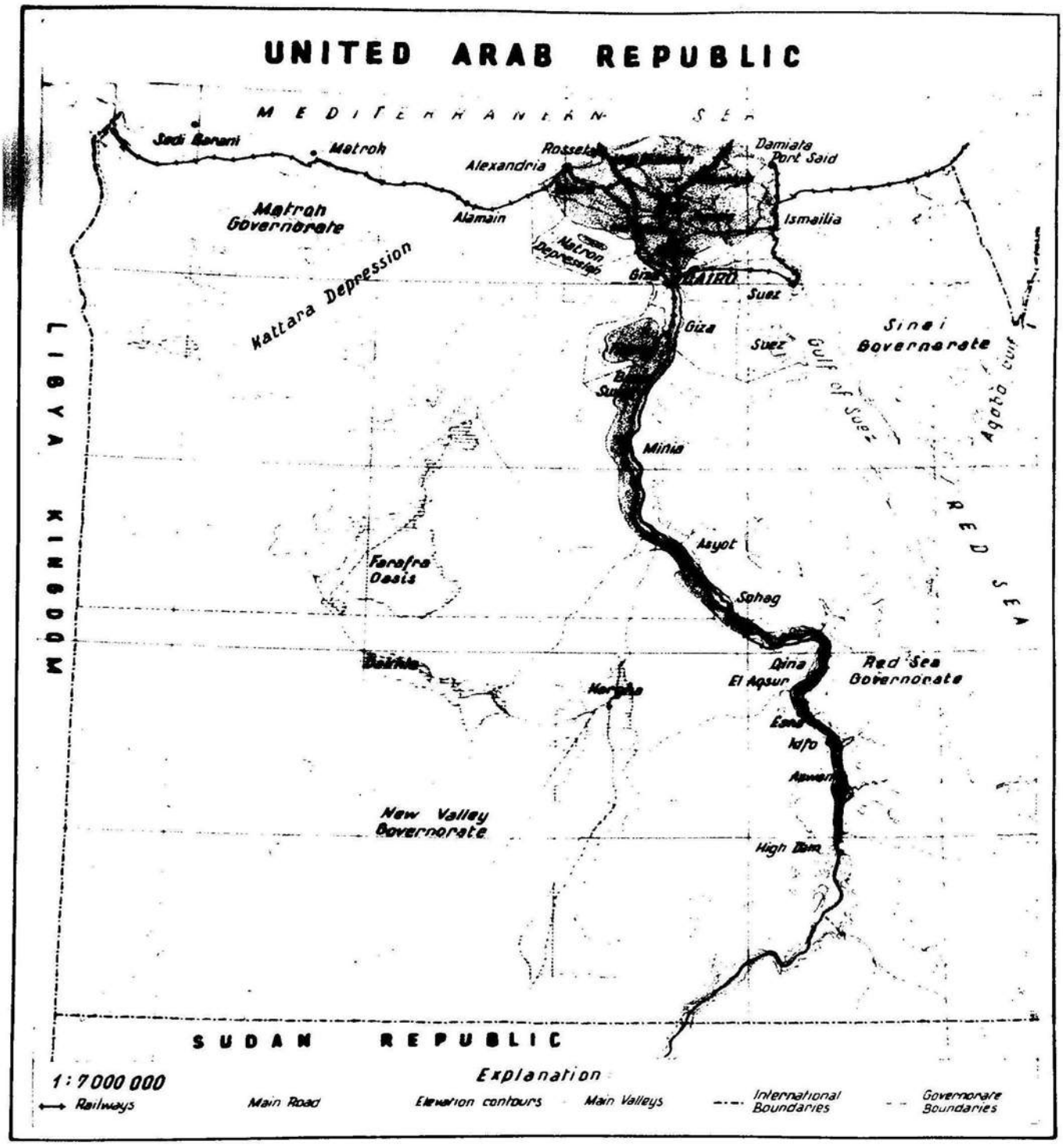


Figure 1-1: MAP OF THE UNITED ARAB REPUBLIC

TABLE 1-1:

GENERAL LAND INFORMATION IN CENSUS YEARS

Area in 1000 square kilometres	Census years 1937	1947	1960
Total area of the Republic	1002	1002	1002
Inhabited area	34,2	34,8	35,5
Cultivated area	22,2	24,3	24,5
Crop area	34,8x)	38,2x)	42,9x)

x) Due to cultivating the land more than one time every year.

area stand in contrast to deserts amounting to 96.5 per cent of the total land surface within the boundaries of the Republic.

The land of the valley is plain. The heights of some principal cities of Egypt above the sea level, taking a longitudinal section of 1o9o kilometres length from north to south, begins with a minimum of 1.5o metre at Damietta, gradually increases to 8.5o metre at Tanta, 34 metre at Cairo, reaches 66.o metre at Assiut, and reaches its maximum of 133 metre at Aswan. Egypt is not mountaneous land, even though there are high mountains existing within its boundaries. The heights of some principal mountains over the sea level are 2637 m and 2285 m for Katrina and Mossa in the Sinai peninsula, 871 m for Etaka at the Red Sea, and 2o5 m for Gebel Mokattam at Cairo.

The deserts are not completely lifeless, some oases are existing where water is found. In the western desert, the principal oases are Dakhla, Kharga, Siwa, Farafra and Baharia. Add to them the valley of Fayum.

Geological Deposits.

The oldest continental materials of Egypt consist of very ancient chrystalline rocks, largely schists, gneiss, and granite.

Some 1oo million years ago, the sea invaded the country from the north. As a result 2oo to 5oo metre of yellowish, reddish or greyish sandstones were laid down horizontally by the sea to the north of Aswan.

Some 55 million years ago, the next important formation was deposited. The rocks are mainly limestones exposed along the valley from south of Luxor to Cairo to heights of 400 metres.

Some 15 million years ago, the triangular area of the Nile appears to have subsided. Since that time Nile sediments competed the Mediterranean waters for possessing the Delta. Today the Delta is located over an average of 11 metres of Nile mud, which in its turn overlies a great depth of Pleistocene sands.

The Eastern Desert commences behind Cairo with a belt of sand, 300 metres depth. Near the edge of the Nile Valley a plateau of limestone is formed. Southwards, Nubian sandstone replaces the limestone. To the east, at the Red Sea, the wild mountains Terrain, Gebel Etaka, is developed of crystalline rocks.

Turning to the Western Desert, in the extreme south there is a sandstone plateau parts of which are of heights exceeding 1000 metres, to the north there is another limestone plateau. Among the characteristics of the surface of the Western Desert is the great fields of mooving sand dunes, oriented by the prevailing north-westerly winds.

Climate.

The climate of Egypt is extremely dry and stable most of the year round. Rainfall decreases steadily from north to south. Alexandria, at the Mediterranean Sea, receives annually 184 mm; while Ghardaka at the Red Sea receives just 3 mm; Damietta at the north-eastern corner

of the Delta receives 1o2 mm; Cairo at the apex of the Delta receives 26 mm; Assiut at the half-way up the Nile Valley receives only 7 mm; and Aswan, at the extreme south of Upper Egypt, receives an amount of 1 mm annually (Table 1-2). These values are quite theoretical, since south of Cairo rainfall comes only once every some years. The northern part of the Delta has about 25 days on which some rain falls, in Cairo this average drops to 12, and at the south to less than 1 day.

Where relative humidity is extremely low in the desert, the proximity of the Nile adds considerable moisture to the air of the Valley and the Delta. As a result of the Nile flood, humidity is higher in autumn, attaining an average of over 8o per cent in the Delta during December. Humidity is lower in May and June, when they average less than 25 per cent in Nubia (Table 1-2). Generally, temperature is pleasantly warm in winter, although almost hot in summer, except for the cooler northern sea-shore. The daily maximum in July and the daily minimum in January can be seen in Table 1-2.

Through the year, the warm daytime temperatures are largely compensated by the fresh northerly breezes. But when these are replaced by the south-westerly winds, extremely hot and dry desert air is brought into the land, this is particularly so during the sandy winds of the Chamasin, the "fifty-days season". At that time the sky is often pale with suspended dust.

TABLE 1-2:

CLIMATE INFORMATION IN EGYPT.

Localities	Average winter Temperature °C		Average summer Temperature °C		Annual average Temperature °C		Relative humidity %	Rainfall (mm)
	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.		
Cairo	19.7	7.6	35.9	21.7	28.7	15.2	66	26
Alexandria	18.5	1o.6	29.6	23.o	25.o	17.3	71	184
Port-Said	18.8	1o.6	31.3	23.2	25.6	17.7	74	79
Damietta	18.1	8.3	3o.5	21.5	24.6	15.8	77	1o2
Suez	19.6	9.4	36.3	22.7	28.8	16.5	64	21
Tanta	19.9	6.3	34.8	19.3	28.3	13.2	74	49
Zagazig	19.8	5.8	34.9	19.6	28.2	13.3	74	28
Giza	19.3	5.5	35.6	19.5	28.3	12.9	68	24
Assiut	2o.18	6.1	37.22	22.4	3o.o	15.3	53	7
Luxor	23.4	5 .4	41.4	22.5	34.2	15.4	47	1
Aswan	23.5	1o.1	41.3	26.4	34.2	19.2	34	1

For most of the Egyptian cities, the main directions of wind is varying from north to north-west direction. At Alexandria mainly the north-westerly direction, at Cairo, Heliopolis station, the wind has the northerly direction, at Assiut the wind is changing between westerly and north-westerly direction.

CHAPTER II.

THE EGYPTIAN POPULATION.

Introduction.

The Egyptian population is steadily increasing. Most of the population is living in the Nile Valley and the Delta where the gross density is about 843 persons per square kilometre. The urban centres are suffering from overgrowing because of the rural-urban immigration. For example in Cairo, the living density reaches 15.640 persons per square kilometre which is considered as one of the highest living densities in the world.

The natural increase of population.

The increase of a population may occur as a result of its natural increase, immigration, or both of them. In Egypt immigration has no influence on the increase of the population, while the natural increase is the cause of it. The natural increase occurs as a result of increasing the birth numbers than the death numbers.

In Egypt, the birth rate is steadily increasing while the death rate is slightly decreasing, which resulted in an increasing natural rate of increase. The number of alive borns in 1950 was 905,000, became 1,114,000 in 1960, reaching 1,242,000 in 1965. There is a close relationship between the number of births of a woman and her standard of education and age of marriage. In general, the higher the standard of education the lesser the number of births (Table 2-1).

The death rate in Egypt is one of the highest death rates in the world, although it is decreasing. While it was from 25 to 28 to each 1000 inhabitants in the years from 1810 to 1930, it became 28.6 to each 1000 inhabitants in the year 1945, reached 19.3 and 15.4 to each 1000 inhabitants in the years 1951 and 1963, respectively. This decrease of the death rate is due to the decrease of the infant mortality rate which was 165 infants to each 1000 alive born infants in 1937, decreased to 108 infants to each 1000 alive born infants in 1961.

The problems resulting from the death of the youth below the age of 15 is not just because of the loss of young persons but because of the losses due to their death before they can work and produce after they had consumed a part of the national income. These losses were estimated to 9.3 million Egyptian Pounds in 1960.

In 1950 the natural increase of population was 516,000 persons, in 1960 it increased to 676,000 persons, and in 1965 reached about 804,000 persons.

The rate of increase.

The Egyptian population was increasing between 1897 and 1937 with an almost constant average rate of 1.3 per cent. Then, as a result of the increasing birth numbers and decreasing death numbers, the rate of increase reached 1.9 per cent between 1937 and 1947, which increased again to reach 2.7 per cent between 1947 and 1960. This means that the rate of increase was doubled during 63 years (Table 2-2).

TABLE 2-1:

AVERAGE ALIVE BORNS OF A WOMAN ACCORDING TO HER AGE OF MARRIAGE AND EDUCATION STANDARD

Education standard	Marriage period in years				
	Less than 5	5-9	1o-19	2o-29	3o and more
Illiterate	1,o9	3,o	5,29	7,o8	7,61
Read and write	1,17	3,41	5,69	7,23	6,86
Elementary school degree	1,33	3,34	4,92	6,14	6,7o
Secondary school degree	1,51	2,92	3,92	4,6o	5,o6
University degree	1,o9	2,62	3,43	3,42	3,5o

TABLE 2-2:

POPULATION AND RATE OF INCREASE IN CENSUS YEARS

Census year	Population (million)	Rate of increase (%)
1882	6,8	-
1897	9,7	2,4
19o7	11,3	1,6
1917	12,8	1,3
1927	14,3	1,2
1937	16,o	1,1
1947	19,o	1,9
196o	26,o	2,7

Population.

The Egyptian population according to 1960 census year was 26,085,000 inhabitants, and it was estimated to be above 30 million inhabitants in 1965.

The number of population was estimated about the year 1800 to be from 2.50 to 3 million inhabitants, and then again was estimated in about the year 1850 to be about 4.75 million inhabitants. The population in the 1882 census year was about 6.8 million inhabitants, and the increased to 9.7 million inhabitants in 1897 census year, with a 2.4% rate of increase. By tracing the Egyptian population from the first census of the year 1882, to the estimation of 1965, we can find that the population increased about 5 times in the year 1965 than that of the 1882 census year (Table 2-2).

The expected population between 1965 and 1980 was estimated. The estimation has two limits, a maximum limit based on the assumption that the rate of fertility of the year 1960 will remain constant till the year 1980, and a minimum limit based on assuming a 50% linear decrease of the fertility rate during 10 years and then remaining constant till 1980 (Table 2-3).

Population and food production.

The importance of studying the population of a nation is to know how far the developing and increasing of the local natural resources will remain in balance with the increase of population. As a result that the population doubled several times from the year 1897 till now,

and the cropped area just increased with a 50% more, the share of the person of the cropped land dropped to the half (Table 2-4).

In spite of the fact that the agricultural production represents one-third of the total national production, and due to the enormous increase of population, the national food production is not enough and we have to import foodstuff which costed 45.8 and 113 million Egyptian Pounds in the years 1960 and 1964, respectively.

Rural and urban population.

The Republic is divided into 25 governorates, out of these the governorates of Cairo, Alexandria, Port Said, Suez and Ismailia are purely urban. The total urban stock of the Republic amounts to 9.8 million inhabitants, and this represents about 38% of the total population, while the rural stock amounts to 16.2 million inhabitants, and this represents about 62% of the total population.

The urban population is steadily increasing not only because of its natural increase but also and mainly because of the rural-urban immigration. This increase is a natural result of the industrialization, better chances of life and education in the urban regions. The percentage of the urban stock to the total population was 21 in 1917 census year, then it became 23 in 1927 census year, increasing to 25 in 1937 census year, then to 31 in 1947 census year, and then to 38 in the 1960 census year.

The cultivated land is 6 million feddans (1 feddan = 4200 m2). The land is cultivated more than one time a year. This means that the cropped area is about 12 million feddans. On the basis of that one feddan gives the living support for one person, the surplus rural population is about 4

TABLE 2-3:

EXPECTED POPULATION TILL 1980.

Year of Estimation	Minimum limit			Maximum limit		
	Male	Female	Total	Male	Female	Total
1965	14919	14326	29245	15259	14618	29877
1970	16225	15453	31678	17729	16730	37459
1975	17383	16447	33830	20592	19149	39341
1980	18687	17550	36237	23826	21861	45687

TABLE 2-4:

INDIVIDUAL SHARE OF CROPPED LAND IN CENSUS YEARS

Census Year	Cropped Area (million feddan)	Population (million)	Individual share
1897	6,8	9,7	0,71
1907	7,6	11,3	0,67
1917	7,7	12,8	0,60
1927	8,7	14,3	0,61
1937	8,4	16,0	0,53
1947	9,2	19,0	0,48
1960	10,2	26,0	0,39

million, which represents 25 per cent of the total rural population.

According to the aforementioned facts, the low standard of living of the Egyptian villages is not only due to their backwardness, but also due to the dependence of the unproductive 25 per cent on the work and production of the others.

Age distribution.

The age distribution is one of the elements giving features to the demographic composition. It is an indicator of the required services and work, also it indicates the labour force of a nation.

Every age group has its own needs and demands, so any change in the age groups distribution may injoin a change in economic, services, and other related fields. For example any increase in children percentage will require a relative demand for schools and teachers, health care, nutrition, consuming materials and so on.

From Table 2-5 we can find out the following):-

1 - 48.7 per cent of the population is within the improductive group out of this 42.7 per cent is the group from 0 to 14 years old. This group is in need of special services and care. The other 61 per cent is the old groups above 60 years old, for whom a special health care and hospitals are in question.

2 - 51.3 per cent of the total population are the productive group, which are the age groups from 15 to 59 years old, who have the ability to work, to produce and to

TABLE 2-5:

POPULATION BY AGE AND SEX

(1960 census year)

AGE GROUP	K i n d			Per cent to the total (%)
	Male (1000)	Female (1000)	Total (1000)	
0 - 4	2111	2021	4132	15,9
5 - 9	1972	1827	3799	14,6
10 - 14	1651	1527	3178	12,2
15 - 19	1114	1040	2154	8,3
20 - 29	1781	1928	3709	14,3
30 - 39	1654	1723	3377	13,1
40 - 49	1228	1191	2419	9,3
50 - 59	817	819	1636	6,3
60 - 69	485	524	1009	3,9
70 - more	255	316	571	2,1
Total:	13068	12916	25984	100,00

beget. Out of this group about 22.5 per cent are females.

3 - About 43 per cent of the population are from 5 to 25 years old and have enormous demands of different levels of education.

Average size of households and percentage distribution of household sizes.

The average size of the household in Egypt is 5 persons. In general, the household size in the urban governorates is smaller than that of the rural governorates.

The percentages of household groups of 1 and 2 persons in the urban governorates are higher than in the rural ones. In general the bigger percentage of the small households is the character of the urban governorates, while the bigger percentage of the big household groups is the character of the rural ones. This may be because the nature of life is different in both of the urban and rural governorates. In the rural governorates, the early marriage is preferable, resulting in a smaller percentage of the signle household, also the big number of children is preferable because they are considered by the father as unpaid workers, also the big number of sons, in the village, is a matter of one's prestige; add to that the low standard of living and education.

Some selected data on the percentage distribution of household sizes in Egypt are given in Table 2-6.

TABLE 2-6:

PERCENTAGE DISTRIBUTION

OF HOUSEHOLD SIZE

(196o census year)

Governorates	1	2	3	4	5	6	7	8	9	1o and more
Cairo	9,7	12,6	13,5	14,3	14,o	12,4	9,7	6,6	3,9	4,3
Alexandria	7,6	12,3	12,7	13,6	13,6	12,5	1o,3	7,3	4,7	5,4
Ismailia	8,4	1o,5	12,o	13,4	13,8	12,6	1o,2	7,4	4,7	7,o
Damietta	7,o	1o,3	12,6	14,3	14,5	13,o	1o,2	6,9	4,3	6,9
Kafr-El-Shaikh	5,8	8,9	1o,9	12,9	13,4	12,7	1o,7	8,2	5,5	11,2
Behera	5,8	9,7	11,9	13,2	13,6	12,8	1o,4	7,7	5,2	9,7
Assiut	5,9	11,3	14,5	16,2	15,4	13,o	9,3	6,2	3,5	4,7
Qina	6,8	12,1	15,1	16,6	15,8	12,6	8,8	5,4	3,o	3,8
Total:	7,7	11,6	13,6	14,6	14,4	12,5	9,5	6,4	4,o	5,7

CHAPTER III.

TOWN PLANNING AND HOUSING IN EGYPT

Town Planning

The Egyptian towns are now passing through a critical period of their lives. They are exposed to great developing movement, to which the European towns had been exposed following the industrial revolution.

The Egyptian towns used to grow haphazardly without any plan, along with communication routes, railways, canals, and the like, preferring the northward direction. This resulted in an undetermined shape, which is divided with canals, main routes, railways, etc., and that represents a great planning problem.

Most of the towns, because of their locations, used to expand on the agricultural land, which was mainly used for vegetables and food production. This causes many problems to both food production and the towns themselves. For the future expansion of towns it was estimated that about 11,300 feddans (1 feddan = 4,200 m2) are needed. The problem then is to direct the horizontal town growth towards the unproductive land of towards the desert if it is possible.

The way of growth of towns reflects their land use. In general land use in towns reached a very high degree of mixation, which isone of the problems existing in the Egyptian towns. Shops stretch as long as main roads or

even residential streets stretch. Residential areas, which are divided with main traffic routes, represent a very big part of the towns. Public and administrative buildings are everywhere. Offices, to a great extent, are occupying residential flats. Open green spaces and child play-fields are very few and in some places they vanish completely. Old industrial buildings are not in proper place in relation to residential estates and traffic routes. The central area of a town which used to be a centre for commercial, cultural, entertainment, and other activities is still a missing element in the Egyptian town with very few exceptions. The elements composing a town centre are scuttering here and there, residential buildings still can find for them a place in the town centres.

While the towns occupy a relatively big area of land, the intensity of buildings is very small, which is due to the low rise of most buildings. This can be seen through the floor space index. For example in the town of Banha the percentage distribution of buildings with heights of one, two, three, four, and more than four were 57, 30.75, 10.25, 1.75, and 0.25, respectively. This means that the floor space index in Banha is about 1.57.

The town of Banha could be considered as an example of the Egyptian towns. As a result, expansion of the Egyptian town must not be directed horizontally to increase its ground area, but it must be directed vertically to make use of its existing ground area, and to avoid any encroaching on the agricultural land. In other words, the aim must not be in building new settlements on virgin land, but in urban renewal and rebuilding of towns.

Housing.

The part occupied by housing in the Egyptian town represents about 6o per cent of the total area of the town. This part is greatly influenced, in density, volume, and area, by the residential unit, which in its term is influenced by the following:

a) Privacy.

Prifacy here is not just privacy against overlooking from outside, or against noise, smell, etc., but it is also privacy within the dwelling. It determines the location of the living room. It is not preferable that strangers go through the dwelling to reach the living room. So this part of the dwelling, with any thing related to it, must be the nearest to the entrance, with a possibility to be separated by doors, or curtains, from the rest of the dwelling.

b) Size of Household.

In general, the average size of the household in Egypt is 5 persons. The percentage of households with 5 and more persons is 52.5. This means that 52.5 per cent of the households need dwellings with 3 or more rooms.

c) Way of living.

The Egyptian family is living in intimacy. The life in its main part is at home. So a big living room and a big balcony are needed. Most of the housewives are washing and ironing at home. So in designing both of the bathroom and the kitchen, enough working space must be given to them. A small balcony, which is mainly

joined to the bathroom or the kitchen, is in request to be used for drying of clothes and also for storing.

d) Climate and Orientation.

Both climate and orientation influence the design of the dwellings. Because of the relatively hot weather, smaller southward openings and bigger northward ones are preferable. Big areas of glass and long external walls are not desirable. From the fact that prevailing wind blows mainly from the north-west direc tion, the main orientation is towards the north or the north-west. In the leeward part of the dwelling is the living room and the balcony. For the dwelling cross ventiallation is desirable with its benefits of riculating the air in the dwelling. If a cross ventillation is not possible, then the possibility must be made for corner ventillation. Mainly just one side orientation is not agreeable.

e) Building Laws.

The building laws play a big role in affecting the design. For example, mechanical ventillation and ducts are prohibited in residential buildings. This means that all of the components of the dwelling, except corridoor and entrance, must have direct natural ventillation. Also there are some restrictions related to the use of lifts and staircases. Some other restrictions are on the permissible heights of buildings and their relation to the width of the streets.

Housing is divided into three categories according to rent. These categories are low rental, moderate renkal, and high rental housing. The difference between them is

in area and finishing. In the seven years programme (1965/1972) the percentage of each was 66.7, 31.3, and 2.0, respectively (Table 3-1). In comparing with the five years programme (1960/1965) the low rental housing takes priority and its percentage rises at the expence of the high rental housing.

Many housing projects were carried on during the last fifteen years. These projects were built on free land spots in differen towns. The biggest projects were the re-building of Port Said after it was damaged during the 1956 aggression, and the quick housing project of 1965-1966 which was carried on within 100 days.

TABLE 3-1:

HOUSING PROGRAMME IN EGYPT.

SECTOR	Five Year Plan (1960/1965) Investments £.1000	Units	%	Seven Year Plan (1965/1970) Investments £.1000	Units	%
Low Rental Housing	39550	113000	59,6	89625	200200	66,7
Moderate Rental Housing	45200	56500	29,8	103065	94000	31,3
High Rental Housing	28250	19775	10,6	14310	5800	2,0
Total of Urban Housing	113000	189275	100,0	207000	300000	100,0
Rural Housing	27000	135000	-	63000	600000	-
TOTAL x)	140600	324275	-	270000	900000	-

x) Excluding Land Costs.

£.Eg. = 00 Ft. 72.-

CHAPTER IV.

THE PROBLEM OF HOUSING IN EGYPT, ITS CAUSE AND SOLUTIONS.

The Problem.

The problem of housing appears in both of urban and rural housing, but it differs in its degree and causes. Stressing on the urban housing, the problem may appear in the following:-

1 - **The overcrowding which appears in high density and occupancy rates.**

The overcrowding in a living estate is mainly associated with lack of ventillation and sunshine, and low standard of living and individual income. It was noticed that the death rate ie high in the overcrowded areas as a result of the outbreak of diseases in such suitable circumstances. A lack of children play-grounds is always one of the characteristics of the overcrowded areas, as a result of that a high rate of crime and vagabondry are found.

The causes of overcrowding in urban estates are numberous, but they may be summarized in the following:-

a) Concentration of work place and other important human needs in a certain place;
b) Lack of comfortable means of communication and street networks;
c) Shortage of housing which enforces the families to share one residential unit;
d) High rents of the new residential units which are not rationalized with the limited income of most of the families;

e) High rate of rural-urban immigration especially to large cities.

Overcrowding takes many forms, it may be in a country as a whole, or in a certain part of a country, or in a particular city, or in a certain district of a city. Taking the whole Republic as one unit, we find that while the total area of the Republic is 1,002,000 Km2, only 35,500 km2 are inhabited at an overall gross density of 7.3 persons per hectare; this density reaches 236 persons per hectare excluding the cultivated area which amounts to 24,500 km2, from the inhabited area. These densities are one of the highest densities in the world.

Another form of the overcrowding is the imbalanced distribution of the population within the inhabited area of the Republic. Out of the total popul tion 26.2 per cent live in just 13 large towns out of the 13.5 per cent in Cairo, 1o.8 per cent in other smaller urban centres, while 61.8 per cent live in 4o44 villages, and the remaining 1.2 per cent is scuttered in other places.

The first indicator of overcrowding is the high densities. For a town like Tanta, the gross density, in 196o census year, was 146 persons per hectare, and for Cairo it was 156 persons per hectare. If we take Cairo as a more detailed example of the study, we can find that the densities in some districts, especially the old ones, reach an abnormal value. For example in the districts of Ban-El-Shairia, Abdin, Boulaqu and Saida-Zenab the densities in 196o census year were 1392, 558, 748, and 724 persons per hectare, respectively. On the opposite of that, we can find that in the districts of Helwan, Kasr-El-Nil, Masr-El-Gedida and Maadi, the densities were 147, 72, 38, and

33 persons per hectare, respectively. This indicates an imbalance in the distribution of population within the same town, and the overcrowding of population in some districts.

The second indicator of overcrowding is the occupancy rate. In 1960 census year, its average in El-Gharbia governorate was 1.8 and its capital Tanta 2.1, while the average of the Republic was 1.9. Taking Cairo as an example, the average occupancy rate for the governorate as a whole was 2.1, while in Bab-El-Shairia, Abdin, Boulaque and Saida-Zenab districts it was 2.7, 1.9, 3.1, and 2.3, respectively.

The depth of the problem of overcrowding of existing housing could be seen from the following:

a) 40000 inhabitants are living in 4000 rooms at an average of 10 persons per room;
b) 45000 inhabitants are living in 5000 rooms at an average of 9 persons per room;
c) 104000 inhabitants are living in 13000 rooms at an average of 8 persons per room;
d) 139300 inhabitants are living in 19900 rooms at an average of 7 persons per room;
e) 364200 inhabitants are living in 60700 rooms at an average of 6 persons per room;
f) 542500 inhabitants are living in 108700 rooms at an average of 5 persons per room.

The upper figures can be stressed by the sample census made by the central committee of statistics about the existing urban residential buildings in 1960. From Tables 4-1, 4-2, and 4-3 we can find the following:-

a) The overcrowding in bedrooms reached a very high value;

TABLE 4-1:

DISTRIBUTION OF URBAN RESIDENTIAL UNITS ACCORDING TO NUMBER OF BEDROOMS AND NUMBER OF PERSONS PER RESIDENTIAL UNIT.

Number of Bedrooms per Residential Unit	Number of Persons per Residential Unit							TOTAL
	1	2	3	4	5	6	7	
1 Bedroom	1252	1664	152o	15o3	1385	1o37	1527	9888
%	12,7	16,8	15,4	14,o	1o,5	15,4	15,4	1oo,o
2 Bedrooms	214	826	1249	1761	2o63	2o39	5534	13685
%	1,6	6,o	9,1	12,9	15,1	14,9	4o,4	1oo,o
3 Bedrooms	25	71	153	224	359	49o	3113	4435
%	o,6	1,6	3,4	5,1	8,1	11,o	7o,2	1oo,o
4 Bedrooms	7	7	8	32	33	64	1164	1315
%	o,5	o,5	o,6	2,4	2,5	4,9	88,6	1oo,o
5 Bedrooms and more	-	1	4	5	11	9	492	522
%	-	o,2	o,8	1,o	2,1	1,7	94,2	1oo,o
Not indicated	-	-	-	-	-	-	27	27
Total	1498	2569	2934	3525	3851	3639	11857	29873
%	5,o	8,6	9,8	11,8	12,9	12,2	39,7	1oo,o

TABLE 4-2:

AVERAGE NUMBER OF PERSONS PER BEDROOM IN URBAN HOUSING

	Average Number per Bedroom
The Republic	3,0
Cairo Governorate	3,0
Alexandria Governorate	2,6
Lower Egypt Governorates	3,1
Upper Egypt Governorates	2,9

TABLE 4-3:

DISTRIBUTION OF URBAN RESIDENTIAL UNITS ACCORDING TO NUMBER OF ROOMS AND NUMBER OF FAMILIES IN EACH

Number of Families	Number of Rooms per Residential Unit							Total	%
	1	2	3	4	5	6	7 and more		
One family	1646	3549	5433	5554	3002	1068	707	20959	70,2
%	7,9	16,9	25,9	26,5	14,3	5,1	3,4	100	
Two families	9	595	991	1115	612	280	255	3857	12,9
%	0,2	15,4	25,7	28,9	15,9	7,3	6,6	100	
Three families	-	8	274	423	262	128	127	1222	4,1
%	-	0,7	22,4	34,6	21,4	10,5	10,4	100	
Four families and more	-	2	7	130	180	101	132	552	1,8
%	-	0,4	1,3	23,5	32,6	18,3	23,9	100	
Single	637	230	767	625	288	135	101	3283	11,0
%	19,4	22,2	23,4	19,0	8,8	4,1	3,1	100	
Total	2292	4884	7472	7847	4344	1712	1322	29873	100,0
%	7,7	16,4	25,0	26,3	14,5	5,7	4,4	100	

b) 55.1 per cent of the residential units which contain one bedroom are inhabited with four persons or more (Table 4-1)
c) 40.4 per cent of the residential units which contain two bedrooms are inhabited with seven persons or more (Table 4-1)
d) The average number of persons per bedroom is three persons (Table 4-2)
e) The percentage of the families sharing the same residential unit amounts to 18.8 per cent of the total number of families (Table 4-3).

In the village, the problem of overcrowding takes another form. The location of the Egyptian village, which is surrounded with agricultural land, affects its growth and directs its expansion insidewards, resulting a very dense areas with a residential part amounting to about 80 per cent, while the remaining 20 per cent is divided between public buildings, shops, streets and other non-residential uses. In general, the gross density of the Egyptian village varies around the number of 500 persons per hectare.

Although the average theoretical occupancy rate in the village is about 2, that is to say 2 persons per room of residential unit, we find that the actual occupancy rate is far more high because just one room of the house is used as a sleeping room for the whole family. Knowing that the average size of a rural household is about 5.3, we can say that the average occupancy rate is 5 persons per room.

2 - Bad conditions of existing housing.

The family, the basic unit of the society, is affected by the residential unit containing it. It was found that substituting a good conditioned residential unit for a bad conditioned one to a family resulted in the following:

a) 15% reduction in death rate;
b) 45% reduction in Tuberculosis infection;
c) 31% reduction in child diseases;
d) 21% reduction in juvenile delinquency;
e) 74% reduction in fire accidents;
f)100% reduction in collapse of houses.

The first indicator of the bad conditions of existing residential housing is that about 25.8 per cent of the residential units are dated before the year 1919. The problem will be clear if we know that the overcrowding and lack of utilities are also associated with the bad conditions of the building. The volume of the problem will appear if we know that the number of these residential units amounts to about 400 000 units and are inhabited with about 3 million, that represent about one-third of the total urban population (Table 4-4).

The second indicator of the bad conditions of housing is the intensity of building. From Table 4-5 we find that 51 per cent of the total housing were built on more than 80 per cent of its ground area, leaving very little area for ventillation and sunshine. Also from that figure we can detect how poor are these residential estates of the open spaces and especially the green ones.

TABLE 4-4:

PERCENTAGE DISTRIBUTION OF URBAN HOUSING ACCORDING TO YEAR OF BUILDING ITS OLDEST PART

YEARS	The Republic	Cairo Governorate	Alexandria Governorate	Lower Egypt	Upper Egypt
Before 1900	12,8	13,2	15,1	11,8	12,9
1900 - 1919	13,0	9,8	10,2	11,7	16,5
1920 - 1939	31,7	28,5	29,2	30,1	25,5
1940 - 1952	25,0	26,6	23,9	26,7	22,9
1953 - 1955	7,5	8,6	8,7	8,7	5,5
1956 - 1959	8,1	9,4	11,1	9,1	5,8
Not indicated	1,9	3,9	1,8	1,9	0,9
Total	100,0	100,0	100,0	100,0	100,0

TABLE 4-5:

PERCENTAGE DISTRIBUTION OF URBAN RESIDENTIAL BUILDINGS ACCORDING TO PERCENTAGE OF GROUND FLOOR TO THE TOTAL AREA

Percentage of Ground Floor to the Total Area				
Less than 60%	60%-78%	80%-99%	100%	TOTAL
27,0	22,0	14,8	36,2	100,0

Turning to the village, with very few exceptions, the rural housing is congested drafty, dark mud huts cramped to avoid encroaching on the agricultural land. It is possible to say that the houses seem to be natural vertical continuation of the earth.

The following data were some of the results of research work made by the Ministry of Housing on the Egyptian villages. First the building materials of walls were as follows: 88 per cent mud bricks, 9 per cent red bricks, and 3 per cent other materials. Second, the roofing materials were: 0.6 per cent without roofing, 3.6 per cent palm tree wood, 7.5 per cent wooden beams, and 88.3 per cent branches of trees covered with mud. Third, all of the houses were without flooring materials and in general it was natural earth.

3 - Shortage of Public Utilities.

Although the government gives the greatest importance to utilize the housing estates, we can find that 54.4 per cent of the urban housing is not fitted with any kind of public utilities. The percentages of the unutilized houses are 29.3 per cent in Cairo, dropping to 14.2 per cent in Alexandria, but increasing to 60.2 per cent in Lower Egypt, reaching 73.3 in Upper Egypt.

Turning to the village, the lack of public utilities is the rule, there is no drainage network, very few villages are supplied with electricity, a very small percentage of the houses are supplied with drinking water, in general they get water from wells or

canals or public taps. In 1952, the percentage of persons getting use of public taps was 15 per cent, and it reached 8o per cent in 196o.

4 - Disproportion between Rent and Individual Income.

The disproportion between rent and individual income is one of the features of the problem of existin housing. Although there is rent control, the rent of an urban residential unit may vary between 2o per cent to more than 5o per cent of the earnings of a family.

B. THE CAUSES OF THE PROBLEM.

The causes of the problem of housing can be summarized as follows:

1 - Steadily increasing population and big sizes of households.

The increase of the population in the urban centres is due to their natural increase and rural-urban immigration.

The estimated number of residential units which are required in the urban centres, to cope with the natural increase of the population, are as follows:

a) 185oo residential units in Cairo;
b) 985o residential units in Alexandria;

c) 1190o residential units in big urban centres with population more than 1oo ooo;

d) 46oo residential units in other smaller urban centres.

This means that a 44.85o yearly residential units are in request.

The big sizes of the households participate with the steadily increasing population to cause the problem of housing in Egypt. The percentage of households with 5 and more persons is 52.5 of the total households, for which, on the base of 2 persons per room, residential units of 3 rooms and more and needed. This means that there is need not only for large numbers of residential units but also for big ones, which means that more costs and building materials are needed to construct lesser number of residential units than if the sizes of the households were smaller.

2 - The enormous immigration to large cities.

The rural-urban immigration has many reasons, it may be as a result of the concentration of most the industries in these cities, or it may be for searching for better life or for education. Anyhow, whatever is the reason of the immigration, it always results in more problems to the cities and especially to the housing stock. The resulting problem is not only the increased demand for more residential units, but also the overcrowding, especially in the poor districts of the cities.

3 - Industrialisation and improved standard of living.

The great industrialisation movement in the Republic increased the demand for housing. As new factories were build, generally in remote places, the demand for building more houses increased to that as a result of improving standard of living a great demand for better and bigger housing areas.

4 - Shortage and high costs of building materials.

The shortage of building materials here means that the quantities of building materials directed to housing projects are few. In the Republic, as a result of the great stress on big construction projects, the priority of providing with the essential building materials is given to these projects, remaining few quantities for housing.

5 - Using the residential units for other purposes.

Using the residential units for other purposes participates in the existence of the problem of housing. For example, in Cairo, out of the total residential units in the governorate 23.5 per cent is sued for other purposes and 0.2 per cent is mixedly used between residential and other purposes (Table 4-6).

In the Republic 2 per cent of the newly established residential units areused for other purposes, this percentage reaches 2.9 in Cairo. That is a result of the concentration of governmental offices in it, associated with lack of office buildings. In Cairo, according to the building census of 1964, there are 2314 residential units occupied by governmental staff.

TABLE 4-6:

PERCENTAGE DISTRIBUTION OF THE NEWLY ESTABLISHED RESIDENTIAL UNITS ACCORDING TO EXISTING USE.

Kind of Use	The Republic	Cairo Governorate	Alexandria Governorate	Lower Egypt	Upper Egypt
Residential	98,o	97,1	99,o	98,o	98,9
Office	1,8	2,6	1,o	1,8	1,1
Mixed	o,2	o,3	o,o	o,2	o,o
Total	loo,o	loo,o	loo,o	loo,o	looo

6 - The Second World War

During World War II the construction of new houses to cope with the increase of population and the replacing of old houses were stopped. The shortage of housing during that period was estimated to be 126,000 units which to give residential accommodation for about 126,000 families or about 630,000 persons.

C. THE PROPOSED SOLUTIONS OF THE PROBLEM.

At the root of all, the problem of urban housing can be reduced if the increase of population is limited, a goal which can be attained by birth control. The proposed solutions of the problem can be divided into basic and subsidiary solutions, but both of them have the importance in solving the problem.

The basic solutions are as follows:

1 - A suitable housing programme.

A suitable housing programme with the aim of covering existing and expected future demand of housing is of vital importance. The programme must not be entirely dependent on governmental investments but also on private and semi-private investments. The aim must be to encourage the private sector to undertake its part in the housing programme. The part, to be undertaken by the private sector, must be of basic importance in the programme. It seems to be reasonable that the more expensive units should be undertaken by the private sector to save the governmental investments for the low rental housing.

The aim of the governmental investments on housing must be to build the largest number of units with the lowest costs. On that base, the greatest share of the investments must be given to build low rental housing. The difference between building low or high rental housing is appreciated if, in the seven year programme of housing, a low rental unit is to cost for the government 450 Egyptian Pounds, while a high rental one is to cost about 2300 Egyptian Pounds, an amount equal to about 5 low rental units. Some data on the seven years plan of housing in Egypt are given in Tables 3-1 and 4-7.

2 - Limitation of immigration to congested areas.

The aim of the limitation is to prevent population congestion in certain places, that would otherwise create social and economic diseases to these places added to their housing problem. The prevention of immigration should not be attained by prohibiting the people from travelling and settling, but by avoiding the causes of immigration to or from certain places. After that if immigration will be needed, then it should be directed to places where labour forces is required.

Mainly the problem of immigration is to be solved by attaining two main principles. The first principle is based on the decentralization of magnets. For example, 75.5 per cent of the industrial establishments are in Cairo, Alexandria and Aswan governorates. Besides the big educational establishments, health centres and the like are also found there. Add to that the better life

and the glare of these centres alltogether create population congestion in them. The idea is to relieve these centres by transmitting some of these magnets to other places where it is needed or at least not to develop any other big establishments in the congested centres. The second principle is based on improving the l living possibilities in the places from which immigration happens, to a degree which makes immigration not needed. This will be possible by providing good work possibilities to every one, at the same time to make each place integrated with its services, educational and health establishments, entertainment, local industries, and the like.

3 - Developing the systems of construction.

To carry out a successful housing programme there must be an efficient building materials industries and the skilled group who will undertake the programme. So the aim must be directed towards the developing of the building materials industries, increasing its capacity and productivity and keeping its costs within a reasonable limit.

The developing of the building materials industries must be associated with the searching for new building materials to replace those which became oft of fashion or not available in sufficient quantities. It is also important to avoid the need to use a certain building material which is not available in enough quantities, that is to prevent any disturbance to the building programme and also to prevent the rise of its price.

The subsidiary solutions may be summarized in rent control, improving the transportation network, providing the existing housing with public utilities, giving importance to repairs and maintenance of existing housing, and not to use the residential buildings for other non-residential purposes.

TABLE 4-7:

THE SEVEN YEARS PROGRAMME OF HOUSING IN EGYPT

SECTOR	PUBLIC Investment £ 1000	%	PRIVATE Investment £ 1000	%	TOTAL Investment £ 1000	%
Low Rental Housing	5415.0	6.0,4	35475	39,6	89625	100,0
Moderate Rental Housing	5.29.0	48,8	52775	51,2	103.65	100,0
High Rental Housing	156.0	10,9	1275.0	89,1	1431.0	100,0
Total	106000	51,2	101000	48,8	207000	100,0

CHAPTER V.

THE CONSTRUCTION INDUSTRY.

Introduction.

The aim of this chapter is to throw some light on the construction industry and its economic significance. The different sides of the subject were studied in general, with some stress on the special circumstances in Egypt in particular.

The nature of the construction industry.

The products of the construction industry are vital to the well-being of our lives, as well as for the economy of nations. For example, we live in houses and flats, we work and produce in offices, factories, and shops, and we use streets, schools and cinemas.

The nature of the construction industry is different from the nature of industry in general. The production of the construction industry mainly takes place at the site where the product is to be used; men and machines, if needed, are to be shifted from factory production to site production even if a part of the work takes place in factories but its final assembly must be on the site. The products of the construction industry are mainly bulky and heavy, they are durable, fixed to a certain location, and difficult and expensive to move or demolish.

The demand for the construction industry.

There is a considerable demand for the constructional output. This springs from the government developing programmes, which increases the demand for streets, office buildings, factories, hospitals, and the like, contributed with the ever increasing demand for housing. These needs arise as a result of the increase of population and the rise of the economic standard of the people, add to that the need for replacing of the outdated and life ended existing stock.

The increasing demand for the constructional work should increase the output of the building materials industry. If the building materials industry be overloaded, this will cause delay and discontinuities to the construction programmes. Also this is likely to raise the costs of both the building materials and the constructional products.

Working under such conditions, it will be important to increase the productivity of the construction industry by improving its technology, developing its building materials, finding new methods of construction, and organisation of works. On the other hand, better organization for demand would bring the benefits of more continuous use of the resources of the construction industry and would help it to develop its building techniques.

The demand for housing.

Housing represents the biggest single demand for the constructional works. If demand exceeds supply certain problems will arise. These are archi- characterized by higher prices of housing accommodation, more intensive use of existing housing, and a need to reduce the rate of replacements or not to replace at all any house whose life has ended. This point was studied in detail in Chapter IV.

The demand to build houses may increase as a result of the following:

a) Increase of the number of families seeking housing accommodation. This may be due to an increase in population as a result of natural increase or immigration, or due to an increased number of new marriage than previously.

b) Change in the type of houses being demanded. For example, an increase in the income of the size of families may result in an increased demand for better and bigger houses.

c) Allocating remote locations for certain productive developments, such as factories and mines, will demand housing for the workers.

d) Further factors, such as an increased availability of funds borrowed to purchase or build a house, a mass destruction of houses due to fire or flood, and changes in persons' preferences regarding housing accommodation also increase the demand for houses.

In developing countries, and also in Egypt, although the demand for housing is striking, it relatively takes low priority. The most important reasons for the low priority housing is that it calls for a large input and yield a little output, it consumes materials and funds needed for ether productive developments. Moreover, in competition with industry and agriculture investments on housing do not generate foreigh changes.

The economic significance of the construction industry.

The importance of the construction industry in the total economy of a nation can be seen through the total expenditure on building and civil engineering works, labour employed, and the ratio of the output of the construction industry to the gross output of sections of economy.

In Egypt, the investments on housing represent 8 per cent of the total investments on other sectors of economy. While the contribution of the construction industry in the national income was estimated to be 1o per cent. Housing represents the largest sector of the construction industry. The value of its output represents 46 per cent of the total value of the outputs of the construction industry.

In Egypt workers employed form 5.5. per cent of the total labour force, and 6.e3 per cent of the salaried employees. Also the number of establishments engaged with construction industry represents 6.3o per cent of the total number of establishments.

A considerable amount of labour is also included in the building materials and components delivered by other industries to the construction industry. In the U.S.A. for exapmple, one out of every ten of jobs are directly or indirectly related to construction industry. Also in Norway each working hour on the building site requires about one working hour in the other sectors of economy delivering goods or services to the construction industry. It is obvious that construction industry has a considerable bearing on other number of industries, services, and professions.

It is a fact that the construction industry had the ability to absorb employments especially during periods of depression.

Housing conditions affect the residents' social, economical and hygienic conditions. It is also indirectly affecting economy in that unless the workers are sheltered the industrial process and the productivity will be harmed or stopped. Houses can also effect economy in that they are a small productive centres of activity for tailors, shoemakers, and storekeepers.

The influence of the government on the construction industry.

The government in its economic activity greatly influences the amount, kind and location of the constructional works. It directs the way of spending money on a certain development, also in spending and saving of money by individuals and companies. It also controls the kind of development which is permitted to absorb investments.

The largest part of the construction industry is directly or indirectly for the government. Even when the constructional work is not on government account, it, for example, influences the determination of the number of dwellings contructed, and the amount of capital to be invested on it (Tables 3-1 and 4-8).

In brief, governments tend to affect the construction industry in a number of ways, they are the direct investors in a great deal of the construction industry, they affect the amount of building by their financial policy, they lay down for example standards regarding fire resistance, ventillation, and orientation, and they influence construction through direct physical controls by issue of permits.

Generally governments may reduce the amount of constructional works either because they are short of funds with which to finance them, or because they wish to limit the amount of national resources being used on construction. Also, the amount of constructional works may be increased by governments either because they require more buildings and works to meet policy, or because they wish to stimulate the economy.

CHAPTER VI.

SYSTEMS OF CONSTRUCTION AND THEIR CONTRIBUTION IN BUILDING ECONOMY

Introduction.

The efficiency of construction industry and hence the cost of building depends upon the following main factors:

a) The clients. They may be putlic authorities or individual bodies. Their contribution lies in specifying their needs and in assessing the value of solutions put forward to them.

b) The designers. Their contribution lies in meeting the specified needs offered to them with a solution economic to construct and to operate. Designers have the largest influence on building costs. They determine the overall building, its shape and area, the materials to be used in construction, and the method of construction.

c) The contractors. Their contribution lies in their efficiency of undertaking the constructional work, their speed of operating, and their proper programming of construction.

d) The producers of building materials and building components. Their contribution lies in cheapening their products, improving their qualities, and distributing them.

The system of constructing a building greatly influences its final costs. It determines the duration of the building process, the consumption of building materials and fuel, and the cost of labour required to carry out the constructional work.

Some systems of construction are more labour consuming than others, and some are more labour saving than others. Systems of construction may be classified as follows:

A. TRADITIONAL SYSTEM OF CONSTRUCTION.

Traditional system of construction is a labour consuming system. It mainly depends on physical power and local building materials such as natural stones, mud blocks, bricks, and wood, beside cement and steel. Generally, while traditional building materials are cheap in themselves they are bulky and heavy and so they are costly to transport, they result in heavier buildings (500 kg/m3) and more costly foundations and other structural elements. As they are variable in shape and size, they are more expensive to be adjusted together. The efficiency of the traditional system of construction is greatly affected by the day-to-day climate conditions. In cohd countries it is difficult to build in certain seasons and the cost of drying up the building represents high overheads on its overall costs. This system of construction is not economic where cost of site labour is high or where there is shortage of labour, while it is more economic in itself where site labour is cheap or where there is high number of unemployment.

When the output of the traditional system of construction cannot supply the demand for its products, and because the traditional system of construction needs long durations, developing the traditional system of construct on is important. The development can be approached either by innovation of the traditional system of construction or by industrialisation of the construction process.

Innovation of the traditional system of construction aims towardsincreasing its efficiency, productivity and quality of products. Site organisation and programming will direct the flow of work on the site with the aim of avoiding any delays in the flow of work and hence will increase the productivity. Developing of the traditional building materials can be achieved through increasing their quality, reducing their own weight and bulk or by developing new materials. The developing of new materials is actuated by the shortage of traditional materials or the specialised labour, or by the hope that the new material will be more efficient or cheaper. The standardization of building materials and components is another way of innovation. Standardisation of building materials and components implies modular co-ordination. Modular co-ordination leads to a common dimension large enough to facilitate the fitting of building materials and components without waste, cutting, or packing to adjust levels. Modular co-ordination, in its right form, should result not only in standardisation of building materials and components but also in standardization of building fittings and furniture. The acceptance of standards, such as floor to floor or floor to ceiling, makes it possible to produce, for example, standard staircases and wall units which can

be corporated in a large range of designs based on these standards. Also introducing pre-cast lintels and roof elements to the traditional building operation may help to simplify and avoid a break in the continuity of the structural process.

B. INDUSTRIALIZED SYSTEM OF CONSTRUCTION.

Industrialization of buildings must be based on broad financial basis, beside progress in fields of building economy, technology, and modular co-ordination. Industrialization of buildings aims to increase productivity. The trend to increase porductivity can be characterized by a shift frm manual work to machine work, from work on the site to work in factories, and from piece production to mass production.

It is obvious that great efforts must be made towards a significant increase in building output to stand with the ever increasing demand for housing, to cut down its problem, and to face the requirements of maintenance and replacement. So the purpose of industrialization of buildings is to produce more in a shorter time, with a reduction or at least without any increase in costs of building.

An industrialized system of construction can be achieved partly by replacing in-situ work by prefabricated elements, partly by mechanization of construction, and partly by programming of construction and site organization.

Prefabrication system of construction.

Non-traditional methods have been introduced when the demand exceeded the supply which the traditional industry could provide. Prefabrication systems of construction is important not only for its ability of mass production of buildings that helps to meet the demand for housing, but also because it is economical in using building materials, shortening of construction time, its independence of seasonal conditions, and its relative fixed price. As the prefabricated elements are lighter than the traditional elements which they replace, the total weight of building is reduced (150 - 200 kg/m3). This will be appreciated in cheaper transportation cost, savings in the costs of foundations and other structural elements, and savings in building materials and fuel.

This system of construction results in more accurate products. It avoids the disadvantages of the traditional system of construction which may appear in failure of some constructional elements, ungranted assembly time, and unfitted fittings due to inaccurate wall dimensions.

Using prefabricated systems of construction will result in shortenint the building time. Its rate of construction is faster than that of the traditional one, resulting in that the number of dwelling which can be built by the prefabrication system are more than the number which can be built by the traditional system during a certain time.

In comparing with the traditional system of construction the use of the prefabrication system of construction will result in reducing the demand for unskilled labour, on the other hand it will increase the demand for skilled labour. It is obvious that up to a certain limit, as the size or weight of building element increases the manpower decreases and mechanical plants are needed.

Prefabrication system of construction has not only decreased the demand for unskilled labour, but also it has decreased the demand for a certain skilled labour. For example the use of prefabricated wall panels will reduce the need for a skilled bricklayer. Also the use of plastered wall panels, and the use of prefabricated joinery and metal fittings will reduce the need for ksilled plasterers and joiners.

The substitution of unskilled site labour for skilled site labour, and site labour for factory labour, will depend on the relation between cost and output of labour of different kinds. For example, if the wages of the unskilled labour are much more lesser than that of the skilled labour, then a substitution of unskilled for skilled labour is worthwhile unless the output of the unskilled is lower than that of the skilled ones.

The prefabrication of building elements demands high dimensional accurancy, resulting from that improvement of traditional materials and searching for new materials capable of being processed by machines will be in question. If in order to that more expensive

materials are to be used, it is likely that the prefabrication system of construction will cost a good deal more than the traditional system.

Prefabrication of building elements is only reasonable if larbe number of similar building units are required. Mass building with many repretitions of similar units or tall buildings with identical floors tend to lend themselves to repeated prefabricated units. Clearly, unless there is a large amount of repetition it is unlikely to carry out prefabrication building programme.

Diseconomies tend to arise if the resulting product is more dificult to transport to the site than the raw materials from which it is made. Also if extra strength is to be added to the element in order to stand the stresses of the journey to the site.

A rapid development of prefabrication system of construction entails not only advantages but also difficulties and disadvantages arising from:-

a) Undesirable monotony and uniformity may happen as a result of mass construction of identical buildings;

b) The establishing of functioning building elements industry will need great investments of money for the construction of fabrics for the building elements, the special machines, cranes and cars, and also to cover the expenses of the experimental works;

c) It is difficult to determine in advance how would the new materials and products stand the test of time.

Mechanisation of construction.

Mechanical plants can be used in the construction industry for the con truction of buildings and for civil engineering works.

The wide range of application of machines in the construction of buildings is smaller than what may seem to be. Generally, in repair and maintenance works the application of the mechanical plant is very limited as just small powered hand tools can be used. Moreover, of the new works at least a half of it is fittings and finishing trades, for which just a small powered hand tools can be used. In a traditional small house more than 60 per cent of the work is carried out by skilled craft workers, e.g. bricklayers, carpenters, plasterers, painters and plumbers. The application of mechanical plants to these trades is very limited. The remaining 40 per cent of the work is carried out by unskilled workers. Unskilled work is divided between excavation, site clearance and levelling, materials handling and unloading, materials mixing and other general jobs such as cleaning. In general, unskilled work is a sort which requires more physical force rather than skill, for which a mechanical plant is appreciated.

The application of a mechanical plant to building process can be seen through the following:

a) Earth-moving plant. The mechanical plant has the greatest potential in digging, levelling and moving soil. Its output is much more than that of man whom it replaces. Also its output in relation to its costs

is very great. The earth-moving machines beside their great productivity have the advantage of doing the work more quickly than would be possible even with a large number of workers, and thus help in reducing the overall site time.

b) Materials handling plant. They are divided into horizontal, vertical, and mixed handling plants. The total weight of materials to be handled is very great. On the site, materials need to be handled several times. The circulation of materials on the site is mainly unloading, handling for storing, handling for operating, and finally loading the remainders to be carried away. The output of the material handling machines depend on the rate at which the materials moved can be utilized. The spread of tower cranes had a great effect on the system and techniques of erection of buildings, as well as on the organization of work on the site. Using such cranes made it easy to handle large building units which helped to facilitate a wide range of using largeprefabricated elements.

c) Material mixing plant. The main materials to be mixed are concrete, mortar, and plaster. The output of the mixing machine is dependingupon the rate at which the mixed material can be used. To use a mixing machine with full capacity, its output must be close to the rate at which the material is required for using.

The total costs of a mechanical plant to the contract are the hire charge, the charges on transporting it to and away of the site, the costs of any

erection and movement of the plant on the site, the cost of repair and maintenance of the plant, and the cost of fuel needed for operating the plant, and the cost of labour needed to operate it.

Mechanical plants are efficient if the period of using them is maximized and the output of the plants while operating is also maximized, which is a question of organisation.

Mechanical plants have the advantages of high productivity, the ability of continuous work, they can also do as much work as several men can do, they help to simplify the organization of the site, and they help to reduce the overall site time and hence they help to lower costs. Earth moving plants beside their high productivity have the advantages of more safty work than if it is manually done.

Mechanisation of work needs more skilled labour to operate the machines, it is a matter of unskilled labour saving. Where there is surplus of labour it may not be economic or wise to applicate machines in the building industry, even if the duration of the site working time will increase. On the other hand, the value of an early completion date may justify the use of labour saving methods even if the resulting cost will be much higher, if, for example, the building is required to solve a certain problem, or if it may provide a large-scale employment.

While th e use of mechanical plants in the construction of buildings may greatly increase productivity, sometimes they form a large overhead on the cost of building. This diseconomy may arise from the following causes:

i) Sometimes the amount of work for which a certain mechanical plant is used may be very small, so that its hire charge and transporting costs may form large overheads on the costs of building.

ii) Since there may be long intervals between each of the operations for which the machine is in question, it may be left idle on the site for a long period or used for other operations which is below its real abilities.

iii) The use of the plant on rough surfaces and in the open air may subject it to wear and tear which call for greater repair and maintenance costs.

iv) Variability between jobs for which a mechanical plant is used may result in low plant utilisation.

v) Machines lack the flexibility of labour; the relative cost of moving it on the site is high.

Programming and site organisation.

Labour output depends partly on the way the work is organized which is a problem of programming and programme execution and partly on the performance of the individual effort and output of the workers which is a problem of supervision and incentives.

A building process consists of simple construction operations. A reduced number of the separate operations will make it easier to organize the work.

Programming is greatly dependent on the continuity of operations. Most building jobs tend to be very complex. They involve many trades and operations. These operations must be planned so that the labour gangs can move from one operation to another without delays. Continuity helps to reduce overheads and labour expenditure. Breaks in continuity will lead to periods when part of the labour force and machines are left idle or used on jobs below their optimum output.

To prepare a tight programme attention must be given to the causes of discontinuity such as shortage of materials and labour, and delays from bad weather, because any departure from the programme may add to the final cost of the building.

A good approach to the problem of programming is to try to simplify the construction process, and to reduce the number of separate operations. In this case introducing machines and prefabricated elements are appreciated. Their use may partly reduce the time of construction and partly delays. In this way breaks in the continuity of work are reduced.

A good method of programming is to develop the programme of work around the operation which takes the longest time, by the adjustment of all other operations to it. In this way continuous programme could be planned. Introducing flexibility into the programme may be important because it is unlikely that a programme can be strictly followed throughout the duration of the building process. Breakdown in the programme may happen as a result of bad weather, shortage of materials, machines and labour, and design changes.

Programming indicates also the flow of work on the site. The more uninterrupted flow of work the more efficient is the programme. Intersections between different lines of flow are to be avoided. Storage of materials and building machines must be arranged so that not to disturb the flow of operations.

To get the best advantages from a programme it must be associated with a proper site supervision. Site supervision is a matter of obtaining the right quantity and quality of work from the operatives. The output of operations will be greater if the materials and plant required are at hand, if proper assistance is provided to the skilled craftsmen, and if the work is so organised that the labour gangs can move from one operation to another without being underemployed.

Many overheads are related to the duration of the building process. Overheads tend to be reduced by shortening overall site time. A shorter site time means concentration of many operations in the day and hence involves the risks of disorganisation resulting from a day's bad weather or from failure to fulfill the production plan. On the other hand a reduced site time has the advantages of reducing the costs of site supervision and labour, and hence the cost of the building process. Short durations of the building process is very essential where there is shortage of labour and plants, in this way the same labour and plants can undertake more constructional works within a shorter time. From the point of view of the developer, reducing the overall site time means shortening of the time between laying out his capital and yielding from the projects.

Finally it is sometimes very essential to reduce the overall site time of a given project to solve a certain problem. Assuming that there is a problem of housing somewhere, it will be of great importance to reduce the overall construction time to help for reducing the problem if not to solve it. Moreover, assuming that there is a new industrial area or a mining place in a very far place, it will be of a great importance to reduce the time of constructing the workers' dwellings, because unless housing is soon provided workers turn-over may hap en, or high wages to be paid to compensate for the lack of housing.

The suitable system of construction for Egypt.

The question here is what system of construction would we use in building? Traditional system or industrialised system? This is mainly a question of labour, money, and volume of required constructions.

The traditional system of construction has the advantages of labour consumption especially the unskilled ones, it is already existing, so it needs no money to be established, and its techniques and materials are already known. This system has the disadvantages that its output is not in ratio with the increasing demand of new buildings, it needs long duration for the com letion of building, and the final product is heavy.

The industrialised system of construction will result in a surplus of unskilled labour and in an increasing demand for the skilled ones. This could only be achieved when there would be other work opportunities for the surplus unskilled workers, and also when special labour qualifying schools are established. A wide scale of industrialisation of building elements and building process need great investments of money which is the key stone to establish a functioning building industry with a pure industrialised system of construction. The volume of required constructions will show how far is the application of an industrialised system of construction is essential. Due to the fact that our traditional system of construction cannot give a rapid supply for the demand of new constructions, and as it is not efficient in mass building, the use of an indsrialized system of construction will be agreeable.

At the present time and in the near future, although the traditional system of construction cannot supply the demand of mass building and even that it may not be the best system of construction, but it is the most suitable system of construction for our special circumstances. This is because we lack the money and the experience which are needed to establish a sound and functioning building industry, and from the fact that at the present time the traditional system of construction give work opportunities for masses of people. The traditional system of construction should be more suitable if its materials and techniques are developed to increase its productivity and the quality of its products.

If we want to start at the present time a sound and functioning industrialised system of construction, we have to differentiate between the problems which surely will happen to the labour market and the great increase of unemployments on the one hand, or to build masses of prefabricated houses with the aim to solve the problems of housing on the other hand. Moreover, we have to differentiate between either to direct our investments for industry in general or to direct it to industrialise our system of construction.

In the far future, till we could solve the problem of labour, and till we could provide adequate investments and required techniques, then the industrialised system of construction would be more suitable than the traditional one because it can provide masses of houses in shorter time and because at that period a traditional system of construction may be out-of-date in comparison with the developments of techniques and science in the fields of building industry.

CHAPTER VII.

THE CONTRIBUTION OF THE NON-ECONOMIC FACTORS IN THE ECONOMIC APPRAISAL OF RESIDENTIAL DEVELOPMENT

Introduction.

Before taking any positive step to plan a residential settlement several factors are to be taken into consideration. We must ask ourselves for whom we shall build? andhow will the final work appear? It is worthless that a residential settlement is economically built unless it is adequate for the people who will house it, and unless it is good-looking.

Several non-economic factors directly or indirectly affect the design and determination of the adequate demand, and hence have their indirect effect in the economic appraisal of the residential developments. The most important non-economic factors are:-

A) Aesthetical factor
B) Social factor
C) Demographic factor
D) Density.

A) Aesthetical factor.

We must not neglect the aesthetical factors whether a small week-end house or a new town is to be planned. From the fact that we live, work and produce in towns, and as towns are things that are seen, they should be as beautiful as possible. Residential buildings, public housing, streets, trees, and any other physical components of the towns are the raw materials of towns. These raw materials when they are combined together must make a satisfying composition.

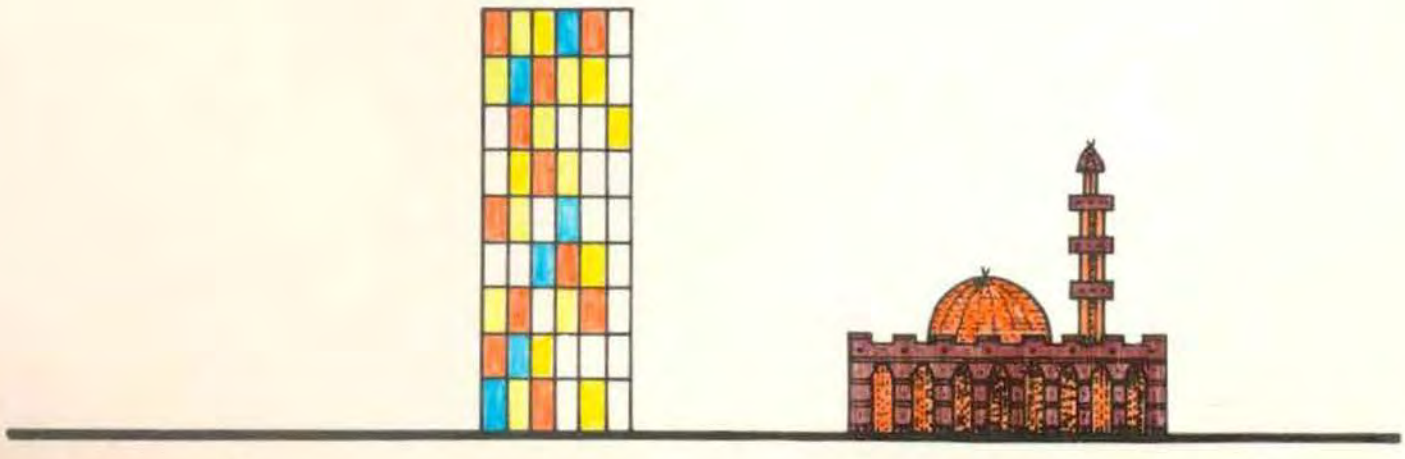
The purpose of studying the aesthetical factors in town planning is to be sure that the components of a town do not only function properly but also pleasing in appearance. To approach to this aim, the aesthetical value of the raw materials of towns and their composition must be seen through their shape, colour, texture, pattern, mass, and silhouette. Also it can be seen from the relationship between the natural form of the land and the geometric form of buildings placed on it. For example, building high-rise buildings on a mountainous land will disturb the syk-line and its continuity, in this case long low-rise buildings may be suitable (Fig. 7-1-A).

The social and demographic factors also prefer compositions formed of buildings with different heights in stead of one. The composition between housing and public buildings with different heights must be designed and take the direction of an abstract plastic art. As a matter of fact it is more difficult to ensure such a direction if the population is not dense enough. In this case methods of setting in scenery are in question.

Figure 7-1 : AESTHETICAL STUDIES.

A

B



C

The systematically build low housed do not always introduce rigidity to the plan, if the row of houses is not too long and their rhythm is softened by gardens and parks.

In the new densely populated towns, where residential buildings sometimes reach over ten 1o to 15 stories, we can gain an aesthetic aspect of a town, varied and dynamic. Here the setting and grouping of the high houses in a certain rhythm may show a favourable system of planning.

The claim for hygiene, ventillation and sunshine generally prefer a looser and more informal planning. The looser planning allows us to see it more completely. Generally we should take care to avoid that closeness of buildings which prevents an adequate ventillation and disturbes privacy. Any layout ins a three-demensional brouping of blocks round a space. The relationship between different heights of blocks and the dimension of the enclosure is of a vital aesthetical question. The street is not a building frontage but it is a space around which the buildings are grouped. The relationship between the heights of buildings and the width of the street plays a big role in the aesthetics of the street. This question is more important in residential estates. Building high-rise blocks on both sides of a relatively narrow street will give a bad tunnel effect. On the other hand, when a street is long and very wide with family houses on both sides, it is difficult to obtain a sense of space enclosure.

Redevelopment of existing towns has another aesthetical problem. At the base of all, the redeveloping plan has to be prepared in such a way that it

should not hurt the precious past and traditions of the town, if it has any. For example, mainly the building of groups of an exaggerated height and mass will surely spoil the aesthetical value of the town, and surely will endanger its historical atmosphere. That is why the residential estates in particulars and towns in general should be formed in a way that should please our eyes and soule, that the inhabitants should feel at home and that they are enjoying the forming of their surroundings.

The character of the population's employments makes an important aesthetic distinction among the new settlements. We have to design houses, which may be in a form of atrium houses and generally grouped in rows, for the agricultural workers. While higher buildings can be designed for people employed in industry. For the settlements of agricultural workers we have to form the residential streets and the whole settlement with respect of the characteristics of both the intimity life of the people and of the nature of the landscape. While for the settlements of the industrial workers the aesthetical grouping of the masses of buildings is a more important task, because it should not only concern with ensuring certain physical grouping but also it should ensure the preservation of the intimity life of the family. In all cases, perhaps a loose ground plan composed of groups of residential blocks around courts will not only ensure the intimity of life, but also respect the old traditions, add to that the benefits of better ventillation and the protection against the strong sunshine of summer.

In historical towns or towns with a special character there are certain regulations concerning building height, mass, and appearance. In the historical part of Cairo the old residential buildings had been built up to a height so that the public buildings and mainly the mosques with their beautiful minarets gave a characteristic town silhouette with an eastern atmosphere. Of course it is obvious that it would not be good to spoil such an atmosphere by building high modern buildings in this area (Fig. 7-1-B). Also placing a high modern building behind an old monumental one will give not only the disadvantages of discord in styles, and atmosphere, but also it will give great differences in appearance of scale (Fig. 7-1-C).

B) <u>Social factor.</u>

Social factor is a matter of income, housing standard, preference, and way of living. The way of living of a family greatly affects the kind and design of dwellings adequate for it. For example, if the housewife is working, this will eliminate the importance of the kitchen, and will call for more small and simple flats. In this case a flat house may be more adequete. Family houses are more suitable for moresettled life, while flat houses are more adequate for more mobile life. The intimity of a family's life and whether its biggest fraction of day-time is inside or outside the dwelling play their role in determining the adequate kind of housing. For a more intimate life, family houses are desirable, also a bigger area of house especially the living room will be essential for life.

The living standard and income of the people decide the kind of housing there is to be. If every one could and would pay for good housing he will have more preferences and wider range of choices. The higher the income the wider is the choice between different kinds of housing, the bigger is the residential unit demanded, the more luxury it will be, and the better is the location. High income groups are able to compete for attractive sites. They have the ability to pay for the amenities of their desired place of residence. Generally, such locations are at the outskirts of the towns, which may have the disadvantage of higher commuting costs. Therefore the separation of place of work and residence is likely to be greater the higher is a person's income. Hing income housing generally take either the form of private villas with a relatively bug private garden, or the form of free luxury flat houses located in scenery. These flat houses are generally high-rise ones because of their relatively high land costs, and also for better viewing, ventillation and sunshine.

Lower-income groups have lesser choices for their kind of housing, its finishing, and its location. Usually there is a relationship between a person's income, his place of work, and his place of residence. The lower the person's income the more important is that relationship. Low-income groups tend to keep down communitng costs, will live near to their place of work. Therefore areas of low-income residence are mainly adjacent to industrial areas and activity centres. With the aim of keeping down commuting costs and as they can pay just low rents or prices for residential accommodation, they are clustered in relatively small areas,

resulting in high living density and more intensive use of land.

Walk-up flat houses are the most suitable type for low-income housing, for their relatively low building cost and low running costs as lifts and other mechanical installations are missing. But, if the low-income family has the time and money to take care of a garden, then attached family houses with gardens are suitable. In this case gardens are appreciated as a small productive field of vegetables, flowers, and the like, for the daily use of the family and also for the local markets.

Low rental housing is usually built to solve the problem of housing of groups of people of low income. Low rental housing must be cheap to build, and also it must be suitable for the people who will house it. An appraisal of the expected use of the dwelling is important to determine its efficient area and to be sure that each of the dwelling components will function properly. For example, the bathroom in a low renal flat may be used for light laundry, so enough space in the bathroom and a connected drying balcony is essential. The kitchen, due to the lack of enough space, may be used for other purposes like ironing and dining, so a proper arrangement of the kitchen's equipments will help to get use of the area of the kitchen for the other purposes. The living room should be used for dining purposes, it must have a complete separation to get use of it as a bedroom. Finally, resulting from the lack of space, a minimum amount of storage space must be given joined to the kitchen, the bathroom or the bedrooms.

Attempts to lower rents of the low rental housing can be approached through the following principles:

a) Reducing the number of rooms per person, that is, increasing the occupancy rate;

b) Reducing the size of room per person;

c) Increasing density to reduce land cost, public utility costs, and street costs per dwelling unit;

d) Reducing the building costs by using cheap materials, by cheap finishing, by eliminating various items and number of electric outlets, and number of doors and windows;

e) Shifting as much as possible of the cost of maintenance onto the tenant, for instance, the shifting of the maintenance of the green areas to the tenants whose apartments they adjoing to be used as private gardens.

It is obvious that the exaggeration in the application of these principles to reduce rents has its counter-effect. The reduction of room sizes per person below acceptable standards does not decrease the costs proportionately to the amount of reduction of space, because the expensive components of utilities and circulation are not effected. The building of projects of very high densities and the great increase of the occupancy rate is exactly opposite to the intent of building such projects, which is the elimination of slums and the provision of dwellings of good living standard for people of low income. Moreover, very high densities and high occupancy rates have their counter-effects on health and social conditions.

Using cheap building materials will call for more maintenance costs and earlier replacement. Furthermore, the shifting of costs to tenants results in a higher cost to a low income tenant.

A possible reduction of costs may be approached through a reasonable application of the five principles add to them using new materials and techniques, proper design, programming, andsite organisation.

C) Demographic factor.

Families could mainly be divided according to their demographic conditions into single persons, couples without children, and couples with children. According to the demographic condition of a family there is a related kind of housing which could be considered as the most suitable. For the sake of study houses can be divided into family houses, walk-up flat houses - up to five storeys - and rise flat houses - over five storeys. Whatever the kindof housing may be, there is a relationship between the size of family and the number of adequate rooms for it.

Single persons can be housed in any kind of housing. Rise or walk-up flat houses are more adequate for them while family houses are not because flat houses are more suitable for a mobile life add to that single persons may lack the time to take care of a garden. Here will arise an economic problem. From the fact that for single persons small flats are demanded, the costs of vertical and horizontal communication and the costs of ancillaries to the flat will be high.

Couples without children may be divided into decreasing or increasing couples. Generally, decreasing couples are mainly aged persons. Walk-up flat houses are not suitable for decreasing couples except their ground floors because using stairs may form great difficulty for aged persons. Rise flat houses are suitable for aged couples because they have not the difficulty of using stairs as lifts are existing, and the only troubles may happen when the lifts may be out of order. Family houses are the most kind of housing suitable for aged persons because there is no need of using neither lifts nor stairs, add to that a garden which will be a usiful thing to spend a time. In general, small dwellings with maximum two rooms are quite enough for decreasing couples especially if we take into consideration that bigger dwellings need more effort for cleaning up.

Increasing couples are mainly newly married young persons, for them any kind of housing is suitable, but it does not mean that it may be suitable if they get children. The most suitable kind of housing is either rise flat houses or walk-up flat houses. A family house may not be suitable especially of the couple is engaged to work. If the couple is expecting children in the near future, it is worthless to live in a dwelling and then after a short time to change it because it becomes unsuitable for the bigger family. In this case it is better to house the young couples directly in the kind of housing which suit for bigger family.

This leads us to the question of housing couples with children which are the most important sector of the families because they are the real base of the society and they represent the biggest percentage of households. Children are either infants or younger children who need to go to school or to play. Couples with just infants can be housed in rise flat houses, in family houses, and in the ground floors of the walk-up flat houses. This determination of the suitable kind of housing is to minimise the difficulties to the mother arising from carrying her child and his car upstairs. If this problem is solved by providing a place in the basement for children cars, walk-up flat houses will also be a suitable kind of housing for couples with infants. Couples with more number of younger children need more importance to determine their suitable kind of housing. From the first sight, the most suitable kind of housing for couples with children is family houses, next to it the ground and first floors in both of walk-up and rise flat houses. The problem arising against flat houses as suitable kind of housing couples with children can be summarised in the danger of using lifts, lack of direct connection with the ground, difficulty of supervising the children downstairs and in the flat, and the nature of the flat with its limited space which is against the nature of the child who needs bigger space to move and play. These problems if solved, walk-up and rise flat houses may become a suitable kind of housing couples with children especially if in the reality a wide scale building of family houses is not possible. Solving the problems of housing couples with children in flat houses can be approached through the following:

a) Increasing the safety of lifts so that children can use them without danger;

b) The lack of direct connection with the ground to be solved by using enough and efficient lifts and well lighted stair-cases;

c) The difficulty of supervising children downstairs can be solved by surrounding the residential blocks with suitable landscaping, and children play-grounds. Also the locate nursery schools within an easy reach so that the children can move without fearing the danger of traffice. The problem of supervising the children in the flat and the fears arising from that the children may fall from windows and balconies can be solved by increasing the heights of sills and ballustrades and making balcony ballustrades more solid. For the future, the problem of supervision will not be so essential when the wives will be engaged in work.

d) The problem arising from the limited space of flats can be solved by increasing their area, and providing big terraces which could be considered as a children play-ground within the flat.

If the problems of flat houses are solved in this way it will be suitable kind of housing for couples with children, but this does not mean that they became better than family houses.

D) Density.

Densities may be high, medium or low. The difficulty of chosing between densities is: Should one seek for the density which provides the cheapest accommodation or which provides the best living conditions?

It is not possible to point out a density which is to be considered the best one at which we should be building since many other fariable factors are participating in the decision.

The location of a city within the region and the nature of the surrounding land tend to affect the growth of the city and its direction and hence an overall town density. For example, if a city is located in the agricultural land a horizontal growth of the city is not agreeable while a vertical growth of it is suitable. In this case the higher the overall town density the bigger is the save of agricultural land.

The spatial site conditions have their role in determining the suitable density. First, there is the interrelationship between the density of a new estate and the overall town density. Second, if the site has bad subsoil conditions, where spacial preparations and machines are needed and where expensive foundations are to be built, higher buildings rather than lower ones are more suitable. Third, if the site cost is very high it is obvious that the higher the density the more extensive use of land and the more cheaper will be the cost of land per residential unit.

The type of employment of the people to be housed determines the kind of housing suitable for them. In a rural district only family houses of one or two floors are agreeable. These family houses may be detached or rows of family houses. It may be designed as atrium houses. Generally, every house must have adequate court

or garden, resulting in low densities of the rural districts. On the contrary, flat houses are more suitable for the industrialized life of the urban districts which push up the densities. Of course, low densities can also be achieved by building flat houses.

The standard of housing and the way of living affect the density. The higher is the standard of living the bigger is the spacing between dwellings, the more are the playgrounds, and gardens, the bigger is the size of the dwelling, and hence the lower is the density. Detached family houses with gardens are more suitable for high income housing, while parallel rows of narrow-fronted row houses are to be build for people who could not make demands for a big garden or better housing conditions. This results in higher living densities for medium andlow income housing.

The size of dwelling has its role in affecting densities. Building bigger dwellings will result in lower densities. But it is important to point that it is possible to place a larger number of smaller rooms in the same area of smaller number of large rooms, and hence to rise the density without affecting the building bulk per certain area materially.

There are certain forces that tend to keep the living densities down. Very high densities may have a counter-effect on the public health, also they eliminate the existence of gardens and children play-grounds which is not agreeable. Very high densities will cause difficulty of designing which is not only pressing up services but also in that if they will be reasonably provided

they will need very big areas of land. On the contrary, in the case of very low densities the problem will be in how far of getting use to the maximum of the pbulic accommodations which minimumly to be provided to any residential estate. There are also certain forces tend to press up the densities from the fact that very low densities are uneconomic because services and land cost are so much per dwelling unit.

The cost of the development and especially the cost of public accommodation per dwelling unit has direct bearing on density. This point will be discussed in detail in the last chapter.

One of the main aims to study densities, and in particular gross densities, is to economise the use of land. It was a wrong idea that great savings of land are to be achieved by high gross densities. For rise a gross density from 8o to 1oo persons per hectare will save 2.5 hectare for every thousand persons. While to increase gross density from 2oo to 22o persons per hectare will save only o.55 hectare per thousand persons.