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“TOWARDS LOWERING THE COST OF HOUSES IN PALESTINE: NEW PERSPECTIVE”

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Degree of Master of Science in Construction Management

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Declaration

I certify that all materials presented in this thesis are my own work and has not written to me, in whole or in part, by any other person(s), and that no portion of this thesis has been submitted as an application for another degree or qualification of any other university or institution.

Signed

Hussam A. Kurraz

Date: August -2006

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Abstract

"Towards Lowering the Cost of Houses in Palestine: New Prospective"

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The main aim of this research is to develop an approach to lower the cost of housing while ensuring adequate environment and health conditions to Palestinian people. This will ultimately enable more people of limited income to own their own houses. To satisfy this main aim, many specific objectives were achieved. These objectives include the followings:

- 1. Investigation of influencing factors that affect the cost of housing projects in all phases.*
- 2. Determination of criteria for economic housing.*
- 3. Proposing an approach to lower the cost of housing.*
- 4. Investigation of the significant of the developed approach using a real-life case study and developing prototype design example for low cost housing project that satisfies the developed approach.*

Many researches in several countries of the world were reviewed by the researcher who also studied in-depth the local Palestinian experience in order to investigate all influencing factors that affect the housing cost. The researcher also reflected his experience within the proposed approach for lowering the housing cost. A group of experts from Gaza Strip and West Bank were interviewed in order to acquire more data and to test and modify the proposed approach.

The developed approach consists of five phases. These are Strategy, Planning and Design, Procurement, Execution, and Evaluation. The developed approach depends on developing new criteria for the planning and design of low-cost housing projects, developing new construction system (procurement), optimal use of building materials, and proposing suitable financial programs. This approach will lead to create more housing units, introduce suitable area of the housing units, reduce the construction duration and reduce the project overhead.

The real life case study showed that the approach has satisfied the objective of this research by lowering the housing cost to nearly 20% of total cost. A comparison between the original and proposed design was conducted by the researcher. This comparison aims to introduce the cost reduction. The total cost saving reached nearly 20% of total cost.

The developed approach can be applied in other countries because the researcher used percentages instead of absolute value for the cost reduction elements.

The main recommendation for public and private housing sectors is to use the proposed approach when introducing new low cost housing projects.

الملخص

إن الهدف الرئيسي لهذه الدراسة هو تطوير طريقة لتقليل تكلفة المساكن مع التأكيد على وجود شروط بيئية وصحية كافية للسكان الفلسطينيين. هذا سيؤدي إلى تمكين عدد أكبر من ذوي الدخل المحدود لامتلاك مساكن خاصة بهم. ومن أجل تحقيق هذا الهدف فقد تم وضع مجموعة من الأهداف التفصيلية. يمكن تلخيص هذه الأهداف فيما يلي:

1. البحث والاستقصاء في العوامل المؤثرة في تكلفة مشاريع الإسكان في جميع مراحل تنفيذها.
2. تحديد معايير للإسكان الاقتصادي.
3. اقتراح طريقة لتخفيض تكلفة المشاريع الإسكانية.
4. البحث والاستقصاء عن العوامل المؤثرة في الطريقة المقترحة من خلال استخدام حالة دراسية واقعية وتطوير واقتراح نموذج مشروع إسكان اقتصادي يحقق المعايير السابقة.

قام الباحث بمراجعة العديد من البحوث الخاصة بالإسكان الاقتصادي بالإضافة إلى دراسة تجربة الإسكان الفلسطينية وذلك من أجل البحث والاستقصاء في العوامل المؤثرة في تكلفة المساكن. بالإضافة لما سبق فقد قام الباحث بالاستفادة من خبراته السابقة في تطوير الطريقة المقترحة لتقليل التكلفة.

تم مقابلة مجموعة من الخبراء في مجال الإسكان من الضفة الغربية وقطاع غزة من أجل الحصول على المزيد من المعلومات وكذلك فحص الطريقة المقترحة وتعديلها.

تتكون الطريقة المطورة لتقليل التكلفة من خمس مراحل هي مرحلة الإستراتيجية، التخطيط والتصميم، طرق التعاقدات، مرحلة التنفيذ بالإضافة إلى مرحلة التقييم. تعتمد هذه الطريقة في تقليل التكلفة على تطوير معايير تخطيطية وتصميمية جديدة، تطوير نظام إنشاء جديد (التعاقدات)، الاستخدام الأمثل لمواد البناء و اقتراح برامج تمويل مناسبة لذوي الدخل المحدود. ستؤدي هذه الطريقة إلى إيجاد عدد أكبر من الوحدات السكنية وتقديم مساحات وحدات سكنية مناسبة بالإضافة إلى تقليل مدة تنفيذ المشروع وبالتالي تقليل المصاريف الإدارية.

إن الحالة الدراسية التي تم إنجازها إذ تظهر أن الطريقة المقترحة قد حققت هدف هذا البحث من خلال تقليل التكلفة بنسبة 20% تقريبا من إجمالي التكلفة فقد قام الباحث بعمل مقارنة بين التصميم الأصلي والتصميم المقترح يهدف إلى تقديم عناصر تقليل التكلفة. لقد وصل إجمالي التوفير في التكلفة إلى 20% من إجمالي التكلفة.

الطريقة المقترحة والنتائج يمكن تطبيقها وتعميمها خارج فلسطين وذلك لاستخدام الباحث النسب وليس التكلفة الحقيقية في عرض الحالة الدراسية.

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Abbreviations

UNRWA:	United Nations Relief and Works Agency
MPWH:	Ministry of Public Works and Housing
PHC:	Palestinian Housing Council
GDP:	Gross domestic percentage
HDB:	Housing and Development Bank
USA:	United State of America
PNA:	Palestinian National Authority
PLO:	Palestinian Liberation Organization
P.L.C:	Palestine Real Estate Investment Company

CHAPTER 1

INTRODUCTION

Housing is one of the basic needs of human. In practical terms "house" can be defined as an "apartment or living quarter in which the residents live and eat" [Al-Dosari, 2005]. General characteristics of housing including average monthly housing costs, types, locations, size and conditions of the units influence the housing affordability. This implies that household should be able to support the direct costs of the housing unit without neglecting any other essential needs.

The vast majority of the world countries face the availability of housing stock for high-income people and lack of housing units for low and moderate income people. So, housing is one of the most pressing problems confronting the world today, especially the third world countries. Countries with limited resources like Palestine face housing challenges and limitations, especially in dealing with low-income people [Ziara, and Ayyub, 1999]. The definition of low-cost housing depends on the economical capacity of the target group. If houses and services are too expensive, the poor cannot afford to buy an apartment. One concept may be affordable in one part of the world, but too expensive in another.

The definitions of affordable housing that outline its primary characteristic include the following:

1. Housing intending to serve families or individuals with low, low-moderate or moderate incomes.
2. Housing which is low cost or subsidized, irrespective of tenure, and is accessible to those who cannot afford to occupy houses that are generally available on the open market.

3. Housing where the rent or mortgage plus taxes is 30% or less of the households gross annual income.

The low and moderate-income people represent the vast majority of the population in the developing countries. Creating affordable housing for low-income people revolves around reducing the cost of housing delivery and the factors that affect producing housing units.

A lot of housing polices and housing projects were conducted in the developing countries in order to solve housing problem especially for low-income people during the past decades. These projects didn't succeed to solve the problem because of the following reasons [Al-Dosari, 2005]:

1. The inability of low-income people to serve the government institutions condition to own a housing unit such as the sustainability of continuous income and continuous work.
2. The high cost of the housing units which is not suitable for low-income people circumstances.

These projects were owned by high-income people not the target group, low-income people. Solving housing problem for low-income people takes high intention in the housing policy and strategy in the world. The scale of the problem varied from country to another. It represents a big problem in the third world countries because of the lack of resources. The solution of housing problem for low-income people is to concentrate on searching for methods that can produce more housing units with a suitable price.

Palestine, similar to the third world countries, faces housing challenges and limitation especially in dealing with low-cost housing. The most recent population census for the West Bank and Gaza Strip was conducted by Palestinian Central Bureau of Statistics in 1997. According to the 1997 census, the population in the West Bank and Gaza Strip were

estimated to 1,600,100 and 1,001,569 anima, respectively [Palestinian Central Bureau of Statistics, Pocket Book, 2000]. The total population is expected to be 3,986,813 by the year 2005[Central Bureau of Statistics, Pocket Book, 2000]. The refugee camps accommodate more than 26.5 and 65.1 per cent of the population in the West Bank and Gaza Strip, respectively [Palestinian Central Bureau of Statistics, Pocket Book, 2000]. In addition, 63% of the Palestinian households are expected to survive under the poverty line.

The co-operative housing foundation estimated that approximately 34,000 new units would be required per year for the period from 1990 to 1995, based on available information regarding population and housing stoke [Ziara, 1997]. The distribution of housing needs for urban areas required an estimated 20,000 new units per year [Ziara, 1997]. Other fact finding missions have estimated that there is a shortage of more than 40,000 housing units [Palestinian-Norwegian Fact Finding Mission, 1995].

Efforts were done to collect data and to share more experts in the structured questionnaire from West Bank by the researcher but these efforts did not succeed Because of the Israeli occupation obstacles. So that, the research is concentrated to cover only Gaza Strip experience in housing sector.

This research consider as the first research aims to look for the housing problem solutions at Gaza Strip especially for low and moderate income people. This research gives valuable information for Arabic library and especially for Islamic library.

1.1. General Objective

The main aim of this study is to develop an approach to lower the cost of housing while ensuring adequate environment and health conditions to Palestinian people. This will ultimately enable more people of limited income to own their own houses. This will lead

to improve the living conditions of the limited income people in Palestine by enabling them to have proper houses with suitable prices.

1.2. Specific Objectives

1. Investigation of influencing factors that affect the cost of housing projects in all phases, including planning, design, and construction.
2. Determination the criteria for economic housing considering all influencing factors of the cost.
3. In the conclusion, an approach is proposed to lower the cost of housing taking into account all cost influencing factors.
4. Investigating the significance of the developed approach using a real life case study and developing prototype design as an example of low cost housing project that satisfies the developed approach.

1.3. Research problem

The low and moderate-income people represent a high percentage in Palestine. On the other hand, the required number of housing units per year is a large number also. In addition, the traditional method for creating low-cost housing project at Palestine did not succeeded to satisfy the low-income people needs. So, there is a need to look for methods that can increase the number of the housing units and decrease the total cost of the houses considering all the environmental and health parameters.

The low income people in Palestine does not earn enough to meet the expenses of feeding, clothing, transport to work , etc. There is no room to think of saving to buy or build a house.

The high cost of major building materials in Palestine is veritable source of serious concern. Most of the major buildings materials are imported from developed countries e.g. cement, reinforcement steel, tiles, ceramic, paints, roofing sheets, keys and locks, sanitary and electrical fittings, etc. No matter how cheap these materials are in their countries of origin, by the time cost of shipping and custom duties are added, they would become expensive.

For the low income, to acquire a piece of land is not an easy task. Available land is always purchased by land speculators who hold for some time only to resell at prices which the low income cannot afford. A lot of new registered housing cooperatives were established in the West Bank and Gaza since 1995 in order to participate in solving land acquisition problem for limited income people.

1.4. Scope of Study

This study aims to investigate all cost influencing factors that affect low-cost housing projects. The researcher has investigated the low-cost housing project planning and design criteria, developing the construction system, optimal use of the local building materials, developing building regulations, and proposing suitable financing programs. The main output of this study is a developed approach for lowering the cost of housing project in Palestine taking into account all previous factors.

1.5. Research Methodology

The adapted approach is both quantitative and qualitative which includes the following steps:

1.5.1. Literature Review

Recent and old relevant publications were reviewed in order to look into other countries experience in reducing the houses cost. These publications investigated the low cost

housing in the third world especially in the Arab Countries. The effort concentrated on reviewing the publications of the Housing Conference Proceedings. The followings subjects were reviewed:

1. Cost management of low cost housing.
2. Housing problems for low income people.
3. Financing of low cost housing project.
4. Construction technology of low cost housing projects.
5. Planning and design for low cost housing project.
6. Development Regulations and Housing affordability.
7. Methods for waste control in the building industry.
8. Design criteria for adequate and affordable housing towards current social, demographic and economic trends.
9. Effectiveness and urban patterns for low cost housing.
10. Procurement systems and project organization model for low cost housing.
11. Land development regulations to affordable housing.

1.5.2. Studying the Local Experience in Housing Project

Projects that have been implemented by Ministry of Public Works and Housing (MPWH) and Palestinian Housing Council (PHC) were studied to investigate life phases and to analyze the factors that affect the project cost. Projects implemented by the partnership between private and public sectors have been also selected in order to make a comparison between private and public sector in Palestine. The selection has been made according to location, target group and size of the projects. Eleven projects have been selected from the largest projects. These are El-Zahra, Austrian, El-Nada, EL-Fara, Dair-El-Balah, Sheikh Zayed, El-Karma, Ain-Jalout, Police, El-Qalaa, and Tal-El-Soltan housing projects.

1.5.3. Developing Criteria for Economic Housing

Criteria for the following aspects were developed in order to assist in creating an approach to lower the houses cost. These have covered the following aspects:

- Planning and design methods.
- Construction industry.
- Use of local building material.
- Financing systems.
- Land tenure and value.
- Codes and building regulations.

These criteria have been developed to suit environment and circumstances of Palestine.

1.5.4. Developing an Approach for Lowering the Houses Cost

The researcher proposed an approach to lower the houses cost in Palestine. This proposed approach has been reviewed and modified according to the comments of experts.

1.5.5. Structured Interviews

A group of 11 experts from housing sector in Palestine have been interviewed and filled a structured questionnaire. The experts were selected from knowledgeable people in housing sector and from different places of work. It was structured face-to-face interviews. The average time for each interview was (90) minutes, and was followed by an informal discussion.

The selection of the experts has considered the place of work, practical experience, and research experience in the housing sector. The experts' place of work was classified as follows:

1. Four experts from MPWH.
2. Two experts from PHC.

3. Two experts from Islamic University.
4. One expert from Ministry of Local Authority.
5. One expert from local Banks.
6. One expert in finance and investment from the Ministry of Justice.

Ten of the experts were from Gaza Strip and only one of them was from West Bank.

Advantages of structured interviews include:

1. It provides information directly from knowledgeable people.
2. It provides flexibility to explore new ideas and issues not anticipated during planning.
3. It is inexpensive and simple to conduct.

The main disadvantage is that it may be difficult to prove validity of findings. So that, the following steps were considered in order to check the reliability and validity:

1. Check representativeness of key informants by selection different experts from different places.
2. Assess reliability by the selection of the most experience and knowledgeable.

1.5.6. Imply in Case Study

An implemented housing project has been selected in order to use the existing conditions of the project in developing a prototype design example which will satisfy the modified developed criteria. A comparison between the prototype design and the implemented housing project has been conducted in order to test the significant of the developed approach in reducing the housing cost. [See page 100]

CHAPTER 2

LITERATURE REVIEW

The main influencing factors which affect the cost of houses include the following:

1. Planning and design methods [Ziara and Ayyub, 1999].
2. Construction industry [Oladapo, 2001].
3. Utilization of local building materials [Erguden, 2001].
4. Building codes, standards and regulations [Ziara and Ayyub, 1999].
5. Land use and tenure (adequate supply of affordable land) [Erguden, 2001].
6. Use of suitable management and financial programs [Ziara and Ayyub, 1999].

The previous factors will be reviewed individually beginning with Planning and Design method.

2.1. Planning and Design Methods

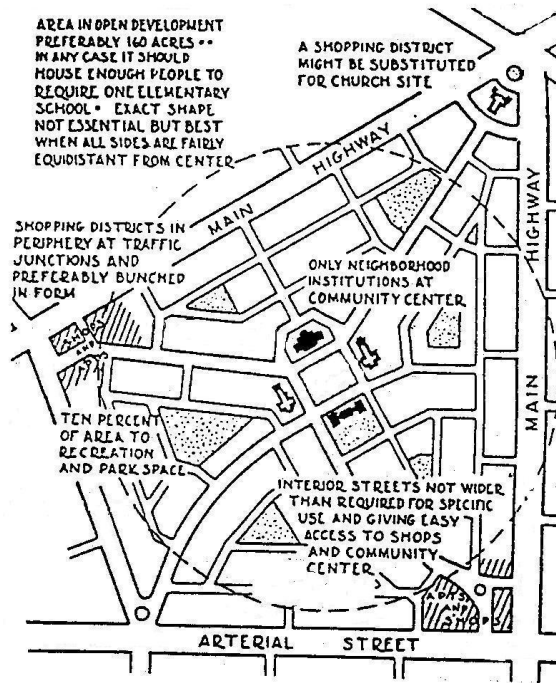
Planning and design are one of the most important influencing factors that directly affect the cost of houses [Idrees, 2004]. A general background of the city planning and residential neighborhood design is given in this section in order to reach the economic neighborhood planning and design which will be applicable for low-income people.

Network planning which was developed by Greeks at the end of fifth century was one of the first planned schemes [Idrees, 2004]. Planning theories were continued in developing to meet the increased demand to suitable environment houses. Summary and brief discussion of these theories is given in Appendix A. The table in Appendix A illustrates the vast majority of city planning theories advantages, disadvantages and the applicability to low cost housing in order to reach the optimal solution for the planning of low cost housing project.

It is believed that the Neighborhood Unit Theory, developed by Perry at 1929, is the best planning and the most applicable solution for low income people, especially if it is designed with necessary infrastructure, parks and services building. This is due to the following factors:

1. Neighborhood Unit Theory introduces high density in comparison with other theories.
There are other theories introduces high density but it is not suitable for low income.
2. Introduces the continuity of the districts.
3. Introduces the shortest roads and sidewalks in comparison with other theories.
4. Many other theories depend on the neighborhood theory concept.
5. Neighborhood Unit Theory was used by the vast majority of the world countries in order to improve the living condition of people especially low-income people.
6. It is the most applicable to low cost housing.

Neighborhoods have always been associated with social characters and their potential to enhance the quality of life of residents; one can say that neighborhoods are the principal elements in a cultural approach to urban design. Figure 2-1 illustrates the principles of neighborhood unit theory planning.



(a)The idea of Neighborhood Unit Theory [Haider, 1994, page 104]



(b)The collection of three neighborhoods [Haider, 1994, page 105]

Figure 2-1 Neighborhood Unit Theory planning details

The shapes in Figure 2-1 illustrates the idea of Neighborhood Unit Theory planning, which depends on the exterior and interior network roads, open spaces, services area, residential area and landscape elements.

2.1.1. Performance Criteria

Criteria of housing unit performance linked to site planning will be reviewed. Then, planning elements should be determined for urban housing sites, which has a direct or indirect impact in housing unit performance and its cost. The criteria of housing unit performance linked to the planning elements of residential sites are cost, security, privacy, sound isolation, air pollution control, size flexibility, ease of arrival (transmigrability), site view, environmental fitting and occupancy levels [Abu-o'of, 2004].

Planning elements, forming urban housing sites are five factors deduced by national and international experience. Each planning element includes several sub-elements. Planning

elements of land sub-division area using Site and Service system is considered one of the important outputs for the housing unit cost. The housing unit cost is increased by several factors which will raise Security, Privacy, Sound control, etc.

Factors related to housing environments and housing units which has direct influence in the cost of houses can be summarized as follow:

a. Factors related to housing environments are:

1. Housing estates patterns.
2. Roads system.
3. Open spacing areas.
4. Crossing passages areas.
5. Landscape factors.
6. Land use density.
7. Level of existing services.

b. Factors related to housing units are:

1. Location of blocks.
2. Design of blocks.
3. Design of the unit in the block.

The previous factors will be reviewed individually beginning with the factors related to housing environments.

2.1.2. Sub-division Planning and Land Use Density

2.1.2.1. Land Use Density

Density considers the number of building or people per donum only. Land use density is 50-62.5 person/donum (which nearly equal to 12.5 dwelling unit/donum) for low cost

housing projects and can be reach 12.5-21.2 dwelling unit/donum. In addition, the Egyptian ministry of housing estimated the crowded rate as follows:

1. Low cost housing 2 person/room
2. Moderate cost housing 1.5 person/room
3. High cost housing 1 person/room

So families consisting of 3-5 persons needed two bedrooms and the families which consist of 6-10 persons needed three bedrooms in low cost housing projects [see Aref, 2005 - Callender, 1966, page 1226- Al-Absi, 2004 – and Islamic Group, 1976, page 30].

2.1.2.2. Sub-division Planning Methods

In general, there are four different concepts for the sub-division of land for low cost housing. These concepts are as follows: (For more information see Appendix B)

1. Conventional zoning.
2. Short passages or double built line.
3. Closed passages.
4. Cluster zoning.

Usrry, et. al. 1970, conducted an analytical and economical research about the effect of site planning methods on the cost of the utilities spaces. The research has studied three methods of land site. These methods were networks planning (conventional method); short passages or double built line, and closed passages method. The research approved that the "closed passages method" is the most economical method because of the following factors:

1. This method introduces the minimum streets and sidewalks area in the site, 20% from the total area, while the other methods are 35% and 27% for the network and double built line respectively.
2. Introduce the minimum cost of the street. For example, the cost of street by this method is 57% of the networks method and 60% of double built line.

3. Introduce the highest density.

Clustered lots have lower overall site development costs, benefit from open space within the development [The national association of Home Builders Research Center, 1994]. The main advantage for cluster concept is that the linear feet of streets and utilities is half of other plans [Callender, 1966, page 1233]. So that, cluster concept plan is the best way for dividing land to reach low-cost housing [Usrry et al, 1970 and Callender, 1966, page 1223-1237].

In general, the municipalities determine the zoning classification which facilitates the future development for the municipal region. These zoning did not consider the low-income people needs. The minimum land plot is 300 m² and the minimum width is 12 m where the conditions are very difficult for low-income people. The experience of Tunisia, Egypt and Jordan for low cost housing shows that it is possible to carry out organized site and services projects on a large scale which subdivision plot ranged from 50-190 m² and the build ratio is not less than 80% of total land [Ebsen, and Rambdl, 2000- Al-Shafi, 1995- Aid and Marghani, 2004 – Al-Hosni, 2005]. The houses are agglomerated together into small blocks with narrow streets and small open spaces in order to reduce the cost of houses. At these houses the future horizontal and vertical extension was considered. Table 2-1 and 2-2 illustrate construction condition for site and services zoning in some low cost housing project at Egypt and Jordan.

Table 2-1 Land lots conditions in Egyptian low cost housing [Aid and Marghani, 2004]

Regulation for the self efforts zoning	
Item	Conditions
Land area	50 m ²
Built ratio	80 %
Building area	40 m ²
Elevation length	6-8 m
Building height	2-3 floor

Table 2-2 The Jordanian policy for householder's classification [Al-Hosni, 2005]

Household classification	Residential unit		land		Minimum income (JD/month)
	Area	Cost	Area	Cost	
1- Builder owner/formal					
a- Private sector employee	90 m ²	10800 JD	150 m ²	6000 JD	616
b- Public sector employee	90 m ²	10800 JD	150 m ²	6000 JD	453
2- Builder owner/informal					
a- Completed house	90 m ²	10800 JD	150 m ²	6000 JD	-----
b- Nuclear house	30 m ²	3600 JD	150 m ²	6000 JD	335
- Subsidy project for people have less than 3500 JD/year					
	40 m ²	4800 JD	50 m ²	1000 JD	156

Table 2-2 illustrates the Jordan household's classification which has direct relation with people income. Many financing programs were created for the householders whose income more than 3500 JD per year. The problem concentrated on the householders whose income is less than 3500 JD. The Jordanian government solution is to create site and services projects for low income people with land subsidy.

In low cost housing project, the demand concentrated on increasing the number of land plots and decreases the services land. In the plot, it is better to decrease the elevation of the plot and increase the depth in order to reduce the length of the infrastructure elements. The proposed ratio between the plot widths to depth is 1:1.5 to 1:2.5 [Abed El Kader et al, 1988

and Abu Sa'da, 1994]. So that, special consideration must be taken in order to provide land plots to low-income people. These considerations are as follows:

1. Minimize land plot to reach 150-190 m² for low-income people.
2. The applicable ratio between depth and width is 1:2 which introduce suitable design.
3. Approved nuclear house concept as a good solution for low income people.
4. The residential zoning must contain all income people types and don't separate low-income people in a special zoning.
5. It is highly recommended to cancel the side setback lines in order to increase the combined walls.

2.1.3. Streets, Sidewalks and Parking Network

Minimum streets and sidewalks widths for low cost housing projects are highly recommended such as: [Islamic Group, 1976, page 58 –Haider, 1994, page 229-265 - Callender, 1966, page 1229 and Aid and Yousef, 2004].

1. Arterial streets 16m widths.
2. Collector streets 7.2 - 10m paving width.
3. Local streets 5.6 - 8m paving width.
4. Closed streets 4.2 - 6.6m paving width.
5. Sidewalks 1.3-1.6m widths.

In conclusion, streets and sidewalk network can be used to lower the cost of houses by decreasing the width to the minimum requirements.

It is clear that the perpendicular parking lot is the most economic method. A central driveway with two rows of cars and go deg parking gives the best economy. For low cost housing, the number of parking lots required is 30-50% from dwelling number [Callender, 1966, page 1239 and Haider, 1994, page 205]

2.1.4. Open Spaces and Landscape

The Egyptian housing experience, which consists of different housing projects system, introduced the following ratio for open spaces between the housing buildings on the existing project [Aid and Yousef , 2004]:

1. Public housing sector, which consist of a group of individual and repetitive housing buildings, have an open spaces area between 65-75%.
2. Formal private housing sector, which divided in two main categories, firstly, housing project inside the existing cities which followed the buildings codes and regulations for these cities, open spaces area for these projects was 25-40%. Secondly, housing project outside the existing cities, this was formed by dividing the land into network planning. Open spaces in these projects were determined by the setback lines around the building blocks.
3. Informal private housing sector, which introduced an open spaces area ratio about 20% from the total area.

In general, open spaces area ratio in low-cost housing project is between 14 - 28% from the total area [Untermann, and Small, 1977, page 203 to 207 and Design consideration check list]. The main influencing factors that affect the garden design between the building and the selection of the trees that will be used as follow: [Mahdi, 1983, page 25 to 30]

1. Natural factors
2. Non-natural factors that includes:
 - Construction cost includes the cost of water network, excavation and backfilling, fences and seats, trees, labors, and machines and equipments.
 - Maintenance cost: the designer can reduce the maintenance cost by the following steps:
 - a) Select slow growing fence plants like Petsborm and Feibernm.

- b) Select trees which can shape by it self without any efforts from gardeners.
 - c) Increase the green areas.
 - d) Decrease the number of flowers boxes.
 - e) Paving sidewalk, construct fences and seats [pre-cast concrete], and determine green spaces by inverted beam.
- Habits and behavior: garden design is affected by cultural level, habits, and society behavior.

Because of, the lack of water resources in Palestine, it is highly recommended to use trees such as:

Acacia sp, Albizzia sp, Casuarinas sp, Celtis australis, haematoxylon, Campechianum, Melaleuca sp, Melta azedarah, Phoenix sp, etc.

Reducing the cost of houses is influenced by site landscape elements which include [Mahdi, 1983, page 27]:

1. The size of water network in the site, which represent 2% from total cost of site work.
2. The usage of trees and plants which need a little amount of water, which represent 4% from total cost of site work.
3. The size of green and playground areas.
4. Householders participation to organize and maintenance the gardens.
5. The size of site lightening, which represent 15% from total cost of infrastructure and site works.
6. Type of furniture will be used, which represent 7% from total cost of site work.
7. Sewage network represents 21.4% from total cost of site work.
8. Inexpensive natural material for the furniture of the site will be used in order to reduce the cost of houses. For example, concrete will be used to construct benches; flagstone or other paving block in exposed aggregate concrete will be used for

sidewalks, dry construction-cut stone for external steps, and stone rip-rap for retaining walls [Callender, 1966, page 1252-1257].

2.1.5. Housing Estates Patterns

The important patterns which describe the housing estates include the following patterns:

<i>Patterns</i>	<i>Advantages</i>	<i>Disadvantages</i>
1. Row houses pattern.	The most economic method	The simplest way-doesn't satisfy the minimum social requirement-not suitable for human standards.
2. Graduated patterns.	High open spaces and roads	Low of density
3. Focus patterns.	High open spaces and roads	There is no graduate in the spaces-increases the initial cost "high percentage of open spaces"
4. Linear patterns.	High open spaces and roads	There is no graduate in the spaces-increases the initial cost "high percentage of open spaces"-low density
5. Nodal patterns.	Flexibility patterns-the variance in the space and views-suitable for human standards.	The difficulties face the design of combined blocks-not suitable for different topography.

(For more information see appendix C)

In conclusion; Nodal patterns can be developed to introduce a good solution for low-cost housing estate patters. The advantage of this pattern can be defined as follow:

1. Optimal land use.
2. Introduce semi-private, private, semi-public, and public spaces.
3. Create a good relationship with the neighbors.

It is clear that a group of combined houses method save about 25% from infrastructure elements in comparison with detached method. This is clear in Gideon, 1983 research which conducted in a comparison between detached houses and a group of combined houses planning method.

Many researchers proposed models for low cost housing estate patterns. These models in general, depends on collect the housing building in order to reduce the open spaces and

increase the combined walls and roofs in addition to separate pedestrians and traffic motion. Figure 2-2 illustrates the models proposed by Idrees, 2004 and Aid and yousef, 2004 [Idrees, 2004 and Aid and Yousef , 2004].

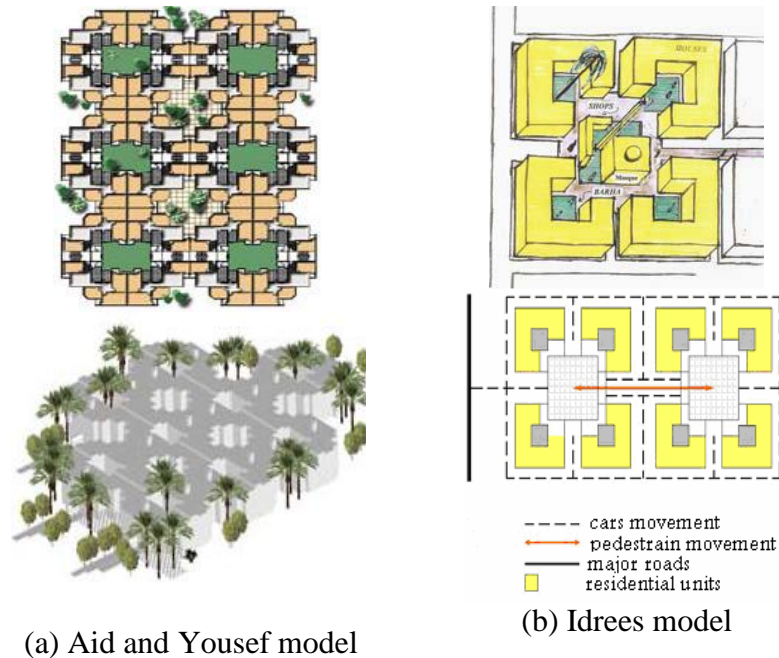


Figure 2-2 Aid, and Yousef and Idrees models for housing estate pattern

2.1.6. Residential Building Design

The house represents the nuclear in the housing neighborhood. A detailed review in houses types will be conducted in order to reach the suitable low cost housing building type.

2.1.6.1. Building Types

There are three distinct apartment building types: row houses (1-3 floors- one apartment), walk-up apartment (3-5 floors- more than 2 apartment), and elevator apartment (more than five floors- more than 2 apartment). Walk-up apartment buildings are the best solution for the low-cost housing over the world due to the optimal use of the land [Al-Absi, 2004].

Many researches were studied the two pattern of housing building which include walk-up apartment and row houses in order to reach the economical optimal design. The result of those studies was to use the walk-up apartment buildings in the cities which will be more

economic [Al-Absi, 2004]. This is because walk-up apartment building contains a lot of families while row houses contain one family.

The relationship between building patterns and the economic effectiveness was studied by many researchers. The result was that the most economic pattern is the collective rectangular pattern with small elevation at the street and the height of building not more than five stories in order to reduce the direct cost and maintenance cost (electromechanical units) which appear from using more than five stories [Al-ahwal, 1979 and Al-Absi, 2004]. Also, storey height in the building was studied, in order to reach the optimal storey height. Reduce 10cm from the height of the storey lead to reduce the building cost by 1.5% at Saudi Arabia residential building [Al-Absi, 2004]. The same rate is also applicable at Palestine. Table 2-3 illustrates the storey height standard at some of the world countries for low cost housing.

Table 2-3 Storey height at some countries for low cost housing (m)

country	Libya	Egypt	France and England	USA	Holland
Net height	2.8	2.6	2.2-2.6	2.4	2.5-2.8

2.1.6.2. Walk-up Apartment Design

The governmental institutions of Egypt defined low cost housing that consists of 1 - 4 rooms and the area is between 40-75 m². Some institutions in the world countries defined criteria for low cost housing as follows: [Islamic Group, 1976, page 61 to 65 - Ali, 2003 and Lewes District Council, 2003]

1. 28% from total number of apartment consist of one bed room, living room, bath and kitchen. The area of this apartment is 30-50m².
2. 48% from total number of apartment consist of two bed room, living room, bath, balcony, laundry place and kitchen. The area of this apartment is 40-65 m².

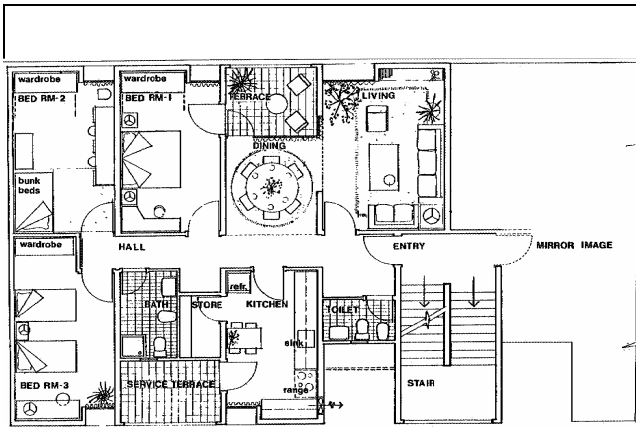
3. 24% from total number of apartment consist of three bed room, living room, bath, balcony, laundry place and kitchen. The area of this apartment is 65-80 m².
4. The minimum sizes for bed room, living room, bath, kitchen and laundry place are 11, 11, 2.3, 2.8 and 1.5 m², respectively. Table 2-4 illustrates the minimum floor areas required for affordable housing.

Table 2-4 Rooms types and its minimum area (m²) for economic design [Lewes District Council, 2003]

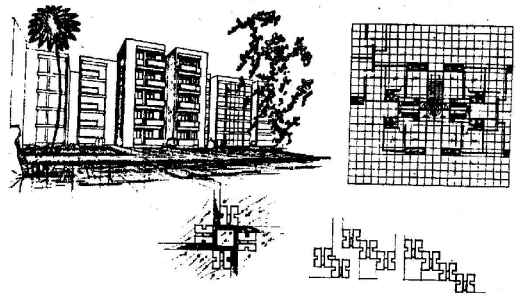
Room Types	Number of People in Dwelling					
	1	2	3	4	5	6
Living Room	13	13	15	16	17.5	18.5
Kitchen	5.5	5.5	5.5	7	7	8.5
Kitchen/Diner	8	9	11	11	12	13
Master Bedroom	8	11	11	11	11	11
Other Double Bedroom(s)	---	10	10	10	10	10
Single Bedroom	---	6.5	6.5	6.5	6.5	6.5

5. Minimum windows area is 10% from unit area.
6. The dwelling area per person is defined as 11-14 m²/person.
7. The main stairs must not connect to the roof and there is no need for installing and build walls to the boundary of the roof.

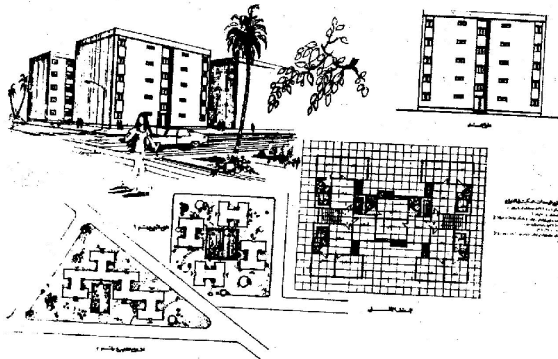
All projects were directed to low income people at the vast majority of Arab countries are five storey wake-up apartment buildings (ground floor + four typical floors), each floor contain 2, 3 and 4 apartments. These projects constructed by using reinforcement concrete skeleton. Some of these projects are pre-cast concrete in order to reduce the cost; the others depend on reducing the open spaces by special model like Aid and Yousef models. Figure 2-3 illustrates some of the low cost housing projects which was implemented and proposed by some researchers at Arab Countries.



Floor plan for a three-bedroom unit
(a) Typical floor plan for Saydiyya project [Morton, and Mqnsted, 1984]



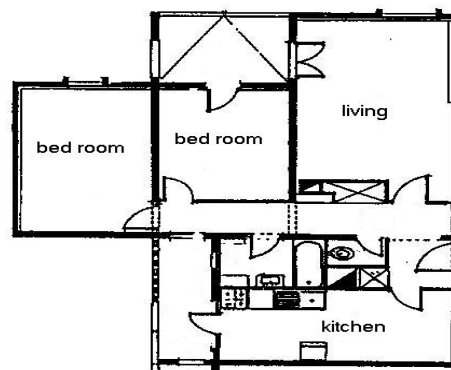
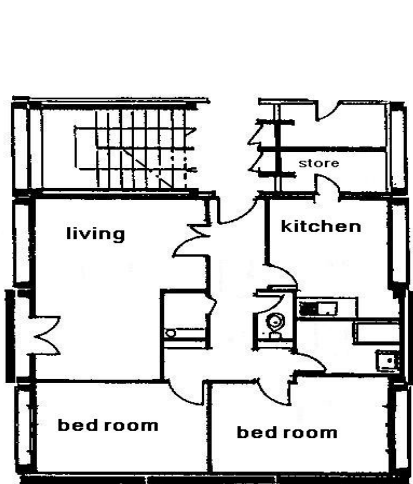
(b) Low cost housing project at Egypt. [Islamic Group, 1976]



(c) Low cost housing project at Egypt. [Islamic Group, 1976]



(d) Typical floor plan for the proposed prototype [Aid and Yousef, 2004]



(e) Low cost housing project at Algeria. [Behloul, 199]

Figure 2-3 A group of low cost housing project at some Arab countries

So, it is highly recommended to design three and/or four apartments per floor because it introduces an economic design that minimizes the use of stairs in the projects.

Resident's reactions have been investigated to the design of their housing environment at Algeria and Egypt. These projects contain buildings which consist of two or three apartment per floor. The buildings were connected together by combined walls system. The apartment ranges from two (65-83.5 m²) to three (93.5 m²) bed rooms. Figure 2-4 illustrates typical floor plans for Algeria projects. The case of these projects allowed the identification of a number of design details that should be avoided in future dwelling design. These are as follows: [Behloul, 1991 and Islamic Group, 1976, page 69]

1. Lack of a proper entrance hall.
2. An entrance door is too close to the guest room door.
3. A toilet is too far to the guestroom.
4. Lack of natural light and ventilation in the toilet.
5. Lack of storage spaces within the kitchen.
6. Kitchen, bathes and living rooms size is very small.
7. It did not consider the relationship between the bedroom number and family size.

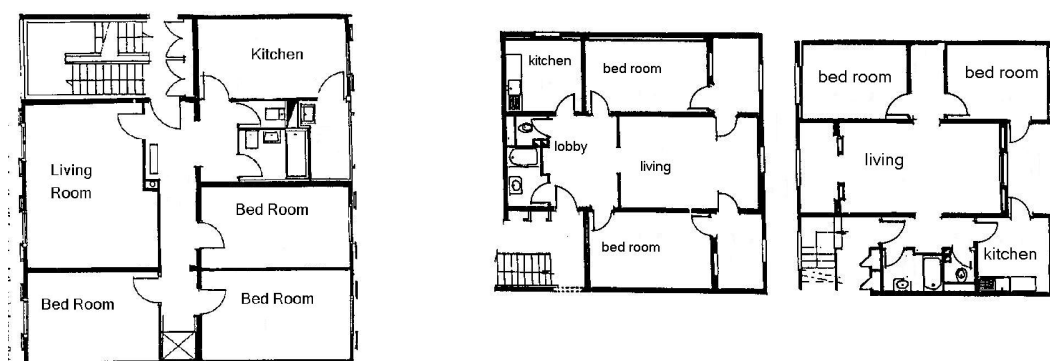


Figure 2-4 Typical floor plans for Algeria projects [Behloul, 1991]

Behloul, 1991 results about the spaces size within the dwelling that increase the satisfaction of the residents was as follows:

1. The kitchen size 12 m² is very likely to be satisfactory.
2. The guest and living room size 12 m² is very likely to be satisfactory.
3. The main bed room size 16 m² is very likely to be satisfactory.

In conclusion, it is clear that, the apartment cost have a direct relationship with its size. The increasing of apartment size leads to increase total apartment cost. So that, reducing apartment size arrangement for reducing houses cost is not suitable for Palestinian people because it will create a bad residential environment that people cannot live in. The Ministry of Public Works and Housing (MPWH) constructed a wake-up apartment building with 80 m² size for limited income people in Dair El-Balah city, this project was rejected from the residents and the Ministry did not find any one to live in. The suitable apartment area should be related to family size, so that, the proposed area per person is 13-14 m²/person for low cost housing in Palestine. The family with four person needs 56 m² apartment unit, the family with 6 person needs 84 m² and the family with 8 person needs 112 m².

2.1.6.3. Consider Module Size in the Design of Residential Building

In New Zealand many materials are sized as multiples of 600mm. So if you design to a module of 300 or 600mm fewer material need to be cut, they are easier to fit, and there is less waste-the over all cost of house can be reduced significantly. In Egypt, a module of 300 or 600 mm is used also in designing housing building.

2.1.7. Palestinian Experience

Because of the acute shortage of housing in Gaza, resulting from a high birth rate and the returnees of Palestinian after the peace agreement between Palestinian Liberation Organization (PLO) and Israel in 1993, a number of housing programs have been launched since 1994, providing the urban population with dwellings and housing facilities outside

and inside the existing urban perimeters. Before 1994, there were no national housing institutions except Palestinian Housing Council (PHC) which was established at 1991 working to contribute in solving housing problem in Gaza Strip and West Bank. Following the establishment of the Palestinian National Authority (PNA) in Gaza / Jericho, Ministry of Public Works and Housing (MPWH) was established in 1994. PHC, MPWH and private sector are the main players working to solve housing problems in Palestine. So, the projects which will be reviewed represent the three player's efforts to solve the problem.

A total of five housing projects have been launched by the PHC in Gaza Strip between 1994 and the beginning of the 1997. Two representative projects have been selected from those five for examination in the present study. The selection has been made according to the location and the size of the projects. The two projects have been selected from the largest projects; El-Karma Project with 416 housing units, and the Ain-Jalout Project with 320 housing units [El-Karama towers file-General, 1995 and Ain-Galout towers file-General, 1994]. The two projects are located in the suburbs of Gaza City within a maximum distance of 18 km from the city center. El-Karma Project locates at the north of Gaza City and the other project locates at the south of Gaza City.

A lot of housing projects have been launched in Gaza Strip between 1994 and the beginning of the 2005, which was implemented by the MPWH. Four representative projects have been selected from those projects for examination in the present study. The selection has been made according to the location and the size of the projects. The four projects have been selected from the largest projects: El-Zahra, Austrian, El-Nada and Sheikh Zayed Projects. These six projects concluded Palestinian housing experience during the previous eleven years. The previous factors will be reviewed individually for Palestinian experience beginning with the factors related to housing environments.

2.1.7.1. Sub-division Planning and Land Use Density

In general, international standards determined the net density as 12–21 dwelling units/donum for walk-up apartment and escalator building project. From previous data, the net densities in El-Zahra, Austrian, El-Nada, Sheikh Zayed, Ain-Jalout, and El-Karama Projects are as shown in table 2-5.

Table 2-5 The net densities in the selected projects (apartment/donum) [MPWH files]

	Zahra	Austrian	Nada	Sheikh Zayed	Ain-Jalout	Karama
Net density	10.5	11.75	12	11.25	42	37.25

Table 2-6 and Table 2-6* illustrates zoning classification and the condition which must be considered by the developers at El-Zahra city.

Table 2-6 Zoning classification and its conditions at El-Zahra city [MPWH files]

Zoning classification	R1	R2
Minimum lot area for the unit (m²)	500	1000
Minimum lot width (m)	20	25

Table 2-6* Zoning classification and its conditions at Gaza city [Ministry of Local Authority]

The zone	Minimum area of the plot (m ²)	Built up area	Maximum floor number	Maximum height (m)	Set back		
					Front	Side	Back
R a	400	50%	3	12	3	3	3
R b	250	60%	5	20	3	2	2
R c	250	80%	5	20	2	1	1
Towers	1000	50%	-----	1.5 street width	-----	At least 3 m	At least 3 m
R A	5000	5%	2	8	5	3	3
A R A	2500	10%	2	8	5	3	3

R a: Residential a **R b:** Residential b **R c:** Residential c **R A:** Agricultural Resident

A R A: Assistant Agricultural Resident

This classification is not suitable for low cost housing.

2.1.7.2. Streets, Sidewalks, and Parking Network

In general, streets and parking area percentages are high in all previous project except Austrian, and El-Nada projects. These percentage ranges from 11.9% to 49.7% of total area as shown in Table 2-7. In addition, the sidewalks width is in average not less than 2.5–3 m.

Table 2-7 The site elements areas of the previous projects [MPWH and PHC files]

	Zahra	Austrian	Nada	Sheikh Zayed	Ain-Jalout	Karama
Project area (m²)	173847	22100	153118	428872	22436.4	22127
Streets and parking %	30	11.9	18.82	24	32.3	49.7
Services land area %	11.7	24	16.6	20.6	0	0
Open spaces and sidewalks area %	26.5	39.4	45.9	44.2	44.8	22
Build area %	31.8	24.7	19.15	11.2	22.8	28.3

2.1.7.3. Open Spaces and Landscape

The average of open spaces areas percentage is approximately 37.1% at these projects as shown in Table 2-7. The cost of site works at El-Karama and Ain-Jalout projects represents 10 and 9.7% from total cost of the project. The site works elements are the following:

1. Water network which represent 2% from site works cost.
2. Sewage network which represent 19% from site works cost.
3. Trees, plant and grass which represent 4% from site works cost.
4. Lighting network which represent 30% from site works cost.
5. Seats and kids playground (furniture) which represent 10% from site works cost.
6. Streets, sidewalks and parking works which represent 35 % from site works cost.

For creating low cost housing projects, saving must be done to the plants and furniture elements. This saving will not be less than 50% from plants and furniture cost.

2.1.7.4. Housing Estates Patterns

Table 2-8 illustrates the characteristics of the projects especially housing estate patterns and planning scheme.

Table 2-8 The characteristics of the selected projects [MPWH and PHC files]

	El-Zahra	Austrian	El-Nada	Sheikh Zayed	Ain-Jalout	Karama
Owner	MPWH	MPWH	MPWH/ *PS	MPWH	PHC	PHC
Designer	MPWH	MPWH	**C.O.	**C.O.	**C.O.	**C.O.
Householder	***L.I.	***L.I.	***L.I.	***L.I.	***L.I.	***L.I.
Planning scheme	network	-----	Cluster	-----	-----	-----
Housing estate pattern	Row with detached building	Nodal with detached building	Linear and Nodal with combined building	Nodal with detached and combined	Nodal with detached building	Nodal with combined building

(*Private sector – **consultant office– ***limited income)

In general, the housing estate patterns used in the previous projects is Nodal estate pattern.

This pattern was used with detached housing building.

2.1.7.5. Residential Building Design

The characteristics of residential building in the previous projects are shown in Table 2-9.

The typical buildings designs are shown in Figure 2-5.

Table 2-9 The apartment spaces areas at previous project [MPWH and PHC files]

Project	Building type/ apartment per floor	M. BR	BR 1	BR 2	Kit.	LR	GR	Apartment area (m2)
El-Zahra	5 stories four apartment	15.1	11.2	11.2	10	15.4	11.2	110
Austrian	5 stories four apartment	12.9	12.9	10.5	7.4	19.9	0	96
El-Nada	5 stories- four apartment	10.7	10.5	8.8	8.2	21	0	91
Sheikh Zayed	5-12 stories 2-3 apartment	11.9	11.5	11.1	10	13.9	16.8	110
Ain- Jalout	9 stories four apartment	16.4	12.9	10.5	11.9	8.2	13.6	116
El- Karama	9 stories four apartment	15.8	10.9	10.9	10.5	11.9	10.9	112

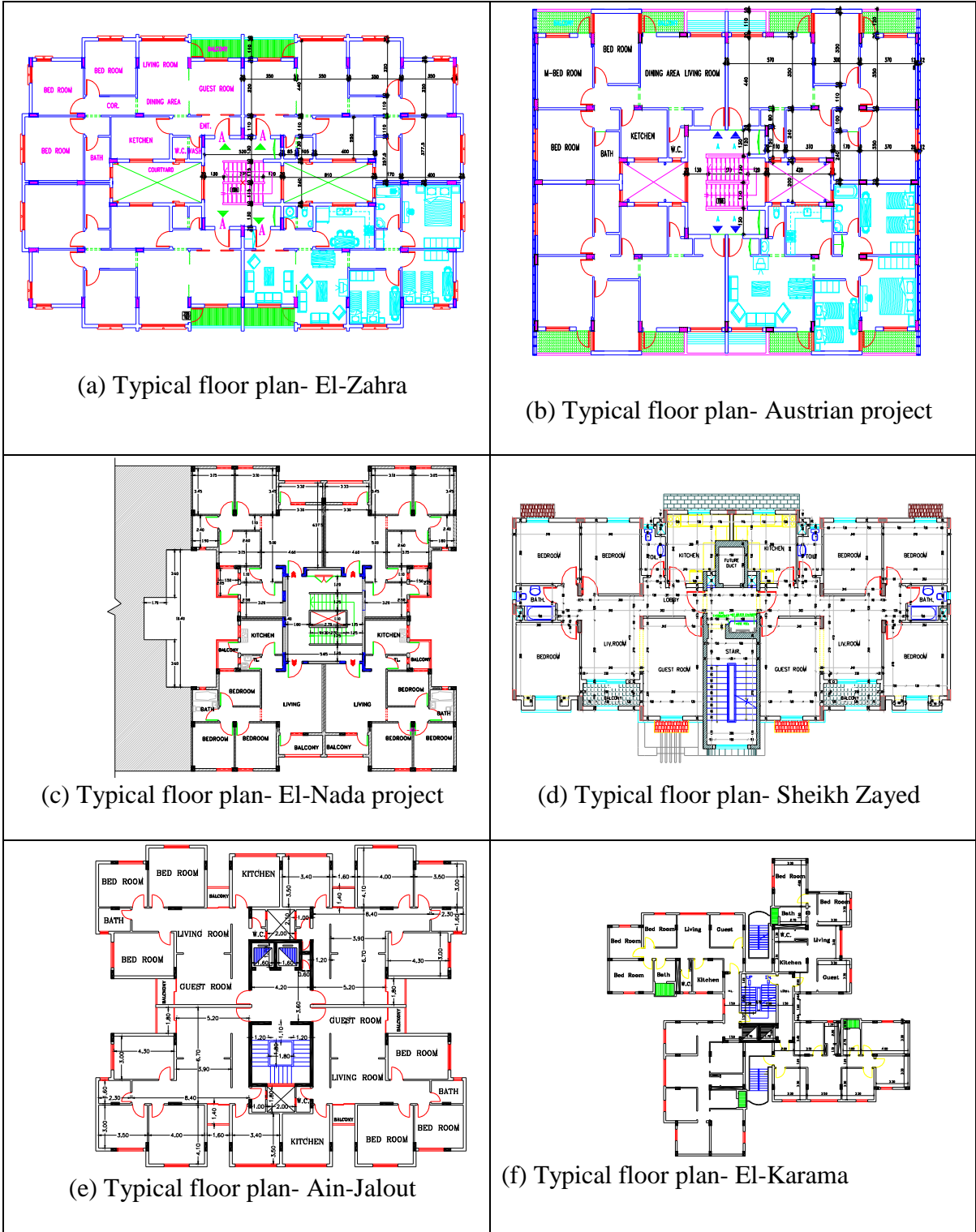


Figure 2-5 Typical buildings designs at previous projects [MPWH and PHC files]

During an investigation about the spaces and apartment areas in PHC projects, the results of that study as follow:

1. The kitchen size 12-15 m² is very likely to be satisfactory.
2. The guest and living room size 14-16 m² is very likely to be satisfactory.

3. The main bed room size at least 14-16 m² is very likely to be satisfactory.
4. Average family size is 7 people.

The net floor height in the previous projects is 2.85 m. The building construction cost represents 73 – 78% of total cost of the projects [Project data file-PHC].

2.2. Construction Industry

2.2.1. Construction Methods

There are several structural alternatives to the cast-in-place reinforced concrete structures (traditional method), including, steel structure, and modern methods of construction such as pre-cast concrete (panels and modules). Versatility of form, durability, fire resistance, speed of construction and the low cost are the main advantages for reinforced concrete structure. The two types of concrete structure (cast-in- place and prefabricated) will be reviewed in order to reach the optimal method which will be suitable for low cost housing.

2.2.1.1. Cast-in-place Concrete Structure

This system consists of the following elements:

1. Floor and roof systems.
2. Exterior and interior walls.

These elements will be reviewed in the following.

Floor and Roof Systems

Reinforced concrete floor and roof systems can be classified as one-way systems and two-way systems. Systems of each type can be identified in the following list: [Nilson et al, 2004, pages 600-601]

1. One-way slab supported by monolithic concrete beams.
2. One-way slab supported by steel beams.
3. One-way slab with cold-formed steel decking.

4. One-way joist floors (ribbed slab).
5. Two-way slab supported.
6. Beamless flat slabs with drop panels.
7. Flat plate slab.
8. Two-way joist floors.

Flat plate slab and one-way ribbed slab without shallow beams have been found to be economical and otherwise advantageous for such uses as apartment buildings, where the spans are moderate and loads relatively light [Barry, 1976, page 69-74 and Nilson et al, 2004, pages 605 and 609]. In addition, one-way ribbed slab without shallow introduce a good solution for the architect engineer to easily divide the spaces without any consideration for the drop beams and it is good for isolation, noise, etc. So that one-way ribbed slab without shallow beams is the most suitable methods for introducing low cost housing.

Exterior and Interior Walls

As a general rule, the exterior walls function is to enclose the building spaces. Such walls are called panel walls. They may made of concrete, concrete block, cement block, tile brick, or insulated metal panels. The interior walls function is to enclose the interior spaces. Such walls are called partition walls. It is believed that, fair face cement block which proposed for reducing the cost of houses is introducing a good solution for low cost housing. This method neglects the exterior and interior plaster in addition to the external and internal paint [see Silva, 2002].

2.2.1.2. Pre-cast Concrete Structure

Pre-cast concrete construction members are manufactured off site in pre-casting yards, under factory conditions, and subsequently assembled on site. This system consists of the

following elements: Floor and roof systems and Exterior and interior walls. These elements will be reviewed in the following.

Floor and Roof System

Any saving achieved in floor/roof considerably reduce the cost of buildings. Some of the prefabricated roofing/flooring components found suitable in many low-cost housing projects as seen in Table 2-10 [Adlakha, and Puri, 2003].

Table 2-10 Saving in prefabricated floor/roof cost comparison with traditional

Floor/roof system	Saving comparison with traditional
Pre cast RC planks	25%
Pre cast hollow concrete panels	30%
Pre cast RB panels	25%
Pre cast RB curved panels	20%
Pre cast concrete/ferrocement panels	25%
Pre cast RC channel units	14%

New systems were proposed for pre-cast slab which leads to reduce the cost of houses by reducing the amount of reinforcement steel and neglect the shuttering frame for slabs. This system depends on uses pre-cast ribs with " T " shape and this ribs supported by bearing walls which look like building system number five at Jordan. This system can use only in the row houses which height doesn't exceed 2-3 floors and the structure depends on bearing walls. This system decreases the amount of steel to the half and neglect shuttering frame compared with traditional way. In addition, it can be effective in creating houses at rural areas but it doesn't effective in urban areas especially at Gaza Strip which need walk-up apartment building. Bearing walls system is costly in Gaza Strip especially when using brick stone. [Abas et al, 2005 and Bakeer, 2001].

Walls

Medium and large panel techniques have not proved economical for low rise buildings as compared to traditional brick work [Adlakha, and Puri, 2003]. Some panels have wiring

and plumbing already inside them, making construction even faster. Wall panels are used either as curtain walls attached to columns and beams or as bearing walls. Ready-made rooms are used most frequently for bathrooms or kitchens, where all the fittings are added in the factory. Many of the benefits of using prefabrication for housing are as yet unproven or contentious.

However, the main advantages and disadvantages of prefabrication illustrates in Table 2-11. [Wing and Atkin, 2003 - Adlakha, and Puri, 2003 - Nilson et al, 2004, pages 617 and 618– and Ibraheem, 2004]

Table 2-11 Pre-cast floor/roof system advantages and disadvantages

Advantages	Disadvantages
1- Reduced weather impact on scheduling	1- Extra reinforcement is required to take care of handling and erection stresses
2- Reducing, the cost of the mould	2- Temporary props may be required
3- Saving in shuttering cost	3- Extra steel is required to prohibit cracks
4- There is saving of time	4- Requires highly skilled labor
5- There is better quality control	5- Higher costs for factories and train staff
6- Increased productivity	6- Poor public acceptability
7- Reduce defects and clean	7- Research found prefabricated industry to be more energy efficient, but there was no significant evidence of waste and transport reductions
8- Early return of investment because of the earlier occupied of houses.	8- Inflexibility of factories in responding to fluctuating demand
9- Fewer accidents	9- The greater cost of transporting pre-cast units

Current practice emphasizes the use of hard connections that provide a high degree of continuity [Nilson et al, 2004, pages 627]. Cast-in-place concrete method achieve the continuity which is required for protect the structure from lateral forces. For all reasons above, cast-in-place method has more advantages than pre-cast concrete. The research aims to reduce houses cost, so that this item will be widely reviewed in the following.

2.2.1.3. Cost

Although some house builders argue that prefabricated industry is less expensive than traditional methods, industry sources indicate increased costs of around 7-10% [Adlakha, and Puri, 2003]. Mqnsted and Percinel, 1984, indicate in a comparison made in Denmark that total price difference between cast-in-place and pre-cast concrete is equal to 9.7% to the advantage of pre-cast building method. Al-ahwal, 1979 conducted in comparison study between bearing walls, cast-in-place and pre-cast concrete systems for low cost housing as shown in Table 2-12.

Table 2-12 Comparisons between structural systems [Al-ahwal, 1979]

systems	Equipments cost	Labor cost	Total cost	Economical effective
Bearing walls	low	high	moderate	2
cast-in-place	moderate	moderate	low	1
pre-cast concrete	high	high	high	3

In general, the saving in the total direct cost is variable from one country to another. Table 2-12 reflects the situation in the Arab countries which found cast-in place is more economical than others. This is due to the high cost of equipment, factories, and labors in addition to the low demand for pre-cast system. So that, using cast-in place concrete system is highly recommended in Palestine because of the previous reasons in addition to the lack of experience in using other techniques.

2.2.2. Procurement Systems and Project Organization

Procurement systems and project organization provide the framework for implementation and development of projects. Housing delivery is affected by the poor performance of the construction industry [Chege, 2001 and Oladapo, 2001]. Contractual arrangements will be reviewed in order to reach and proposed a method which will be suitable for lowering the cost of houses.

2.2.2.1. Contractual Arrangement

Design/Bid/Build (Lump-sum-A unit-price-A negotiated cost-plus-fixed-fee)

This method requires teamwork among the three principal contracting parties as follows: Owner team- Designer team- Contractor team [Barrie and Paulson, 1992, page 27]. This method has advantages and disadvantages as seen in Table 2-13.

Table 2-13 Design/Bid/Build advantages and disadvantages

Advantages	Disadvantages
1- Minimal involvement of the owner is required in the construction process	1- Over all design-construct time is usually the longest
2- The owner knows the project approximate cost before commencing construction.	2- The owner is often in an adversary position with the general contractor.
3- minimize mistakes in design	3- Changes can be expensive at site work.

Design/Build [Oberlender, 1993, page 16-18]

It is a two party arrangement between the owner and the Design/Build firm. This method has advantages and disadvantages as seen in Table 2-14.

Table 2-14 Design/Build advantages and disadvantages

Advantages	Disadvantages
1- Shorten the time required to complete a project. Reduce claims. Establish cost	1- This method requires extensive involvement of the owner for decisions that are made during the selection of design alternatives and the monitoring of costs and schedules during construction.
2- Provide flexibility for the owner to make changes in the project during construction.	
3- Minimal owner coordination is needed between construction, design, and other project element. Single-point responsibility. Construct ability	2- The selection of the engineer/contractor firm is not easy and requires definite criteria.

Construction Management (CM): [Barrie and Paulson, 1992, page 27]

The construction management contract is a four party arrangement involving the Owner, Designer, Construction Management and Contractor firms. This method has advantages and disadvantages as seen in Table 2-15.

Table 2-15 Construction Management advantages and disadvantages

Advantages	Disadvantages
1- Little conflicts between the owner & designer.	1- Finish the project early may leads to insufficient trade-of
2- Full time coordination is available between designer & contractors.	2- Success of the program depends greatly of professional construction manager.
3- This method leads to shorten time.	3- Professional construction manager does not guarantee either price or quality.
4- The cost will be low by the value engineer.	4- Doesn't give clear image about the cost.

In general, all previous methods are not suitable for introducing low cost housing project. So that, develop new model is required to reach the requirement of low income people by reducing the total cost of houses. Generic model of procurement system for low cost housing was proposed by Oladapo, 2002 as shown in Figure 2-6 [Oladapo, 2002, and 2005 المقرحي، وآخرون]. Jordanian institution proposed also a model which depends on the householder participation in the execution phase.

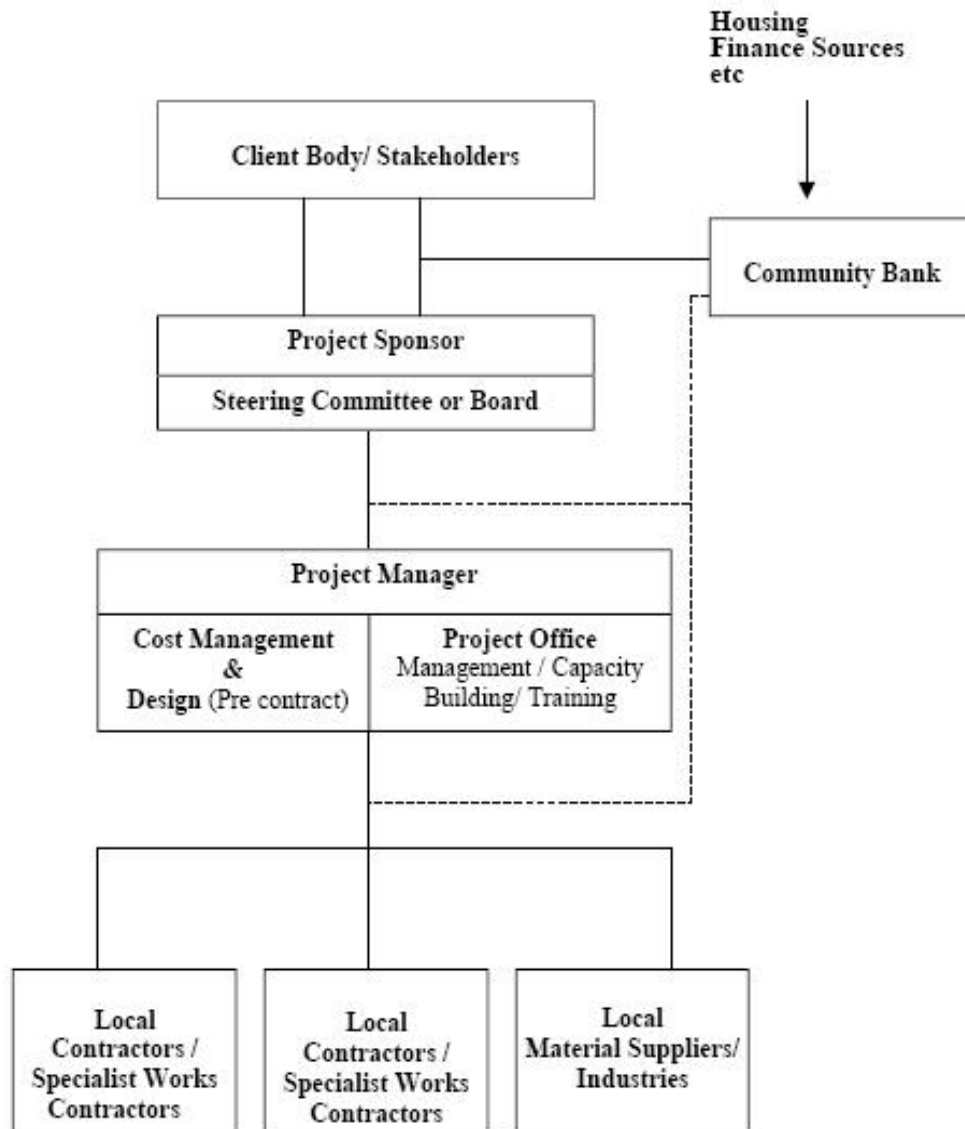


Figure 2-6 The contractual parties' relationship at the proposed model

Figure 2-6 illustrates modified traditional procurement approach as follow:

1. Individual project sponsor representing the client body and stakeholders.
2. Individual client project manager providing single point authority and communications and instant decisions.
3. Cost and contract management responsibility.
4. Design responsibility for pre-contract stage.
5. Local contractors.
6. Local specialist or trade subcontractors.

2.2.3. Experience in Palestine

Construction industry percentage in contribution to Gross Domestic Percentage (GDP) by economic activity in Palestine Territories at constant prices, 1999-2002 is 13.4, 6.5, 5.1 and 2.7%, respectively [Central Bureau of Statistics, 1998]. These rates began to decrease from 1999-2002 because of the second Intifada¹ which was begun at 2000. 14.4 and 9.3% are the labor percentage working at construction industry with proportion to total workers at West Bank and Gaza Strip [Palestinian Central Bureau of Statistics, 2005].

Currently, concrete structure system is the only system exists at Palestine for constructing houses. Cast-in-place concrete is the only system used in constructing houses at Palestine. Ribbed slab approximately have been found to be the most used construction system at Palestine for constructing houses. In the past, the vast majority of roof and floor system used was solid slab with drop beams. Panel walls at Palestine made of cement hollow blocks. Partition walls which used are cement hollow blocks with small thickness.

Design/Bid/Build arrangement is the most used method in Palestine. This method defined as traditional contractual method.

2.3. Utilization of Local Building Materials

The high cost of building materials is another factor that results in reducing housing affordability for low-income people. Building materials may represent about 40% of the total construction costs for a house in developing countries in the Middle East [Shadid, 1997]. The effective use of building materials would help to reduce building costs and improve affordability to people. Many cost-reduction options of building materials exist that can be considered by planners and developers. They include the use of local materials more economically and the increasing of their structural efficiency. Also, significant

¹Intefada is a popular revolution against the Israeli occupation - demonstrations and strike.

improvement in efficient use of conventional materials such as reinforced concrete can be made.

Abas, 2002, Khulwsi, 1993, Shafai, 1988, and Palestinian institutions (MPWH and PHC) determined the percentage of the various item costs that executed in different projects in Egypt, Saudi Arabia and Gaza Strip. These percentages illustrate in Table 2-16.

Table 2-16 the percentage of various item costs at Palestine and some Arab countries

Item	Egypt		Saudi Arabia	Palestine	
	Shafai	Khulwsi	Abas	MPWH	PHC
1- Excavation and back fill	0.42	0.5	2.1	0.00	1.1
2- Foundation	6.01	0.00	5.1	0.00	0.00
3- Skeleton framework	28.96	38.5	13	33.44	36.2
4- Masonry work	9.96	7.00	5.3	5	11.4
5- Insulation work	0.87	0.5	1.5	7.07	1.2
Total (1-5) civil works	46.22%	46.50%	27%	45.51%	49.9%
6- Interior plaster	12.3	3.5	4.1	3.18	4
7- Tilling	7.85	12.5	7	9.33	11.5
8- External cladding	0.00	1.5	3.9	0.00	0.00
9- Exterior plaster	6.55	3.5	2.3	0.00	1.5
10- Windows	2.25	0.00	3.5	2.65	4.1
11- Doors	6.95	18.5	3.5	7.97	7.6
12- Interior paint	2.08	1.5	2.7	9.07	4
13- exterior paint	0.00	0.00	1.7	0.00	1.5
14- Others	0.00	3.5	8.7	1.1	1
Total (6-14) architectural works	37.98%	44.5%	37.4%	33.3%	35.2%
15- Electrical works	2.24	1.5	8.8	6.74	6.2
16- Sanitary works	8.27	9.5	9.3	0.00	8.7
17- Mechanical works	5.25	0.00	10.1	14.45	0.00
18- Others	0.00	0.00	7.4	0.00	0.00
Total (15-18)	15.76%	11%	35.6%	21.19%	14.9%

From Table 2-16, it is clear that there is a big difference between the percentage in Egypt, Saudi Arabia and Palestine. For example, the civil works percentage in Egypt, Saudi

Arabia and Palestine is 46.4%, 27% and 47.7, respectively. The finishing level, construction type, construction technique used, and material used are the factors that affect the differences in the results between these countries. It is clear that the skeleton and masonry works at Palestine represent on average 43% from total cost of the building works, in the same time the finishing works represent 57% of total cost of the building works. These percentages elaborate the importance of finishing materials in reducing the total cost of houses.

One of the most important items in reducing the cost is the use of local building materials. Many researches conducted and proposed new methods in construct houses by the use of local materials. For example, the use of clay block to create bearing walls at Egypt and other countries in order to reduce the cost of houses [Al-Rafi, 2004 and Houben, 1994]. These systems are not applicable at Palestine due to the absence of the indicated material and the less effective of the proposed structure for row and wake-up apartment building, this structure depend on bearing walls.

Other researchers conducted in reducing the use of expensive materials such as reinforcement steel at the slabs and roofs by using pre-cast elements [Abas et al, 2005]. These methods depend on using bearing walls which is not applicable in Gaza Strip. In addition, some researchers used the bamboo and palm trees instead of reinforcement steel in the slabs and roof. These researches were concentrated on Africa and South America countries. Other researches conducted in using recycling plastic pet bottle panels with the concrete. Also, these methods are not applicable at Palestine.

2.3.1. The Available and Used Material in Palestine

As with most activities in the Palestinian territories, the building materials industry suffers from restrictions on expansion, from heavy taxation and from Israeli competition. In

addition, the Israeli refusal to grant permits for major factories, e.g. cement, placed a heavy constraint on the sector and made it dependent on imports from and through Israel. However, Palestinians import a large proportion of items, such as Portland cement, steel, aluminum and glass, which are imported from or through Israel [Shadid, 1997]. The Palestinian authority is required to facilitate the arrival of imported construction materials to low-income people by reducing or neglect the taxes. All materials which are used to made the tilling and block is available at Palestine except cement which is exported from Israel, Egypt and Turkish. The main skeleton framework contains reinforcement steel, concrete and cement block which is available at Palestine except reinforcement steel and cement. The Palestinian construction industry produces building materials, including stone, marble, concrete, gravel cement block, terrazzo floor tiles, plastics, PVC pipes, electrical control boards, steel water tanks, aluminum, paint and solar heating equipment. These products use local and imported materials. MPWH conducted on a study about the source of building material which is used in an escalator residential building. The results are shown in Table 2-17.

Table 2-17 Usage percentages for local and import materials [MPWH]

Material Source	Percentage (%)
Inside Gaza Strip	6.00
From West Bank	16.30
From Israel	53.40
From other countries	24.30

2.3.2. Materials Waste in the Construction Industry

Waste defined as any inefficiency that results in the use of equipment, materials, labor or capital in larger quantities than those considered as necessary in the production of a

building. Formoso et al, 1999 also defined waste as any losses produced by activities that generate direct or indirect costs but do not add any value to the product from the point of view of the client.

Waste can be classified into unavoidable waste (or natural waste), in which the investment necessary to its reduction is higher than the economy produced, and avoidable waste, when the cost of waste is significantly higher than the cost to prevent it. The percentage of unavoidable waste in each process depends on the company and on the particular site, since it is related to the level of technological development [Formoso et al, 1999].

Garas and Anis and Gammal, 2003, conducted in a study about the materials waste in the Egyptian construction industry. The result of this study showed that materials waste were one of the most frequent sources of financial waste. The study also, defined the waste types in construction projects as follow:

1. Over ordering/excess
2. Over production.
3. Wrong handling.
4. Wrong storage.
5. Manufacturing defects.
6. Theft or vandalism.

The study showed that timber frame works with an average waste of 13% and sand with an average 9% was the highest percentages of the waste among all materials. While other materials such as reinforcing steel with an average 5%, cement 5%, and concrete 4% were within the acceptable rates: 7% steel, 5% cement is the international rate.

Much of the waste in material seem to occur due to lack of coordination between various specialties on site, and changes to design leading to additional cost wastes to the final project. Uncompleted design and untrained labor were among the most causes of waste

generation. In addition, damage during transportation, and unnecessary people movements pinpointed areas of quick improvements.

In order to improve the waste rate at the construction projects which affect the execution cost, the contractors are required to prepare the following:

1. A waste management plan prior to the execution phase.
2. Regular feed back through kept records (database) about waste rates and their causes from previous projects.

On the other hand, a training program is required for the labor to improve the waste rate.

2.4. Codes, Subdivision Ordinances and Impact Fees

The design and construction of buildings are governed by municipal by laws called "building codes". This is to ensure safety and health of people. Building codes include occupancy, ventilation, fire resistance; design, etc. [Schill, 2004]

Subdivision regulations typically require developers to set aside land for road ways, schools, and parks. Impact fees are imposed to charge developers the marginal costs of services that arise from new housing and its occupants [Schill, 2004]. Permitting processes for development approval tend to be burdensome and excessive, adding to the cost of the development [Morrow, 2001]. Multiple layers of review, lack of clarification as to requirements, and the inappropriate use of discretion are some of the common problems that can be improved through more thorough planning and streamlined process design.

Restrictive and excessive building codes add significantly to the price of housing, lower the level of low-income home ownership, and are identified as some of the greatest barriers to making affordable housing profitable for developers. Several studies have sought to examine the cumulative impact of different types of local development regulations on the cost of housing which found to increase the cost 4.2% to 8.4 % per unit on a home with a

median sales price of \$236000 [Luger and Kenneth, 2000]. Building codes, subdivision ordinances, impact fees and permitting process will be reviewed in the following.

2.4.1. Building Codes

Building codes become regulatory barriers under certain circumstances. For example, some codes require the use of materials or production processes that go well beyond minimum health and safety requirements. According to Listokin and Davvid, 2004, the more quantitative studies suggest that the impact of building codes on price is no more than five percent. Depreciation will reduce the quantity of housing services a given housing unit provides over time. Building codes, therefore, also can affect housing supply by hindering the rehabilitation of buildings. In many jurisdictions, rehabilitation is subject to the same minimum standards as new construction. Therefore, to meet the requirements imposed by newer technologies, entire systems will have to be replaced at great expense. Some states in USA have enacted "smart codes" specifically geared toward rehabilitation with an eye to reducing cost. For example, , the adoption of a rehabilitation code by the state of New Jersey may have reduced costs by between 10 and 40 %, and increased the amount of building renovation activity substantially [Listokin and Davvid, 2004]. A reasonable option for localities to pursue is to develop separate standards and building codes geared only for affordable housing development [White, 1992].

However, building codes ensure a quality of houses (long term) in addition to health and safety. It is highly recommended to ensure these codes.

2.4.2. Subdivision Ordinances

Some of the major areas regulated by subdivision ordinances include infrastructure requirements, lot requirements, and design requirements [National Association of Homebuilders]. If subdivision ordinances establish high minimum standards and excessive

requirements, the price of housing is likely to be affected. Complying with the standards can be expensive for a developer, and the costs may be reflected in less affordable housing [Morrow, 2001- Quigley and Rosenthal, 2004 and White, 1992]. Incentives should either decrease developer's construction costs or allow them to construct additional units. In conclusion; land use incentives that promote affordability is as follow:

1. Density bonuses.
2. Relaxation of zoning/subdivision codes.
3. Direct subsidies to the developer.
4. Exemption from impact fees.

2.4.3. Impact Fees

Impact fees require a developer to financially mitigate for the effects of a development project. Impact fees are allocated mainly to address the effects on infrastructure, water, sewer, and streets, but may also extend to include amenities such as schools, parks, or affordable housing. Impact fees play two conflicting roles in affordable housing policy. Since impact fees increase development costs, developers often pass the costs onto the homebuyers through increased housing prices. On the other hand, impact fees supply localities with a fund of money. This money can potentially contribute to the construction of affordable housing units [Weitz, 1985 and Schill, 2004].

It is highly recommended to spend impact fees on affordable housing, by establishing a housing fund. The localities may allocate funds to non-profit organizations, local volunteer organization, and other agencies to construct affordable housing.

2.4.4. The Permitting Process "Administrative Processes"

The complexity of the procedures consumes an excessive amount of time, and the regulatory delays cost developers money. When a development proposal is tied up in the

permitting process, developers still bear costs: the interest on the construction loans, property taxes, investment opportunity costs, and overhead [May, 2004 and Morrow, 2001].

It is found that the increase in time to obtain a permit is strongly associated with rising land and housing prices. The common flows in permitting processes are:

1. Lack of agency cooperation, communication, and coordination.
2. Unclear directions and instructions for submitting proposals.
3. Procrastination-delay.
4. Excessive and over lapping permit requirements.

An effective ways of streamlining the process is to develop one-stop permitting and to limit the amount of time a locality can take to review a proposal and make a decision. The idea of one-stop permitting is to create a process where developers can obtain and submit all of their permitting applications at one location. It is highly recommended to create one-stop permitting.

2.5. Land Use and Tenure

From previous studies, the land cost represents 40% from total cost of the housing project at Saudi Arabia. Figure 2-7 illustrates the housing project cost elements and its percentage at Saudi Arabia.

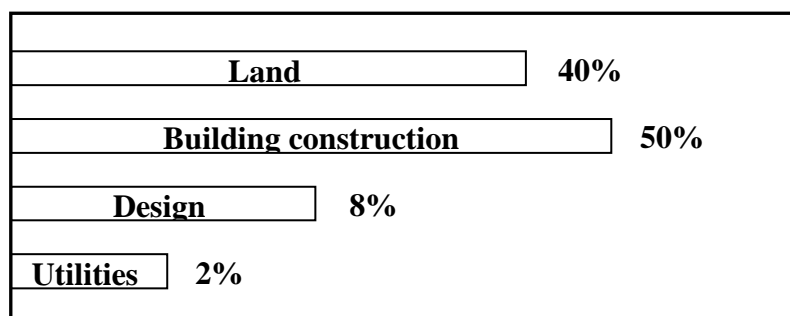


Figure 2-7 The cost elements percentage at Saudi Arabia [Shoblak, 2003]

Both the public and private formal land housing provision systems are unable to respond to the needs of the poor. In fact informal land and housing delivery remains the only realistic option for meeting housing needs of low income households. The informal settlements

characterize between 40% and 50% of most cities in the developing countries. Informal settlements also provide accommodation to 32% to 85% of this population. Availability of land access to cheap land is one of the key factors, which facilitates the proliferation of informal settlements in urban areas in country [Kombe, 2005 and Mathey, 1992 in Roston and Durand Lasserre, 2002].

Land cost is a factor influencing the cost of housing. The cost of land varies a great deal from one place to another. It depends on urbanization status and on the position of the site relative to locality. The cost of land represents one of the most important constraints encountered in selecting site, for low-cost houses especially in Gaza Strip. The options available for locating new development in relation to an existing urban area can be summarized as follows: [Coon, 1997]

- 1- Peripheral expansion of existing towns and villages.
- 2- Intensification of existing development.
- 3- The establishment of new settlements.

International experience suggests that each of these has arranged of advantages and disadvantages as follows: [White, S. Mark, 1992]

2.5.1. Peripheral Development

The outward development of towns in all directions is the most prevalent form of urban expansion. Advantages and disadvantages can be summarized as in Table 2-18.

Table 2-18 Advantages and disadvantages for peripheral development

Advantages	Disadvantages
1- Proximity of new development to existing development	1- Town's services and infrastructure may have little spare capacity, and their expansion may be costly.
2- Economic provision of services and infrastructure	2- Continued outward expansion of nearby towns may result in the towns merging, and hence losing their particular identity.
3- Allow natural expansion of the various social communities	

So that, peripheral development is a good solution for affordable housing, because it provides the cheapest land if it is provided by spare infrastructure capacity.

2.5.2. Intensification

It is achieved by increasing building densities. This could be accomplished by allowing new buildings to be higher, or to cover a larger proportion of the plot, or by replacing existing development with buildings which are higher or cover a greater proportion of the plot. Advantages and disadvantages can be summarized as in Table 2-19.

Table 2-19 Advantages and disadvantages for Intensification development

Advantages	Disadvantages
1- It taking place already in the larger Palestinian towns.	1- The loss of public open space.
2- Pressures for intensification will be increased if alternative opportunities for development are not provided with a consequential increase in land prices.	2- The loss of amenity to adjacent areas.
	3- The inappropriateness of multi-story living to traditional norms and social needs
	4- The harmful impact of high or dense development on the visual character of the town

So that, it is represent a bad solution for a suitable environmental housing.

2.5.3. New Towns

The reasons for establishing them included a desire to relieve congestion, to develop under-populated areas, to establish economic growth poles, to curb the growth of existing cities, and to reduce pressures to develop agricultural land. The scale of future development in Palestine is that the most part of future growth will have to be accommodated in new settlements after the Israel withdrawal. Advantages and disadvantages can be summarized as in Table 2-20.

Table 2-20 Advantages and disadvantages for New towns development [Cheshire, 2004]

Advantages	Disadvantages
1- An efficient structure, with appropriate location and phasing of the main activities.	1- Significant infrastructure costs will be needed.
2- A balanced structure between the workforce and the number of jobs.	2- Financial costs to the community at large including additional policing, education, regional transport infrastructure etc
3- A harmonious environment	
4- Efficient use of roads and infrastructure planned and phased to meet future needs	

For the low income in Palestine, to acquire a piece of land is not an easy task. Available land is always purchased by land speculators who hold for some time only to resell at prices which the low income cannot afford. A lot of new registered housing cooperatives were established in the West Bank and Gaza since 1995 in order to participate in solving land acquisition problem for limited income people. Public land was sold to upper, low, and middle income people registered in housing cooperatives by the Ministry of Public Works and Housing (MPWH) in order to help them to acquire a piece of land which help in reducing the cost of houses. These efforts are still not enough.

The high density at Gaza Strip cities leads to build new cities although it will be costly but the extension of the existing cities will be more costly because of the weakness in the

existing infrastructure and the high price of the land at these cities. So that, the most favored urban strategy is almost certain to be a combination of peripheral development and New towns options.

The use of centers of cities for the construction of low-cost houses may not be vital, considering the high cost of land. However, social problems may arise as a result of allocating separate areas for lower-income people, reducing diversity and integration of population. In order to minimize social problems and to create jobs for low-income people, mixed areas in which people from all income categories live should be developed.

2.6. Use of Suitable Financial Programs

The task of the government has shifted toward enabling the market to operate as efficiently as possible. The most important issue for housing finance policy is that the system be operated in low-cost way, in a form that efficiently and effectively manages the various risks involved, and with a minimum of inefficient subsidy.

From the borrowers perspective there are two dimensions of affordability: the ability to service the loan and the ability to provide the down payment [Lea, and Wallace, 1996]. A number of countries have established savings programs for housing. These programs have been shown to be effective in stimulating aggregate saving as well as creating a pool of long-term funds for housing. The possible financing systems which are directed to low-income housing summarized as follows:

1. Governmental mechanism.
2. Formal financial sector.

2.6.1. Governmental Mechanisms

The starting place for government is to provide the infrastructure and the economic environment conducive to the creation of long term savings and lending. Policies that foster

a well functioning legal system and confidence in the future (from both an economic and social perspective) are likely to be the most important in developing housing finance system. The least effective approach is to subsidize the construction of specific housing units (such as The General Authority of housing and building cooperatives - The governorate and the Ministry of Housing and Reconstruction – Tenant - based assisted housing and Public housing); the most effective is to enable the supply process and to use direct subsidies to the purchasing power of the intended beneficiaries. Enabling the supply process includes improving the flow of funds and risk management for housing finance in order to help the market to work better, not to force or subsidize the availability of finance for housing [ECHR, 2004 - NCSHA, 1995- Lea and Wallace, 1996 - Aref, 2004 and Diamond, and Lea, 1995].

In Palestine, the governmental mechanisms were defined in two ways: the first way was the introducing of direct housing project through public bidding to the contractors or selected investors. By this way, the governmental institutions faced many problems like delinquencies. The second, introducing a subsidy land (site and services) for the cooperatives society members which helped in reducing the total cost of housing by the subsidy of the land price. This approach faced main problem which was the absence of the credits institutions in order to fund the construction of the housing building. So that, this method represents a suitable experience if the governments institutions create financial institutions beside the subsidy of land.

The factors that affect the problem of provide people of low income in Palestine with houses can be as follows:

- 1- Low level of income: The low income people in Palestine does not earn enough to meet the expenses of feeding, clothing, transport to work , etc. There is no room to

think of saving to buy or build a house. Their income will be too low to meet the repayment obligations if they have a loan from banks or their employers.

- 2- High interest rate: In Palestine banks interest rates are as high as 7.5% to 12% for investment in housing projects. It is absolutely impossible for the low income to service any loan at such a high interest rate.
- 3- Human problems: The low income is used to have a large family; polygamy is more rampant among this group. The effect is that so much money is spent on feeding and clothing that nothing can be saved from the income for housing.

2.6.2. Formal Financial Sector Mechanisms

Formal Financial sector mechanisms in financing affordable housing on Egypt, Jordan and USA is defined as follows: [Tewfik, 1997 - Lea and Wallace, 1996 and Aref, 2004]

1. Egyptian Arab Land Bank: The bank has always confined its lending activities to the real estate market, with emphasis on financing (a) the construction of properties, and (b) the purchase of real property. Interest rates are 6% for residential property. Loan terms cannot exceed 25 years and there is no maximum amount of loan.
2. Housing and Development Bank (HDB): The HDB grants medium and long-term loans to companies, Cooperative Housing Societies and individuals to build new housing units. The loans, covering 80% of a property's total price, would be paid back over 20 to 30 years with annual interest rates subsidized at 6% for low-income. The Jordan experience is like Egypt.
3. Affordable Housing Program of the Federal Home Loan Bank Board: This program provides subsidized loans and other assistance to members engaged in lending for the acquisition, construction, and rehabilitation of long-term housing for very low, low-, and moderate-income households at USA.

4. Insurance and Guarantees: One response to the higher credit risk of affordable lending is to find third parties to underwrite such risk. Both private and government mortgage insurance is available for loans that meet the guidelines of the provider. Mortgage insurance provides investors with the benefits of specialization and nationwide diversification.

Risks are always inherent granting use of funds to an unrelated party over a long period of time. These risks can be generally classified into six categories: [Diamond and Lea, 1995]

1. Credit risks: the principal lesson from the North American experience is that a legal system that creates, records, and enforces property rights facilitates housing finance. In addition, experience in the United States and Canada has shown that private mortgage insurance is viable when mortgage contracts are fully enforceable.
2. Liquidity risks: North American experience has been supportive of the proposition that depository institutions, whether commercial banks or savings banks, can provide a good funding base for long term mortgages.
3. Cash flow risks: This includes interest rate risk, prepayment risk, inflation risk, and exchange rate risk. In the absence of bond-funded fixed-rate lending, the major option for managing cash flow risk is with variable rate loans.
4. Agency risk: The North American experience strongly confirms the need for a strong equity backing of risk-taking financial intermediaries. Accounting rules must provide adequate information to investors and regulators, and government supervision must enforce the capital requirements.
5. System risk: In both Canada and the United States, the combination of deep financial markets and liquidity safeguards significantly reduces the likelihood of a system meltdown.

6. Political risk: Developing countries must keep the potential for traumatic political upheaval in mind in designing their systems.

2.7. Concluded Remark

Six cost influencing factors were reviewed by the researcher. These factors are:

1. Planning and design.
2. Construction industry.
3. Codes, subdivision ordinances and impact fees.
4. Land use and tenure.
5. Financing programs.
6. Use of local building materials.

Planning and design factor plays a major role in lowering the cost of houses. The following criteria have been considered in reducing the cost of houses:

- a) Criteria related to site layout elements
 1. Subdivision planning and land use intensity.
 2. Streets, sidewalks, and parking network.
 3. Open spaces and landscape.
 4. Housing estate patterns.
- b) Criteria related to residential building design.
 1. Apartments building types.
 2. Apartment design.
 3. Buildings materials.

The second factor is construction industry which contains two subjects as follows:

1. Construction methods and technique.
2. Procurement methods and organization chart.

These subjects were reviewed and discussed by the researcher to reach the lowest construction and procurement method. There is a need to develop new procurement method to assist in reducing the cost in Palestine.

The third factor is codes, subdivision ordinances and impact fees. This factor insured the use of building codes, high density for low-cost housing projects and spends the impact fees on affordable housing.

The fourth factor discussed the land tenure and the suitable location for low cost housing projects. The most favored urban strategy is almost certain to be a combination of peripheral development and new towns options.

The fifth factor reviewed the suitable financing programs for creating low-cost housing projects. All the efforts concentrated in creating sustainable programs without any governmental subsidy. These programs take into consideration the low-income people circumstances by lowering the interest rate and use long term loans.

The previous criteria have been considered by the researcher in developing an approach for lowering the cost of houses in Palestine. The next chapter discusses the proposed approach in detail.

CHAPTER 3

PROPOSED APPROACH FOR LOWERING THE COST OF HOUSING IN PALESTINE

3.1. Introduction

In this chapter, proposed criteria are described for lowering the housing cost. As well, special criteria are selected in order to create an approach for lowering the cost of housing at Palestine. The approach has been developed to suit Palestinian housing sector while utilizing international experiences. The proposed approach consists of five Phases including:

1. Strategy
2. Planning and design
3. Procurement
4. Execution
5. Evaluation

The selection of these phases has been based on the real life procedure for constructing housing project and the main influencing factors that affects the total cost of the housing project. Figure 3-1 shows the main phases and flowchart approach for lowering the housing cost.

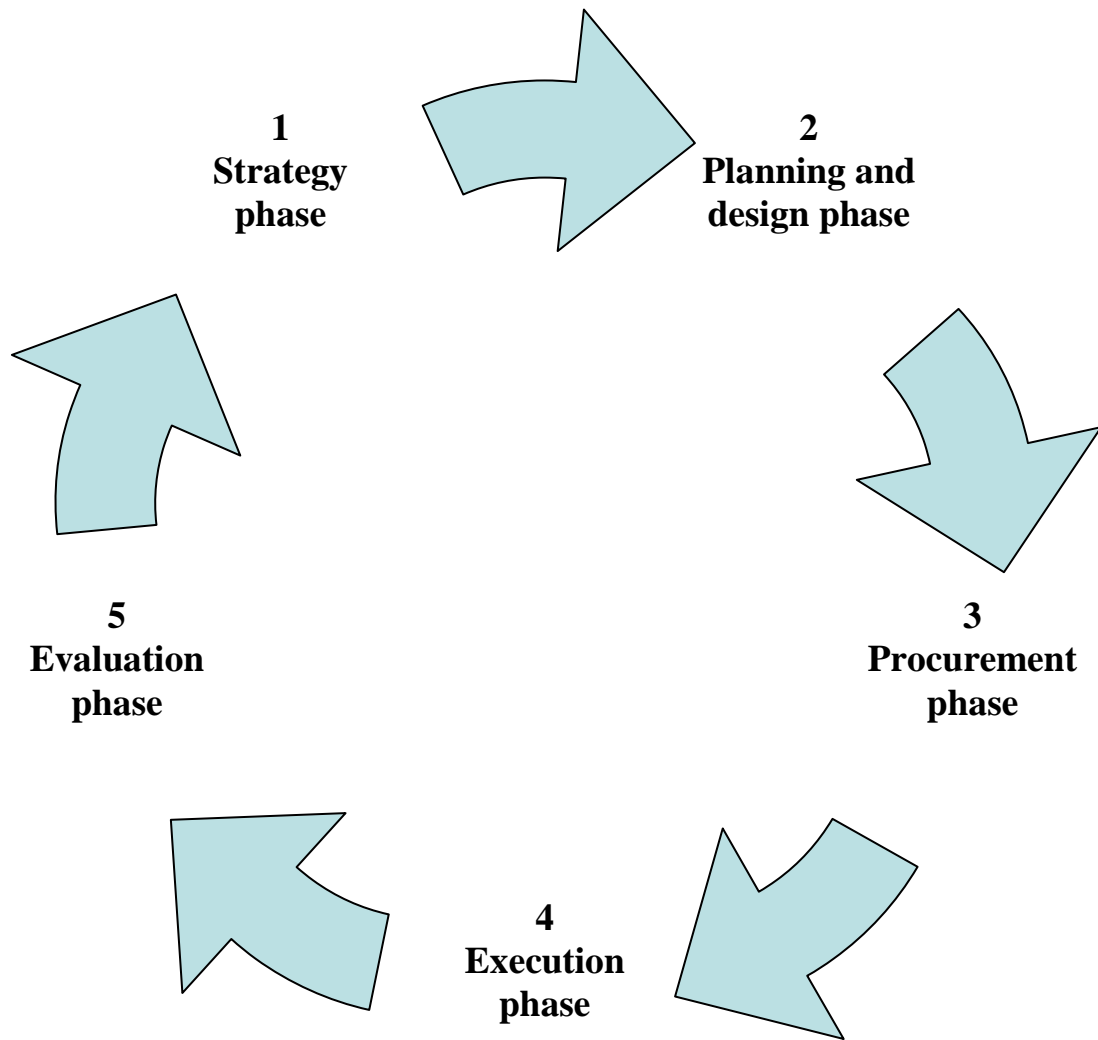


Figure 3-1 The main Phases and approach flowchart

The First Phase "Strategy" is divided into the three parts following:

Part 1. Location has direct impact on housing project cost. The main aim for this part is to look for the cheapest land.

Part 2. The second part aims to find the low cost financing methods, which must be sustainable and inexpensive.

Part 3. The third part aims to find a suitable governmental role in creating low cost housing project. The government can play a huge role in creating special codes and regulation for low cost housing and creating good conditions for facilities

producing housing units by private sector instead of creating direct subsidy for low income people. A subsidy is unsuitable solution because it creates distortion for the housing market where the government cannot create sustainable programs.

Figure 3-2 illustrates the three parts of Strategy Phase.

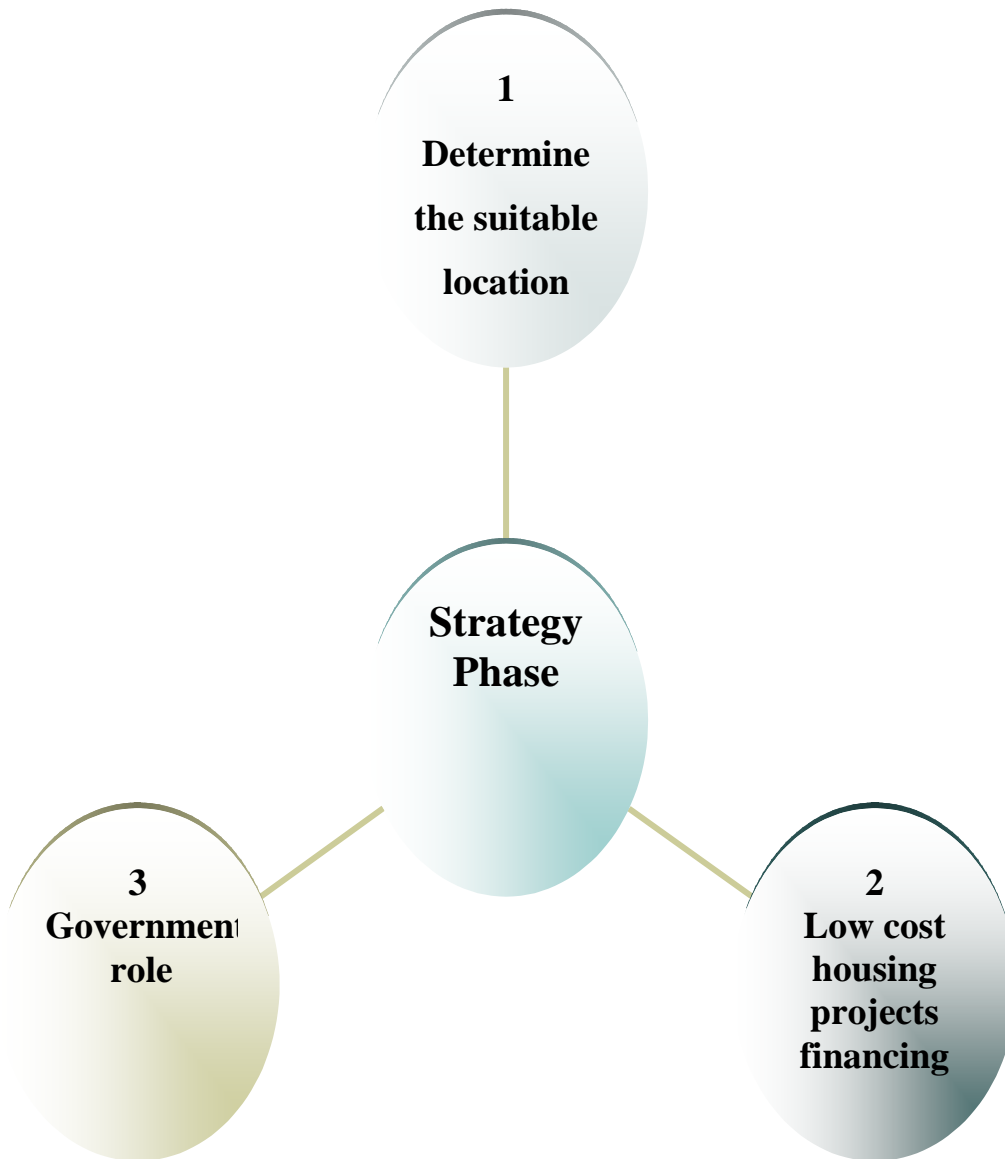


Figure 3-2: Phase1: strategy

The Second Phase "Planning and Design" considers the most important influencing factors of cost. This Phase represents the most important phase in reducing the total cost of housing projects. The cost of elements in this phase is divided into two main categories. The first is site layout elements which include land subdivision and density, open space system, road and parking system and housing estate patterns. The second is building design which includes building design, unit design and finishing materials. This classification for planning and design phase is proposed by the researcher and takes into consideration valuable elements. The researcher simplified the elements in order to reach a suitable solution for lowering the cost of housing projects. Figure 3-3 illustrates the two categories of Planning and Design Phase.

The Third Phase is Procurement. Many alternatives were studied in order to reach the lowest cost procurement method. Each method has advantages and disadvantages. No existing method can satisfy the lowering of the total cost and in the same time satisfy the owner requirements. The researcher has looked for non-traditional method that satisfies the previous objectives. So that, Design/Build method has been selected and developed by the researcher. The main disadvantage for Design/Build method is the low control to the project by the owner or his representative. The researcher proposed a model to satisfy the previous objectives. This model includes more contribution from the owner or his representative by sharing in decisions making in all procurement phase. Figure 3-4 illustrates the Procurement Phase elements.

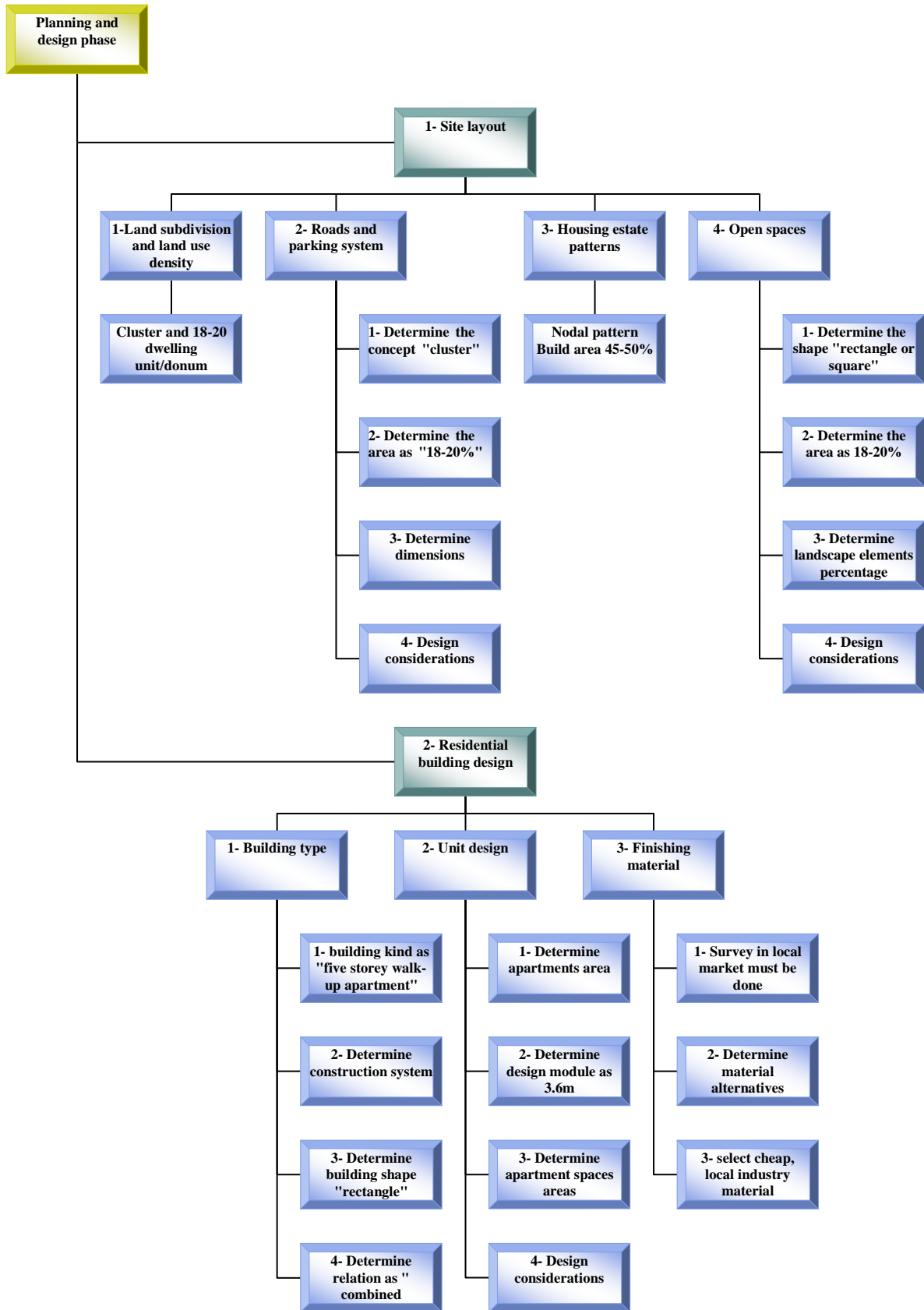


Figure 3-3: Phase2: planning and design

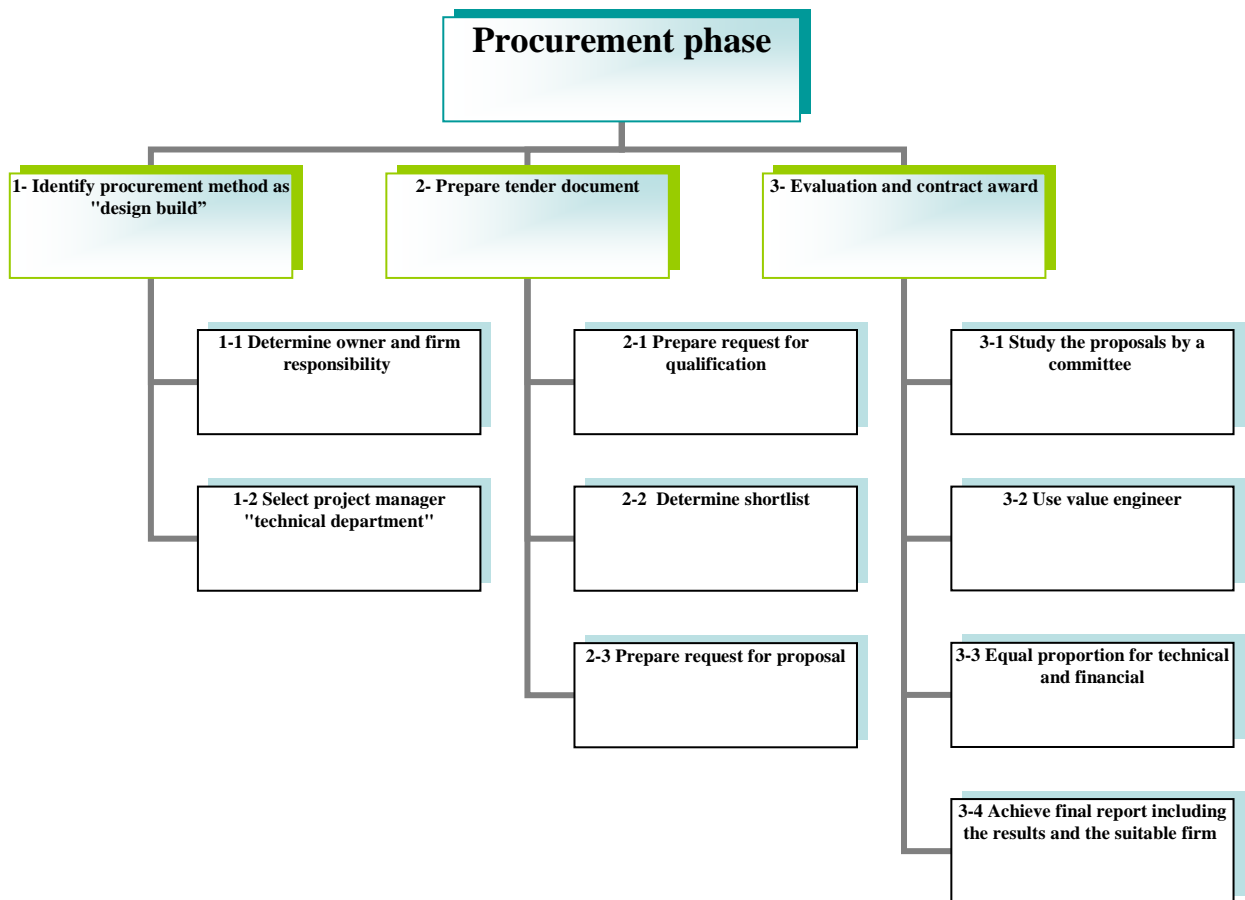


Figure 3-4: Phase3: procurement

The Forth Phase is Execution. In this phase, no way is found to reduce the construction cost but procedures can be taken to prevent any increasing in the cost. The researcher concentrated on the factors which can increase the cost during the execution. These factors can be summarized as follows:

1. Sudden increase in the price of the building material.
2. Differing site conditions.
3. Employer delay of payments.
4. Changing orders.

In addition to the ordinary factors which are included in the construction contract such as contractor responsibility for the project time, banalities for unjustified delay and the reduction of paper works. So that, the researcher proposed procedures for the owner and the contractor in order to prevent any increase to the project budget during the construction phase such as “creating good schedule, creating good relationship, facilitates contractor's payments, etc”. Figure 3-5 illustrates the Execution Phase elements.

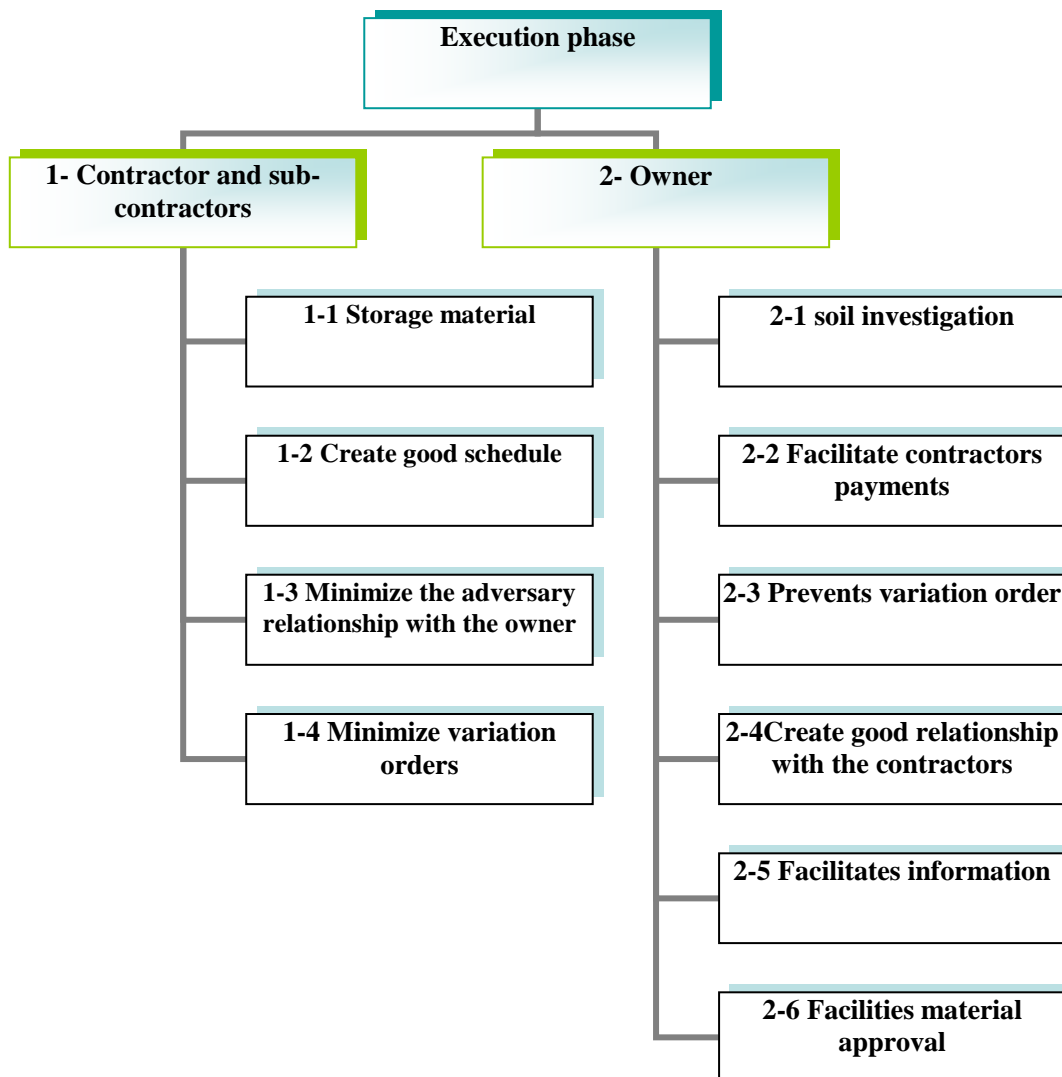


Figure 3-5: Phase4: execution

The Fifth Phase is Evaluation which integrated with all above phases. The Evaluation Phase is a major phase for this approach. The researcher has used the Evaluation Phase to satisfy the following steps:

1. Evaluate each individual Phase at the end of the Phase in order to solve any problem that developed during implementing of the Phase.
2. A comparison between the planned and the actual project cost will be reported after the completion of the project in order to define mistakes in order to avoid it in any new projects.
3. Post occupancy evaluation must be done after two to three years from the completion date in order to measure the satisfaction of the residents.

Figure 3-6 illustrates the main elements for Evaluation Phase.

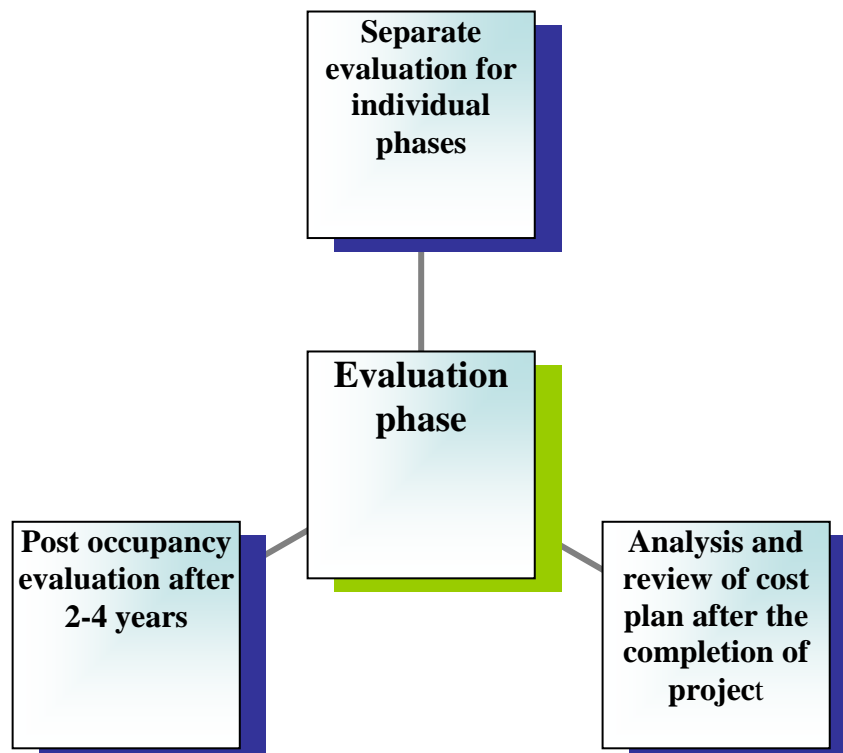


Figure 3-6: Phase5: evaluation

The proposed approach is detailed as follows:

3.2. Strategy Phase

The main strategy for lowering the cost of houses is summarized by the following:

3.2.1. Determination of the Suitable Location

The researcher proposed urban strategy selects Peripheral Development for small to medium projects. These projects will be implemented by the private sector (uses existing infrastructure and cheap land). Also it selects New Towns Development for large scale projects, especially if these are produced by public sector. So, the more economic urban strategy is a combination of Peripheral Development and New Towns options.

3.2.2. Low Cost Housing Projects Finance

- 1- Create national housing fund to finance low cost housing projects as a revolving fund program for low income people. This program work through non-governmental institutions. Proposed loans terms will be 20-30 years. Funding sources are as follows:
 - a) Receipts from sales and rent earning and benefits charges of government owned real state both rural and urban.
- 2- Create short term fund programs which don't exceed five years for improving living conditions of low and moderate income people. These programs can work through non-governmental institutions.
- 3- Creating national housing fund in order to increase the contribution of the local banks.

3.2.3. Governmental Role

The Palestinian government may intervene to lower the cost of houses through the following provisions:

1. A reasonable option for localities to pursue is to develop separate standards and building regulation geared only for affordable housing development.
2. Provide the infrastructure and the economic environment conducive to the creation of long term savings and lending through polices that foster a well functioning legal system and confidence in the future.
3. Create mortgage market.
4. Increasing the involvement in the depository institutions in the mortgage market.
5. Alter the distribution of income by increasing income relative to purchases basket.
This will create a balance between the income and the people needs (clothing, food, housing, etc).

3.3. Planning and Design Phase

This Phase is the most important phase in reducing the total cost of housing projects. The following criteria in the planning and design are recommended by the researcher in order to reduce the housing project cost.

1. Select flat land.
2. Identify planning and design elements that influence the total cost of houses which consist of site layout elements and residential building design elements.
3. Identify site layout elements which consist of land sub-division and density, housing estate patterns, open spaces, and road and parking system.
4. Identify residential building design elements which consist of building type, residential unit design, and finishing material.
5. Determine the entrance and exit of the project after studying available land conditions such as climate, topography, land boundary streets and traffic. As an example, project entrance and exit shouldn't create crowdedness to the boundary streets traffic.

3.3.1. Land Sub-division and Land Use Density

This is the first step in the Planning and Design Phase. Land area is divided into zoning by using cluster concept and consider the net land use density ranged "between" 18-21 dwelling unit/donum, in order to increase the unit number and decrease dwelling unit sharing in the total land. Due to limitation of land area in Gaza Strip, maximum range is chosen by the researcher.

3.3.2. Road, Sidewalks and Parking System

The second step in Planning and Design Phase is road, sidewalks and parking system. This step is cleared by the following:

1. Determine the road system based on cluster concept which introduces the minimum road length.
2. Use 25-30% from total area for streets, sidewalks and parking areas. Streets and parking areas must not exceed 20% of total land area, which is applicable for low cost housing.
3. Consider the following dimension for streets, sidewalks and parking:
 - a) Sidewalks width ranged between 1.3-1.6 m.
 - b) Local streets width is 6 m.
 - c) Collector streets width ranged between 8-10 m.
 - d) Parking lot dimension doesn't exceed 2.5x5 m².
4. The following criteria in the design is considered:
 - a) Services and utilities area are 8-10% of total land area, which represents the minimum percentage that is used by many countries in the world. Reducing services and utilities to the minimum leads to lower the total cost of housing projects.

- b) A central drive-way with rows of cars and go deg parking gives the best economical conditions.
- c) Number of parking lots equal at most 20% of total apartment number. In housing project the ordinary percentage is 50% of apartment number. In this research, 20% is proposed because this percentage is applicable for the low-income people at Gaza Strip, according to the Palestinian census.

3.3.3. Housing Estate Patterns

This is the third step in the Planning and Design Phase.

1. The residential building on the site is designed based on Nodal pattern, where this system create healthy residential environment. In addition this system is used by the majority of low cost housing projects in many countries in the world.
2. Build area is ranged 45-50% of the total area. This percentage was used by the majority of countries in the world for low cost housing.

3.3.4. Building Type

Building type is the fourth step in Planning and Design Phase. This step is summarized by the following points:

1. Select five storey walk-up apartments for designing the residential buildings and each floor consists of 3-4 apartments. This type is more economical than others at Palestine.
2. Select a construction technique which is "cast-in place reinforcement concrete" with using one way ribbed slab for roof system. This technique is economical in the ordinary situation but in mass production this method may not be economical. In Palestine case, cast-in place is the suitable method because it considered local labor power.

3. Determine the shape of residential building as "rectangle and/or square". This shape produces optimal use of land.
4. Determine the relation between buildings as "combined building". This relationship lead to increase combined walls and slabs which will reduce the total cost of housing.

3.3.5. Design of Residential Building and Units

The fifth step in the Planning and Design Phase is design of residential building and units.

1. Determine apartments area as follow:
 - a) The proposed area per person is 13-14 m². International range is 11-14 m² /person. The researcher selects the maximum area to create good residential environment for Palestinian low-income families. For example, the family with 6 people needs 66 m² area, if using 11m²/person. This area is narrow for Palestinian low-income families.
 - b) The proposed area for dwelling unit is 80 m² with two bedrooms for 30% of total number of apartment while 70% of total number of apartment consists of three bedrooms with 128 m² area.
2. Determine the suitable design module as 3.6m. This module is used in the vast majority of the world countries.
3. Table 3-1 illustrates the proposed dwelling spaces area which depends on the international experience and the results of the local post occupancy evaluation study for PHC projects.

Table 3-1 The proposed dwelling spaces area

Items	Proposed Size
Kitchen	13 m ²
Guest and living room	14,16 m ²
Main bedroom	14-16 m ²
Other bedrooms	12.5 m ²
Toilet	1.6 m ²
Bath	4 m ²
Windows area	8-12% of space area.

4. The following points were considered in the design of the residential units:
- a) Avoid entrance door leading directly onto narrow corridor.
 - b) Toilet must be closed to the guest room.
 - c) Storage space must be considered in the apartment design.
 - d) Main stair should not be connected to the roof in order to restrict any further vertical expansion and there is no need for build walls to the boundary of roof.
 - e) The suitable height for all spaces is 2.6 m.
 - f) Use simple elements such as rectangle and/or square in the elevations.

3.3.6. Finishing Materials of Residential Building

This is the sixth step in the Planning and Design Phase. In order to reduce the cost of houses, it is highly recommended to look for cheap materials which have moderate level of quality. Low quality will lead to reduce the life span of structure and increase long term cost of housing. The proposed method is to develop the local industry to be in good quality. So that, using local industry doesn't mean bad quality. The procedures that can be taken in selecting finishing materials are as follows:

1. Surveying in the local market must be conducted in order to define the available material.
2. Determine the material alternative.
3. Select the cheap, local made and moderate material quality as shown in table 3-2.

Table 3-2 The proposed finishing materials

Item	Traditional materials	Proposed materials
Water proof	Bituminous membrane with sun reflection texture	Local made
Tilling	Terrazzo tile (marble) + ceramic for bathes and kitchen	Terrazzo tiles (local) + ceramic for baths only
Internal paint	Internal super creyle paint	Polyseed paint
External paint	External super creyle paint	without
Doors	Flush and solid Wooden doors with three coat paint	Flush and solid Wooden doors with primary paint.
kitchen	Granite for the table face	Local marble for the table face
Electrical works	Israeli and others industries	Local made
Sanitary works	Israeli and others industries	Local made

3.3.7. Open Spaces

This is the seventh step in the Planning and Design Phase.

1. Use rectangle and/or square for determining open spaces which followed the building shape. In addition, these shapes are the cheapest during construction.
2. Determine total open spaces area equal to 18-20% of total land area. In other countries, open spaces reach 14-28% of total land area for low cost housing. Open spaces means green and playground areas. The proposed percentage for open spaces is suitable for introducing enough green and playground areas and creating good housing environment, which have good lighting and ventilation. This result is reached by researcher experience in the housing projects planning and design.
3. The average cost percentage of site work elements is as follows:
 - a) Water network doesn't exceed 2% from site works cost.
 - b) Sewage network doesn't exceed 19% from site works cost.
 - c) Site lighting network doesn't exceed 30% from site works cost.

- d) Site furniture doesn't exceed 10% from site works cost.
- e) Plants and green doesn't exceed 4% from site works cost.

The above percentages are considered as the maximum in the proposed approach.

4. Consider the following criteria in the design in order to reduce the total cost of housing projects:

- a) Maximize the play ground areas without any green elements.
- b) Select slow growing fence plants like Petsborm and Feibernm.
- c) Select trees which can shape by it self without any labor efforts.
- d) Decrease flower boxes.
- e) Use trees which need little irrigation such as Ficus Salicifolia, Acacia sp and Pinus sp.

3.3.8. Cost check and review

Cost check and review must be done for the above Planning and Design Phase by a team work depending on value management after implementing this phase.

3.4. Procurement Phase

Modified Design/Build method is selected in order to decrease the cost of houses due to the following reasons:

1. Single point responsibility leads to decrease variation order related to design mistakes, bad coordination and adversary relationship between contractor and consultant.
2. Fixed price for design, construction and at the beginning of the project, thus reducing the potential for cost overruns.
3. Team concept between design and construction lead to decrease the cost because of the advantage of sharing the contractor in the design and prevent the mistakes in design which may increase the cost.

4. Faster schedule: this leads to decrease administration cost in addition to decrease over head cost for the design/build firm. In general, this leads to decrease total cost of housing project.
5. Executed responsibility for Design/Build firm.
6. Design responsibility generally for Design/Build firm.

Figure 3-7 illustrates the proposed model of procurement system and project organization for low cost housing in Palestine. It illustrates modified Design/Build procurement approach as follows:

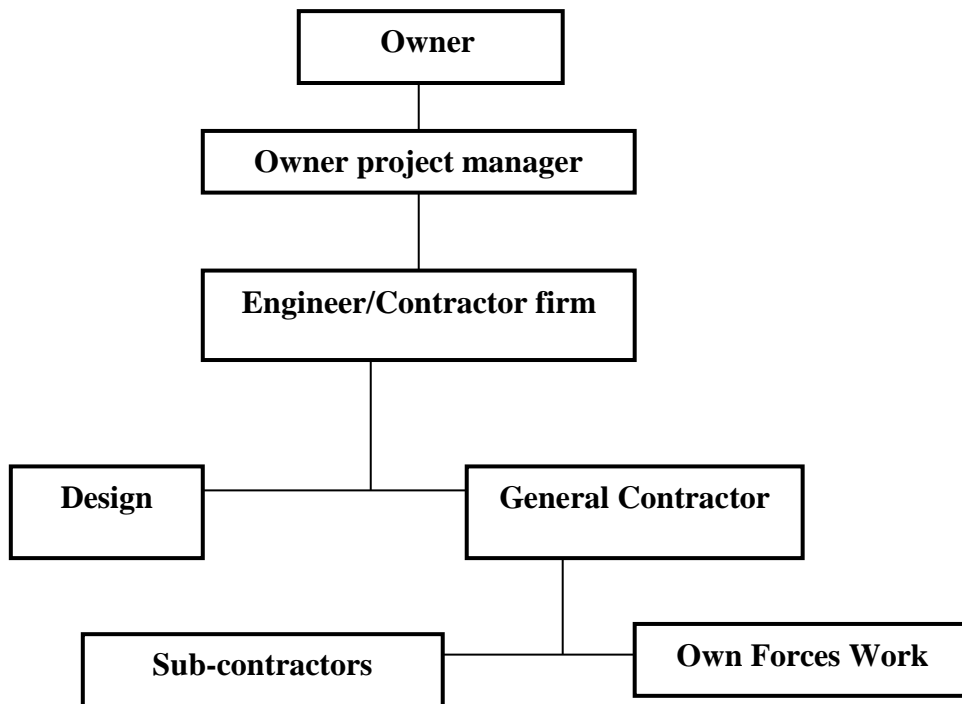


Figure 3-7 The proposed model of procurement system and project organization

1. Individual project owner representing stakeholders.
2. Individual owner project manager providing single point authority and communications and instant decisions and will be involved in all project phases planning, design, and execution. Owner project manager is preparing tender document for design/build contract, defining criteria for selecting design/build firm, sharing in selection the firm, and following up and coordinating all phases of the

project with the design/build firm to ensure the required quality and other owner goals. Owner project manager will help in reducing the design/build firm risk.

3. The basic proposed model concept is that the owner assigns a contract to a firm that is knowledgeable and capable of designing and executing all aspects of the project to meet owner needs. On the other hand, the owner will encourage the firm to reach more than his goals by the physical incentives.

Detailed procedure for Procurement Phase will be described in the following steps:

3.4.1. Procurement Method and Organization Framework

1. The owner signs a partner contract with the Design/Build firm.
2. Determine owner responsibilities as follow:
 - a) Prepare architectural program and project goals.
 - b) Select and identify project manager.
 - c) Fund the project and pay for the execution works.
3. Determine firm responsibilities as follow:
 - a) Design the project through full coordination with owner representative.
 - b) Execute the project through full coordination with owner representative.
4. The owner must select project manager (technical department) who has good experience and knowledge in designing and executing housing project and has an overall vision for social housing projects. The responsibilities of project manager are:
 - a) To prepare tender document for select design/build firm.
 - b) To help the owner in evaluation and selecting firm.
 - c) To help the firm in developing conceptual design.
 - d) To follow up the executing phase.

3.4.2. Tender Document for Selecting the Firm

1. The owner prepare Request for Qualification by the following:
 - a) Prepare terms of reference.
 - b) Evaluate and determine the shortlist.
2. The owner prepares Request for Proposal through achieving owner statement of requirements.
3. Invite not less than five and not more than ten qualified firm to introduce technical and financial proposal.
4. Determine the evaluation approach as "best value" which consists of the sum of technical and financial evaluation degrees.

3.4.3. Evaluation and Contract Award

1. Determine evaluated rating criteria and factors which are existed in the Request for Proposal and these factors may included but not limited to project design, project construction, understanding of project, schedule, and problem resolution.
2. Use value engineer in the technical evaluation.
3. Only offerors whose technical proposals have scored at least 70% will have their price proposals opened.
4. The degree allocated 70% and 30% between technical and financial proposals respectively. The suitable firm that has the best value is selected.

3.5. Execution Phase

The Execution Phase is divided into two main categories as follows:

1. Contractor and subcontractors procedures to prevent any increasing in the cost such as " storage material, create good schedule etc".

2. Owner procedures to prevent any increasing in the cost such as "prevent variation orders, soil investigation etc".

Detailed procedure for Execution Phase will be described in the following steps:

3.5.1. Contractor and Subcontractors Procedures

3.5.1.1. Storage Materials

Storage materials lead to reduce the effect of sudden increase in the price of building material. It also administers and controls the use of materials and reduce the waste of materials.

1. Divide the work into phases which can be administered and controlled.
2. Establish good storage system between the storage place and the site work in order to administer and control the use of material.
3. Purchase and storage the critical materials (like reinforcement steel) needed for the project in suitable place in order to reduce the effect of the sudden enclosure. This can also be done in order to control and administer the use of materials. The maximum amount of material that can be stored is just only for one month working days, due to the money value in the local market.
4. Material estimation program (structural bill of quantity) is used to determine the approximate amount of material needs for the items in order to control the use of material.
5. If the amount of material during Execution Phase begins to exceed the approximate amount, assist the case and look for the reason in order to correct any mistakes.
6. Project workers must be trained in the site work before the work begins in order to minimize the material waste.
7. Hire skilled workers lead to minimize the waste of material.

8. Contractors must use good vertical transportation system like tower crane for big projects.

3.5.1.2. Project Schedule

Using Ms Project program to create good project schedule, leads to optimal using of the workers in the site within the approved time.

3.5.1.3. The Adversary Relationship

1. Creating good relationship with the owner project manager, leads to facilitate the execution of the project within the time.
2. Any problem should be immediately solved in the site by the negotiation with the owner representative.

3.5.2. Owner Procedures

1. Repetition of the same housing patterns help in constructing the project in short time.
2. Good classification and development for the contractors can be done in order to facilitate the projects execution within the time.

3.5.2.1. Contractor's Payments

1. Down payment to the contractors is highly recommended in order to facilitate the contractor cash flow. In same time, the local banks are required to facilitate the bank guarantee procedures for the contractors.
2. The contractor payments should be quickly checked and paid within the contract time or before in order to facilitate cash flow for the contractor which will affect the completion date and prevent any claims related to the payment.

3.5.2.2. Variation Orders

Any positive variation is prevented and negative variation is approved in order to decrease the cost.

3.5.2.3. The Adversary Relationship

1. Creating good relationship with the contractor representative, leads to facilitate the execution of the project within the time.
2. Encourage a good involvement to owner representative. This leads to minimize and prevent any contractor mistakes during Design and Execution Phase.

3.5.2.4. The availability of Information's

1. Facilitate any information required by the contractor in order to shorten the time of the design and execution.
2. Any contractor inquiry should be answered clearly and quickly.

3.5.2.5. Material Approval

In case any original material doesn't exist, available equivalent materials should be approved to facilitate the Execution Phase.

3.6. Evaluation phase

In this Phase, an evaluation should be done for each Phase before starting the next Phase in order to correct any adverse matters. Planed cost and actual cost will be reviewed and compared in depth. Overall evaluation should be made to avoid any disadvantages in other projects.

In order to investigate the resident's reaction at the project design, post occupancy evaluation should be conducted after 2-4 years of implementing the units.

CHAPTER 4

APPROACH REVIEW BY EXPERTS

4.1. Introduction

This chapter represents the core results of this study. A group of Palestinian experts in housing sector were individually interviewed and filled a structured questionnaire, in order to test and modify the proposed approach. Selection of the experts has considered the place of work, rich practical experience, and research experience in the housing sector. The experts answers have been analyzed in order to modify the proposed approach for lowering the houses cost at Palestine. The structured interview was divided into two parts as follows: (for more information see Appendix D)

Part I: Questions related to the expert background

In this part, questions related to the expert education, relevant experience, recent position and main tasks in his recent work have been introduced in order to test the validity and reliability of the informants input.

Part II: Evaluation of the proposed approach

This part was divided into five sections as follows:

1. Questions related to strategy phase

Four open end and closed questions related to the three parts of strategy phase (project land location, project financing and governmental role) were asked to the informants in order to answer and give his opinion.

2. Questions related to planning and design phase

This section consists of three questions concluded the data which is required from the experts. These questions introduce an overview to the elements of planning and design

phase. The questions are related to the determination of planning and design elements which affect the total cost, the applicable percentages of these elements, and the suitable dwelling unit spaces areas to low cost housing.

3. Questions related to procurement phase

Six opened end and closed questions were asked to the experts in order to test the proposed procurement method (Design/Build) for lowering the housing cost.

4. Questions related to execution phase

Three open end questions were asked to the experts related to the proposed procedures which can be taken by the owner and contractor to prevent any increase in the project cost during execution phase.

5. Evaluation Phase

One open end question was asked to the experts.

Finally, the experts added comments and suggestions to improve the proposed approach.

4.2. Characteristics of the Selected Experts

A group of 11 experts in housing sector in Palestine have been interviewed and filled the structured questionnaire. It was structured face-to-face interviews. Table 4-1 illustrates the characteristics of the experts.

Table 4-1 The characteristics of the experts

Expert Position	Institution Name	Education	Years of relevant experience
Ex Minister	MPWH	PhD	16
General Manager	MPWH	B.Sc.	26
Deputy General Manager	MPWH	M.Sc.	20
Deputy General Manager	MPWH	M.Sc.	26
Director General (West Bank)	PHC	M.Sc.	24
Director General (Gaza Strip)	PHC	B.Sc.	17
Assistant Professor	Islamic University	PhD	10
Assistant Professor	Islamic University	PhD	7
General Manager	Ministry of Local Authority	M.Sc.	27
Bank Manager	Local Bank	M.Sc.	26
General Manager	Ministry of Justice	M.Sc.	24

Table 4-1 shows that two experts are from PHC, four experts from MPWH, two experts from Islamic University, one expert from Ministry of Local Authority, one expert from local Bank, and one expert from Ministry of Justice. The experts were selected from different institutions which have direct relation to the scope of this research.

4.3. Strategy Phase

The questions related to Strategy Phase were divided into three parts which include the most economic location for low cost housing project, the role of government, and low cost housing financing policy.

4.3.1. Low Cost Housing Project Location

Peripheral development option was selected by six experts because of the following reasons:

1. It uses cheap land.

2. The infrastructure, and utilities and services are available.

Combination between peripheral development and new town option was selected by five experts because of the following reasons:

1. The small capacity of the existing infrastructure leads to go towards construct new towns which will be more economic for low income people.
2. Reduce occupied area in the existing cities.
3. Reduce high density of population in small area.
4. Use cheap land.

The two alternatives mentioned above have advantages and disadvantages. The proposed solution by the researcher is to select peripheral development for small to medium projects which will be implemented by the private sector (uses existing infrastructure and cheap land) and select new towns development for large scale projects, especially if these are produced by public sector. In addition, any existing city has limited infrastructure capacity for limited population. So that, the more economic and flexible solution for selecting a location in order to construct low cost housing project is a combination between peripheral development and new towns. The determination of using peripheral and new town development in details are the modification to the proposed approach.

4.3.2. The Role of Government

All experts defined the role of government by facilitate producing housing units for low income people by private sector. All of them refused any direct subsidies for low income people by the governmental institutions because this will leads to destroy and corrupt the housing market. The main role for the government is to create laws for encouraging private sector to invest in low cost housing project and develop separate standards and building regulations in order to reduce the total cost of houses. The creation of government-private sector partnership unit leads to facilitate introducing low cost housing

units. In addition, incentives must be given to the developer in order to encourage them to invest in low cost housing. These incentives include facilitation incentives such as "facilitating the license procedures, availability of land, create infrastructure for the developed areas, etc".

Researcher Comments

Palestine has very limited resources, so that private sector must be taken into consideration in any development plan. The researcher agrees with the expert's opinion that the main role for government is to facilitate producing housing units for low income people by private sector. The researcher also agree of creating laws for encouraging private sector to invest in low cost housing project and to develop separate standards and building regulations in order to reduce the total cost of houses. This means that the efforts must concentrate on reducing the total cost of housing for low-income people instead of direct subsidies. Housing is classified as social needs. The sustainable of any housing program is the main aim. Subsidies programs don't satisfy this objective because of the limited resources in Palestine. In addition, the government must encourage scientific researches by creating research center looking for new methods and material that satisfy the minimizing of housing cost.

The proposed approach will be modified by the following:

1. Neglects the following statement in the proposed approach which includes "alter the distribution of income by increasing income relative with purchases basket".
2. Add new item "establish research centers".
3. Add new item "creation of government-private sector partnership unit leads to facilitate introducing low cost housing units".
4. Add new item "incentives must be given to the developer in order to encourage them to invest in low cost housing. These incentives include facilitation

incentives such as "facilitating the license procedures, availability of land, create infrastructure for the developed areas, etc".

4.3.3. The Low Cost Housing Financing Policy

The vast majority of informants (9 experts) defined financing policy as two type, long and short term policy. Long term policy depends on creating national housing funds to be the insurance for depository institutions (Local Banks) in order to encourage these institutions to give long term loans for low income people. In addition, create national housing fund for finance low cost housing projects as a revolving fund program working through non-governmental institutions. Fund sources are classified as:

- Receipts from sales and rent earning and benefits charges of government owned real state both rural and urban.

Short term policy depends on creating short-term finance programs that will not exceed five years to improve the living conditions of low and moderate income people and creating housing finance program for the governmental employee.

This classification was found by the researcher to be more flexible to Palestine circumstances in order to create sustainable programs.

Other informants (2 experts) defined financing policy as short-term finance program because there are no resources to the government to create long term financing funds. This opinion neglects the circumstances of low-income people. The low-income people needs long-term program to be able to own their residential unit.

Researcher Comments

The researcher agrees with dividing financing strategy to two types which are long term and short term policy. Long term policy needs resources which are not available in the recent time at Palestine. This doesn't mean neglecting long term policy but to encourage

the government to look for the funds. In addition, non-governmental institution can create short term financing program for low-income people.

The only modification to the proposed approach is dividing the financing policy to long-term and short-term. There is no modification to the proposed item.

4.4. Planning and Design Phase

The vast majority of informants are engineers except two of them are accountant. The accountant informants have little knowledge in the planning and design phase. The nine expert engineers have different knowledge; five experts have very good knowledge in planning and design and four experts have an acceptable knowledge.

The questions related to planning and design phase were divided into three parts which include the elements of planning and design that affect the cost, the ratio of site layout elements and the design of the dwelling unit spaces.

4.4.1. Planning and Design Elements That Affect the Cost of Houses

The nine knowledgeable informants approved the proposed elements which include the following:

1. Site layout elements: include land subdivision and density, housing estate patterns, open spaces, and roads and parking system.
2. Residential building design elements: include building type, residential unit design, and finishing material.

Some of them suggested another elements which include land topography and energy consumption elements. Of course, land topography affects the cost of houses either positive or negative. So, it is highly recommended to select the flat land which doesn't need backfill or more excavation.

The other suggested element energy consumption need in-depth researches. These researches deal in general with all influencing factors that affect houses cost. Every factor can be researched in-depth in other researches.

Researcher Comments

The researcher agrees with the selection of flat land in order to lower the cost of housing. The only modification to the proposed approach is to select flat land.

4.4.2. Housing Project Elements Ratio

All informants (9 experts) found the proposed net density 18-21 dwelling unit/donum (122.4-142.8 person/donum) is a high ratio. All of them found this ratio denser especially when dealing with five storey walk-up apartment building not high rise building. The suggested ratio was 15-18 dwelling unit/donum which is applicable for low cost housing project.

The experts approved and suggested road, sidewalks and parking ratio as 25-30% of total area, services and utilities ratio as 8-10% of total area, and open spaces ratio as 15-18% of total area. They suggested new build up ratio as 40-45% only instead of 45-50% and number of parking lots is at least 25% instead of 20% total apartment number. In their opinion, high build up ratio means transfer the urban project into slums. High build up ratio helps in reducing total cost by increasing total dwelling unit number which leads to decrease the sharing in land cost and decreasing open spaces which needs additional efforts. The proposed build up ratio can be satisfied. The expert trend is to decrease this ratio in order to increase the open space area because the vast majority of Palestinian people are low and moderate income people. So that the image of the city will be concrete mass by using high build up ratio. The researcher agrees with this opinion and this leads to decrease the net density to reach 15-18 dwelling unit/donum instead of 18-20 dwelling

unit/donum. The researcher agrees to increase the parking lots number from 20% to 25% of dwelling unit number because of the special conditions of Palestinian families in owning cars.

All of the experts approved the selection of cluster concept, Nodal with combined building, five storey walk-up apartment building, 3-4 apartments per floor, cast-in-place reinforcement concrete method, and one way ribbed slab for slabs and roof system as a good alternatives for lowering the cost of houses. Table 4-2 illustrates the approved and the suggested ratio for housing project elements by the experts.

Table 4-2 The approved and the suggested ratio

No.	Item	Approved and suggestion ranges
1-	Net density	15-18 dwelling unit/donum (suggested)
2-	Road, sidewalks and parking area	25- 30% total area
3-	Services and utilities area	8-10% total area
4-	Number of parking lots	25% total apartment number (suggested)
5-	Open spaces	15-18% total land area (suggested)
6-	Build up ratio	40-45% total land area (suggested)
7-	Land subdivision	Cluster concept
8-	Housing estate patterns	Nodal with combined building
9-	Building type	Five storey walk-up apartment
10-	Number of unit per floor	3-4 apartment per floor
11-	Construction method	-Cast-in-place reinforcement concrete method. -One way ribbed slab for slabs and roof system. -Fair face hollow cement block for walls system.
12-	Dwelling unit design	-15-20% total number of apartment is two bedrooms with 80m ² area. (suggested) -45-50% total number of apartment is three bedrooms with 116m ² area. (suggested) -30-35% total number of apartment is three bedrooms with 128 m ² area. (suggested)

The general informant trends were to create more than two type of apartment design area. These types take into account the Palestinian families' size which is in average 6.8 people per family. The suggested apartment size was 80 m2 for small families, 116 m2 for moderate size families and 128 m2 for large families.

The availability of different size of dwellings is required to satisfy all families' size needs. The researcher agreed with the previous opinion which concentrates in increasing the production of 116 m² apartment. The researcher modified the proposed approach by changing the rates for apartment as shown in Table 4-2.

The modifications to the proposed approach are as follows:

1. Net density 15-18 dwelling unit/donum.
2. Number of parking lots equal 25% of total apartment number.
3. Open spaces equal 15-18% of total land area.
4. Build up ratio equal 40-45% of total land area.
5. 15-20% total number of apartment is two bedrooms with 80 m² area. 45-50% total number of apartment is three bedrooms with 116 m² area. 30-35% total number of apartment is three bedrooms with 128 m² area.

Researcher Comments

The researcher agreed with the expert's opinion which concentrates in reducing the proposed net density in order to improve the city image. This is due to the vast majority of Palestinian people are low and moderate income people. The researcher agreed with the expert's opinion to increase the parking lots number from 20% to 25% of dwelling unit number because of the special conditions of Palestinian families in owning cars. The researcher agreed with the expert's opinion which concentrates in increasing the production of 116 m² apartment in order to create different size of dwellings which satisfy all families' size needs.

4.4.3. Residential Unit Design

The proposed apartment spaces area was approved by all informants (11 experts) except the kitchen area. They suggested the kitchen area and storage space to be 9-11 m² and 1.6 m² respectively.

4.5. Procurement Phase

The main question asked to the experts is "what is the most economic procurement method". Two of the informants have not any information about the subject. Four informants selected modified Design/Build method for constructing low cost housing project because of the following:

1. This method reduces variation order.
2. Leads to faster schedule.
3. Decrease owner responsibility for design mistakes.
4. Create good specification because this firm has minimum standards.

The four informants defined the Design/Build method disadvantages as follow:

1. The owner has less control to project specification. The owner must definitely define the output of the project.
2. Legal and governmental obstacles which can be solved by creating the legal umbrella.
3. Difficulty in gaining bidding competition as traditional methods. Design/build depends on invitation to introduce technical and financial proposal not dealing with the lowest bidder.

Five informants selected traditional methods because of the following:

1. People, public and private institutions are familiar with this method.
2. Less knowledge in Design/Build method by all construction contract parties.
3. Legal obstacles for Design/Build method.
4. Design/build method used for institutions which have not experience.

Researcher Comments

The main objective of this research is to introduce an approach to lower the cost of housing. To satisfy this objective, creative and new method must be introduced. So that,

less knowledge in Design/Build method at Palestine doesn't give convince justification to reject it. All of the experience informants agreed that the Design/Build method can reduce the total cost of houses if the required experience and the legal framework exist. The most suitable relationship between the owner and Design/Build firm is partnership. In addition, selecting good knowledge owner representative leads to decrease the Design/Build firm benefits and increase the monitoring to satisfy owner needs. It is highly recommended to use international experience and create training courses for contractor and consultant outside Palestine.

No modification to the proposed approach is done except the modification of the relationship between the firm and the owner as partner.

4.6. Execution Phase

The questions related to Execution Phase were divided into three main categories as follows:

1. Question related to the procedures which can be taken by the contractor and sub-contractor in order to prevent any increase of the cost.
2. Question related to the procedures which can be taken by the owners in order to prevent any increase of the cost.
3. Question related to the procedures which can be taken by the contractor and sub-contractor in order to decrease the waste of material at site work.

All informants except two experts accepted and approved the proposed procedures for contractors and sub-contractors to prevent any increase of the cost. These procedures are as follows:

1. Establish good storage system between the storage place and the site work.
2. Use Ms Project program to create good project schedule which leads to optimal manpower use of the workers in the site within the approved time.

3. Create good relationship with the owner project manager, leads to facilitate the execution of the project within the time.
4. In addition, contractors must use good vertical transportation system like tower crane for the big projects.

All informants except two experts accepted and approved the proposed procedures for the owners to prevent any increase of the cost. These procedures are as follows:

1. Facilitates contractor's payments. It is highly recommended to offer down payment for the contractor.
2. Prevent any positive variation and approved negative variation in order to decrease the cost.
3. Create good partner with the contractor and follow up the project.
4. Facilitate any information to be available for the contractor in order to shorten the time of the design and execution.
5. Facilitate the approval of equivalent materials especially when the original material is unavailable.
6. Repetition of the same housing patterns.
7. In addition, good classification and development for the contractors is needed.

All informants except two experts accepted and approved the proposed procedures for the contractors and sub-contractors to reduce material waste. These procedures are as follows:

1. Store required construction materials in order to prevent any sudden increase in the price of building materials.
2. Establish good storage system in order to control the use of material.
3. Use material estimation program (structured bill of quantity) which monitors the approximate amount of material needs for the items in order to control the use of material.

4. If the amount of material during executing phase begins to exceed the approximate amount, assist the case and look for the reason in order to correct any misleading.
5. It is highly recommended to use the skilled workers in order to minimize the material waste.

Researcher Comments

Using tower crane as some informants suggested is costly if using it in small and moderate housing project size. In mass production, it reduces the total cost. The case in Palestine and the proposed building doesn't need tower crane.

Some experts add contractors' classification as new item to the procedure which can be taken by the owner in the procurement phase to prevent any increase in the cost.

No modification is reported to the proposed approach.

4.7. Evaluation Phase

All informants (11 experts) accepted and approved the proposed procedures for evaluation phase. These procedures are as follows:

1. Separate evaluation for each individual phase should be reported at the end of each phase in order to determine the problems and look for solutions which help in reducing the houses cost.
2. Analysis and review of the planned and actual cost after the completion of the project.
3. Post occupancy evaluation must be reported in order to investigate the resident's satisfaction and evaluate apartment unit performance.

4.8. General Recommendations and Suggestions by Experts

Experts have considered some general recommendations and suggestions to assist minimizing the housing cost, such as:

1. Structural system and material used for low cost housing in Palestine needs more investigations.
2. Finishing materials need more investigations to lower the cost of houses.
3. Housing sector needs more researches.

4.9. Concluded Remarks

The modification to the proposed approach based on suggestions by the experts can be summarized as follows:

1. Select peripheral development for small to medium projects to be implemented by the private sector (uses existing infrastructure and cheap land) and select new towns development for large scale projects especially if these are produced by public sector.
2. The governmental role will be modified by the following:
 - a) Neglects the following statement in the proposed approach which includes “altering the distribution of income by increasing income relative to the purchases basket”.
 - b) Add new item “create research centers”.
 - c) Add new item “creation of government-private sector partnership unit leads to facilitate introducing low cost housing units”.
 - d) Add new item “incentives must be given to the developer in order to encourage them to invest in low cost housing. These incentives include taxes incentives”.
3. Add land topography to the planning and design elements which are affected the cost.
4. The planning and design elements modification to the proposed approach is as follows:

- a) Net density 15-18 dwelling unit/donum.
 - b) Number of parking lots equal 25% of total apartment number.
 - c) Open spaces equal 15-18% of total land area.
 - d) Build up ratio equals 40-45% of total land area.
 - e) 15-20% total number of apartment is two bedrooms with 80 m² area, 45-50% total number of apartment is three bedrooms with 116 m² area, and 30-35% total number of apartment is three bedrooms with 128 m² area.
5. The kitchen area is proposed to be 9-11m² by the experts, while storage space to be 1.6 m².

4.10. Summary of Proposed Approach

The proposed approach that accounts the expert opinions is summarized as follows:

4.10.1. Strategy Phase

The main strategy for lowering the cost of houses based on the following points:

4.10.1.1. The Suitable Location to Construct Low Cost Housing Projects.

- a) Peripheral development for small to medium projects which will be implemented by the private sector.
- b) New towns development for large scale projects especially if these are produced by public sector.

4.10.1.2. Low Cost Housing Projects Finance

Long-Term Policy

1. Creating national housing fund to be the insurance for depository institutions (local banks) in order to encourage these institutions to give long term loans for low income people.

2. Create national housing fund to finance low cost housing projects as a revolving fund program for low income people. This program can work through non-governmental institutions. Proposed loans terms will be 20-30 years. Funding sources are as follows:
 - a) Receipts from sales and rent earning and benefits charges of government owned real state both rural and urban.

Short-Term Policy

Short term finance programs which will not exceed five years is to be created for improving living conditions of low and moderate income people. These programs can work through non-governmental institutions.

4.10.1.3. Governmental Roles

The Palestinian government may intervene to lower the cost of houses through the following provisions:

1. Develop separate standards and building regulation geared only for affordable housing development.
2. Provide the infrastructure and the economic environment conducive to the creation of long term savings and lending through polices that foster a well functioning legal system and confidence in the future.
3. Create mortgage market.
4. Increasing the involvement of the depository institutions in the mortgage market.
5. Establish research centers.
6. Creation of government-private sector partnership unit leads to facilitate introducing low cost housing units.
7. Incentives must be given to the developer in order to encourage them to invest in low cost housing. These incentives include facilitation incentives such as "

facilitating the license procedures, availability of land, create infrastructure for the developed areas, etc".

4.10.2. Planning and Design Phase

4.10.2.1. Planning and Design Elements That Affect Houses Cost

1. Site layout elements which include land subdivision and density, housing estate patterns, open spaces and road, land topography and parking system.
2. Residential building design elements including building type, residential unit design and finishing material.

4.10.2.2. Residential Project Elements Ratio

Residential project elements ratio are summarized in Table 4-2.

4.10.2.3. Residential Unit Design

Residential unit design spaces size are summarized in the following table:

Item	Final Size
Kitchen	9-11 m ²
Guest and living room	14,16 m ²
Main bedroom	14-16 m ²
Other bedrooms	12.5 m ²
Toilet	1.6 m ²
Bath	4 m ²
Store	1.6 m ²
Windows area	8-12% of space area.

- a) Main stair must not be connected to the roof in order to restrict vertical expansion and there is no need for build walls to the boundary of roof.
- b) The suitable height for all spaces is 2.6 m.

4.10.2.4. Finishing Material

Finishing materials are as follows:

Item	Final Materials
Water proof	Local made
Internal wall finishing	interior plaster
Tiling	Terrazzo tiles (local) + ceramic for baths only
External wall finishing	External plaster with Tyrolean
Internal paint	Polyseed paint
External paint	without
Doors	Flush and solid Wooden doors with primary paint.
kitchen	Local marble for the table face
Electrical works	Local made
Sanitary works	Local made

(For more information looks chapter 3)

4.10.3. Procurement Phase

Modified Design/Build method is selected in order to decrease the cost of houses due to the following reasons:

1. Single point responsibility leads to decrease variation orders related to design mistakes, bad coordination and adversary relationship between contractor and consultant.
2. Fixed price for design, construction and at the beginning of the project, thus reducing the potential for cost overruns.
3. Team concept between design and construction. This leads to decrease the cost because of the advantage of sharing the contractor in the design and prevent the mistakes in design which may increase the cost.

4. Faster schedule: this leads to decrease administration cost in addition to over head cost for the Design/Build firm. In general, this will reduce total cost of housing project. (For more information look chapter 3)

4.10.4. Execution Phase

Some considerations are taken in order to prevent any increase in the project cost during execution phase. In general, the main reasons for increasing the project cost can be summarized as follow:

1. Sudden increase in building material cost.
2. Differing site conditions.
3. Employer delay of payments.
4. Change order.

So that, the Execution Phase divided into two main categories as follows:

1. Contractor and subcontractors procedures to prevent any increasing in the cost such as " storage material, create good schedule, etc".
2. Owner procedures to prevent any increasing in the cost such as "prevent variation orders, facilitates payments, etc".

4.10.5. Evaluation Phase

In this phase, an evaluation should be done for each phase before starting the next step in order to correct any adverse matters. Planed cost and actual cost will be reviewed in depth, then overall evaluation should be made to benefit in other projects.

In order to investigate the resident's reaction at the project design, post occupancy evaluation should be conducted after 2-4 years of implementing the units.

CHAPTER 5

CASE STUDY

5.1. Background

The use of the developed approach has been verified using a real life case study. For this purpose an existing housing project has been considered for implementing the approach. The selection and description of the case are included in this chapter.

Several housing programs have been launched since 1994, outside and inside the existing urban perimeters because of the acute shortage of housing in Gaza. This acute shortage caused by the high birth rate and the returnees of Palestinians after the peace agreement between Palestinian Liberation Organization (PLO) and Israel in 1993. Before 1994, there were no national housing institutions except the Palestinian Housing Council (PHC) which was established in 1991 to help in solving the housing problem in Gaza Strip and West Bank. After the recognition of the Palestinian National Authority (PNA) in 1994, Ministry of Public Works and Housing (MPWH) assigned the responsibility for planning and implementing a Palestinian housing strategy and programs. MPWH, PHC and private sector are the main players working in the housing sector in Palestine. The following projects show the efforts of these players to help in solving the housing problem.

A total of five housing projects which were implemented by the PHC, have been launched in Gaza Strip between 1994 and the beginning of the 1997 [El-Karama towers file-General, 1995 and Ain-Galout towers file-General, 1994]. The five projects are located in the different governorates of Gaza Strip. El-Karma Housing Project is located at Jabalia city in the North of Gaza City, Ain-Jalout Housing Project is located in the Nusirate Camp at the middle area of Gaza Strip, Police Housing Project is located in the Beit-Hanon City to the

North of Gaza Strip, El-Qalaa Housing Project is located in Khanyounes City, and Tal-El-Soltan Housing Project is located in Rafah City.

Several housing projects have been implemented in Gaza Strip between 1994 and the beginning of the 2005 by the MPWH. Six important projects have been selected for testing in this study. The selection has been made according to the location, target group and the size of the projects. The six projects are: El-Zahra, Austrian, El-Nada, EL-Fara, Dair-El-Balah and Sheikh Zayed Housing Projects. In addition, El-Nada project represents the partnership between public and private sectors. Figure 5-1 illustrates the location of these projects.



Figure 5-1 Gaza strip map and the location of the projects

The eleven projects implemented by PHC and MPWH clarify the Palestinian housing experience during the last thirteen years. Table 5-1 illustrates the project characteristics.

Table 5-1 The projects characteristics (MPWH and PHC files)

Project Title	Project area (m ²)	Number of apartment	Householder	Owner	Designer	Project classification
Zahra	173847	2580	*L.I.	MPWH	MPWH	Site and services
Austrian	22100	206	*L.I.	MPWH	MPWH	Urban
Nada	153118	1458	*L.I.	MPWH/ PS**	***C.O.	Urban
Sheikh Zayed	428872	3652	Not defined	MPWH	***C.O.	Urban
EL-Fara	9263	140	*L.I.	MPWH	MPWH	Urban
Dair-El-Balah	3900	80	*L.I.	MPWH	MPWH	Urban
Ain-Jalout	22436	320	*L.I.	PHC	***C.O.	Urban
Karama	22127	416	*L.I.	PHC	***C.O.	Urban
Police	18000	256	Police men	MPWH	PHC	Urban
El-Qalaa	6127	96	*L.I.	PHC	***C.O.	Urban
Tal-El-Soltan	9938	110	*L.I. and low income	PHC	PHC	Urban

(* Limited Income - ** Private Sector – *** Consultant Office)

One housing project was only included in the case study. The following requirements have been examined, In order to select this project:

1. The project must be directed to limited income people.
2. The project must contain at least 300 dwelling units.
3. The project is classified as urban housing project, i.e. not site and services project.

Table 5-2 represents the short list of projects which satisfy these requirements.

Table 5-2 The projects which satisfy the previous requirements (MPWH and PHC files)

	Number of apartments	Householder	Project classification
El-Nada	1458	*L.I.	Urban
Ain-Jalout	320	*L.I.	Urban
El-Karama	416	*L.I.	Urban

(* Limited Income)

Three projects can be considered for selection in the case study, according to the criteria (Table 5-2).

5.2. The Case Study Projects

5.2.1. Project description

In order to determine the project from Table 5-2 for selection as case study, it is necessary to describe these projects briefly.

5.2.1.1. EL-Nada Housing Project

El-Nada housing project was constructed by Palestine Real Estate Investment Company (P.L.C) in 1998 in Beit Hanoon. This project represents the partnership between the public (MPWH) and private sector (P.L.C). El-Nada housing project planning scheme is cluster zoning concept. Figure 5-2 illustrates the project layout. The housing estate pattern at the project is mixed between Linear and Nodal pattern. This pattern was used with collective buildings.



Figure 5-2 El-Nada housing project layout [Site layout plan-El-Nada project].

The percentage of streets and parking areas at El-Nada housing project reached approximately 19.2% of the project area. Table 5-3 illustrates the area of site elements at the project.

Table 5-3 The site elements area at El-Nada housing project

Item	Area (m ²)	Percentage (%)
Total area	153118	100
Services and utilities land area	25354	16.6
Residential building area	29321.45	19.15
Streets and parking area	28811.27	18.82
Open spaces & sidewalks area	70281.88	45.9
Number of parking lots	477	31% (apartment number)
Number of apartment	1458	----
Apartment area	91 m ²	----

This project has a net density of 12 dwelling units/donum which equal 72 person/ donum. Building type at El-Nada housing project is five storey walk up apartment building. Figure 5-3 illustrates typical floor plan.

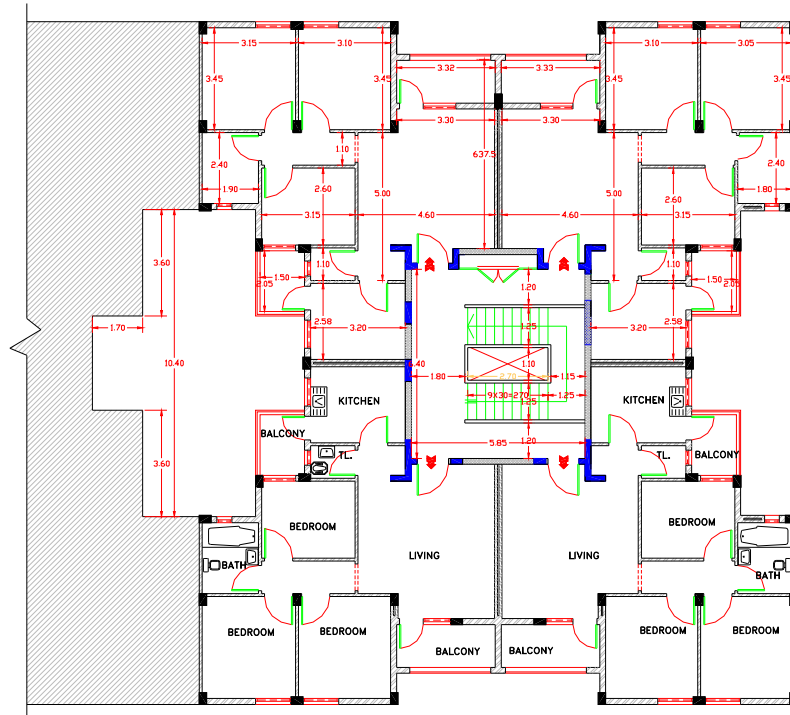


Figure 5-3 Typical floor plan for typical building at El-Nada housing project

Each building floor contains four apartments with a net area of 91 m². Each apartment contains three bed rooms, kitchen, bathroom, and living room. Area of the bed rooms are 10.5, 10.7 and 8.87 m² and the areas of kitchen and living room are 8.22, 21 m², respectively.

5.2.1.2. Ain-Jalout Housing Project

Ain-Jalout Housing Project was constructed by the PHC in 1993 in Nusirate. This project was granted to Palestinian people by European Union in order to participate in solving housing problems at Gaza Strip by creating revolving fund program. PHC role in this project was the owner [Ain-Galout towers file-General, 1994]. The project consists of ten escalator buildings, where each building contains nine floors. Figure 5-4 illustrates the project layout.



Figure 5-4 Ain-Jalout Housing Project layout [Site layout plan - Ain-Galout project]

The housing estate pattern at the project is Nodal estate pattern. This pattern was used with detached housing buildings. Streets and parking areas percentage at Ain-Jalout Housing Project reached approximately 32.3% from the total area of the project. Table 5-4 illustrates the area of site elements at the project.

Table 5-4 The site elements areas at Ain-Jalout Housing Project

Item	Area (m ²)	Percentage (%)
Total area	22436.4	100
Services and utilities land area	0	0
Residential building area	5120	22.8
Streets and parking area	7253	32.3
Open spaces area	10063.4	44.8
Number of parking lots	96	30% (apartment number)
Number of apartment	320	----
Apartment area	116 m ² 102 m ²	90% 10%

This project has a net density of 21 dwelling units/donum which equals to 126 person/donum. The building type is nine escalator apartment buildings. Figure 5-5 illustrates the typical floor plan.

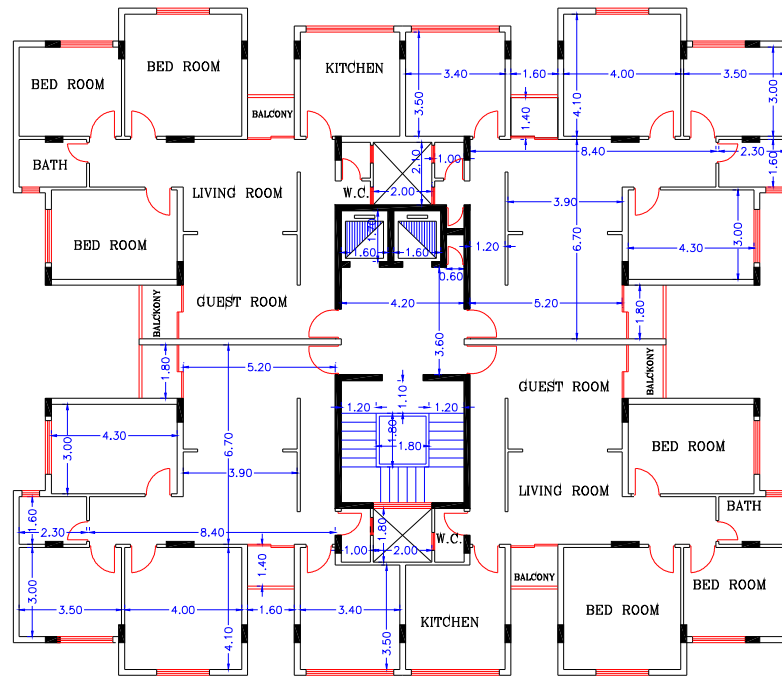


Figure 5-5 Typical floor plan for typical building at Ain-Jalout Housing Project

Each building floor contains four apartments and the net area of the apartment is 116 m². Each apartment contains three bed rooms, kitchen, bathroom, guest room, and living room. Bed room's areas are 10.5, 12.9 and 16.4 m² and the areas of the kitchen, the living, and the guest rooms are 11.9, 8.2, and 13.65 m², respectively.

5.2.1.3. EL- Karama Housing Project

El-Karama Housing Project was constructed by PHC in 1994 at Jabalia City. This project was granted to Palestinian people by the United State of America Government and the European Union in order to participate in solving housing problems at Gaza Strip. PHC was the owner of the project. This project was sold to the Palestinian residents through paying 20% of apartment price as down payment and 80% will be paid as long term loan. This strategy aims to establish a revolving fund and construct other projects from

repayments for sustainability [El-Karama towers file-General, 1994]. The project consists of thirteen escalator buildings, each building contains nine floors. Figure 5-6 illustrates the project layout.

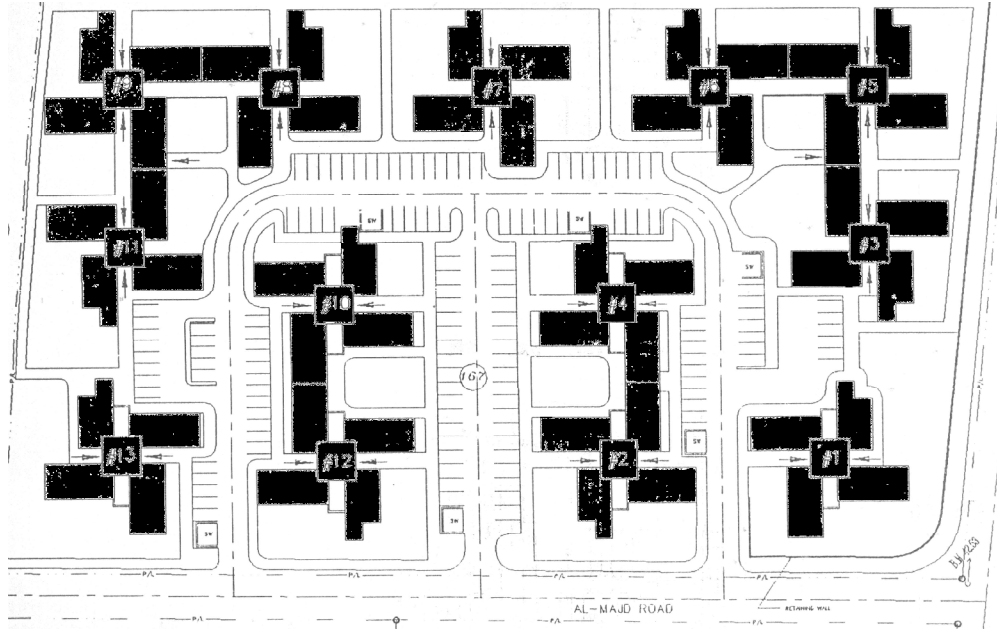


Figure 5-6 El-Karama Housing Project layout [Site layout plan - El-Karama Project]

The housing estate pattern used at the project is Nodal estate pattern. This pattern was used with combined housing buildings. Streets and parking areas percentage at El-Karama Housing Project reached approximately 49.7% of total area of the project. Table 5-5 illustrates the area classification of site elements at the project.

Table 5-5 The site elements area at El-Karama Housing Project

Item	Area (m ²)	Percentage (%)
Total area	22127	100
Services and utilities land area	0	0
Residential building area	6240	28.3
Streets and parking area	11019	49.7
Open spaces area	4868	22
Number of parking lots	166	40% (apartment number)
Number of apartment	416	----
Apartment area	112 m ²	75%
	100 m ²	25%

El-Karama Housing Project has a net density of 37.2 dwelling units/donum which is equal to 223 person/donum. Building type at El-Karama Housing Project is nine escalator apartment buildings. Figure 5-7 illustrates the typical floor plan.

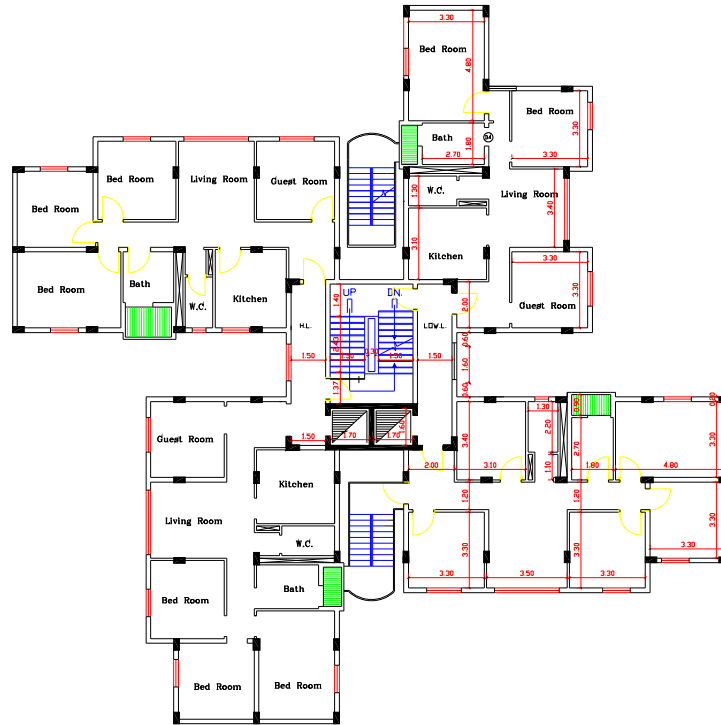


Figure 5-7 Typical floor plan for typical building at El-Karama Housing Project

Each floor of the buildings contains four apartments located in two levels. Three apartments contain three bed rooms and the fourth apartment contains only two bed rooms. The net area for the big apartment is 112 m² and the area for the small apartment is 96 m². Each apartment contains bed rooms, kitchen, bathroom, toilet, guest room, and living room. The area of the bed rooms are 10.89, 15.84 and 10.89 m² and the areas of the kitchen, the living, and the guest rooms are 10.54, 11.9, and 10.89 m², respectively.

5.2.2. The Selection Criteria

The following criteria have been used to select one of the previous three projects for the case study:

1. Project location and project land price: Suitable location for any low cost housing project means that the project land located at the peripheral development in addition to the availability of infrastructure and utilities. The project of good location and the lowest land cost was given the maximum degree five. The project of suitable location and more expensive land cost was given degree three. The project which has acceptable location and the most expensive land was given degree one.
2. The project size of at least 300 dwelling unit: The selection of 300 dwelling unit is related to the minimum volume of any residential neighborhood. The project which has the biggest number of dwelling units was given the degree of five. The project which has the moderate number of dwellings was given the degree three, and the project which has the small number of dwellings was given the degree two.
3. The project satisfies neighborhood elements: Such as residential zones, services and utility zones, road and parking systems, and open spaces zones. The project which has all neighborhood elements was given the degree of five and the project which has some neighborhood elements was given the degree of four. Neighborhood elements are available for all projects except utilities and services element that is not exist in all project.
4. Availability of information about the project: The project which has available data was given the degree of five, the project which has missing data are given the degree of three and two. The availability of information means that the drawings, the contract document and actual cost of the project are available.
5. The completion of all phases of the project: The vast majority of the housing projects were constructed by dividing the works into two or more phases, for example building construction phase and site works phase. The completed project was given

the degree of five and the project which is not complete was given a degree less than five according to the completion of number of phases.

These criteria have been used to select the suitable project for the case study. A scaled factor from 1-5 (1 represent the bad and 5 represent the best) has been used for each criterion. For example, the scaled degree for the criterion "project size" is applied as follow:

Number five for the biggest project "El-Nada", number three for the smaller project and number two for the smallest project. Another example, the information of Ain-Jalout project is more available than El-Karama and El-Nada projects. In addition, a weight factor has been used for every criterion as follow:

1. Criterion 1: Project location and project land price has more important than others. So that the weight factor was 0.3.
2. Criterion 2: The project size has a weight factor 0.2.
3. Criterion 3: The neighborhood elements have a small weight factor which equal to 0.1.
4. Criterion 4: Availability of information is very important factor so that it gives 0.25 as a weight factor.
5. Criterion 5: The completion of all phases of the project is given 0.15 as a weight factor.

The sum of the weight factor is 1.00. Table 5-6 illustrates the scale and weight factors degree of each project.

Table 5-6 The scaled and weighted factor degree of each project

Criteria	Number of Degree			Weight factors
	El-Nada	Ain-Jalout	El-Karama	
1- Project location and land price	5	3	1	0.3
2- Project size	5	2	3	0.2
3- Neighborhood elements	5	4	4	0.1
4- Information availability	2	5	3	0.25
5- Completion of all phases	1	4	5	0.15
Total	3.65	3.55	2.8	1

From Table 5-6, it is clear that the best project for the case study is El-Nada project which was implemented by the partnership between P.L.C and MPWH. Thus, this project was considered in the case study as follows:

5.3. Alternative Planning and Design Based on Developed Approach

The following drawings illustrate the planning and design based on developed approach. The criteria in the final proposed approach has been used in order to measure to what extent the final proposed approach will reduce the total cost of the housing project. Figure 5-8 illustrates the conceptual planning and design which depend on allocate the site to four residential zones and use the cluster concept for roads and parking system and Nodal concept for housing estate patterns. Figure 5-9 illustrates the site layout. Three types of apartments of different areas were used (80, 116, 128 m²). Building type-A consists of three apartments per floor. Building type-B consists of four apartments per floor. Figures 5-10 to 5-15 illustrate the types of buildings which were used in the proposed design. Table 5-7 illustrates the characteristic of the original design and the proposed design.

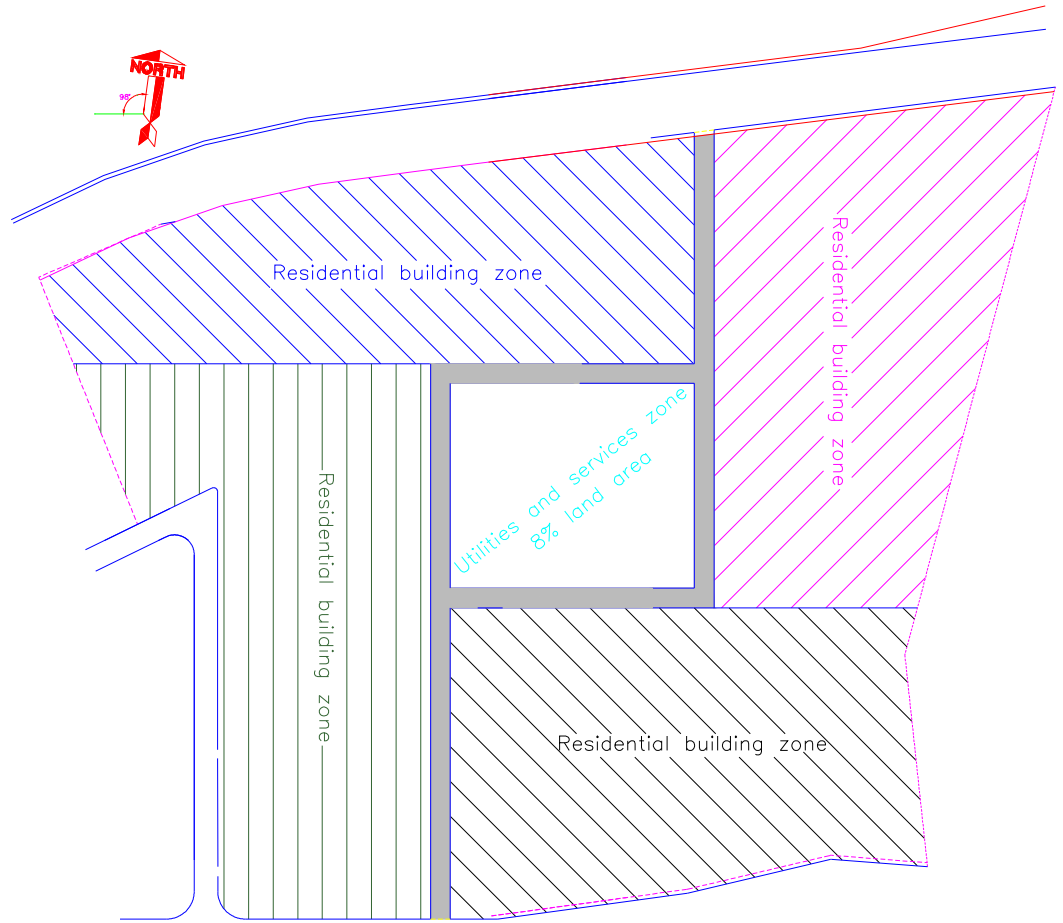


Figure 5-8 Conceptual planning and design



Figure 5-9 Site layout

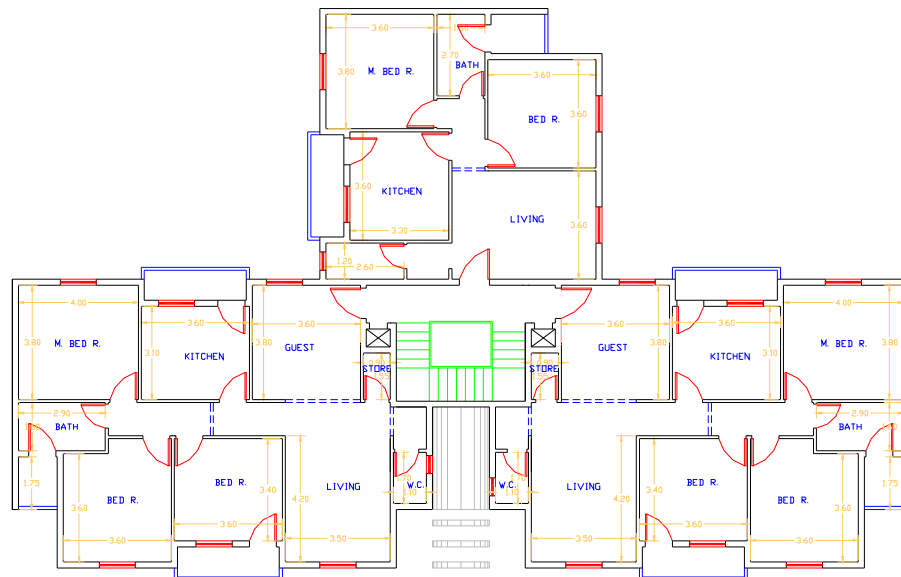


Figure 5-10 Typical floor plan – type-A

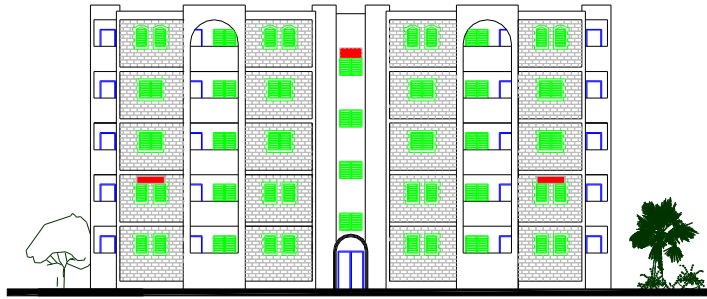


Figure 5-11 Main elevation – type-A

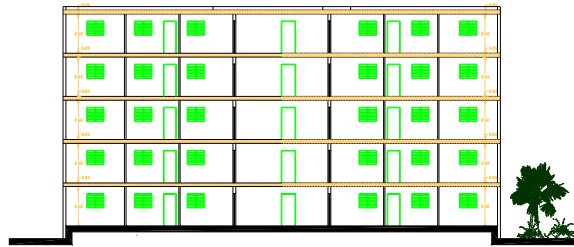


Figure 5-12 Section – type-A

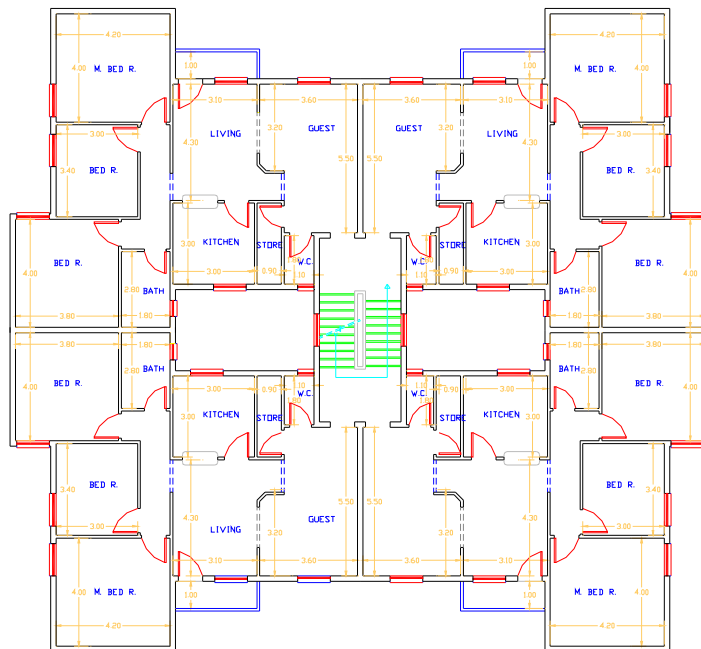


Figure 5-13 Typical floor plan – type-B

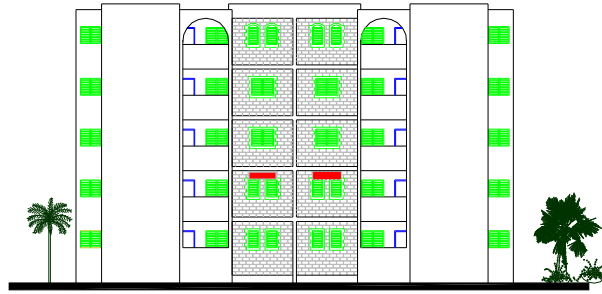


Figure 5-14 Main elevation – type-B

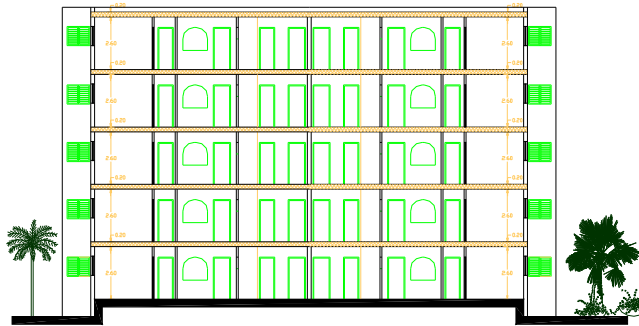


Figure 5-15 Section – type-B

Table 5-7 Characteristics of the original and proposed design

Item	Original Design	Percentage	Proposed Design	Percentage
1- Land area	153118 m ²	100%	153118 m ²	100%
2- Roads and parking	28811.27 m ²	18.82%	22093.56 m ²	14.4%
3- Roads length	1274.25 m.l	-----	1100 m.l	-----
4- Paved paths	44738.72 m ²	29.2%	31534.18 m ²	20.59%
5- Services and utilities	24703.99 m ²	16.13%	12724 m ²	8.3%
6- Residential building	29321.45 m ²	19.15%	61246 m ²	40%
7- number of dwelling units	1458	-----	2410	-----
8- Open spaces system	25543.16 m ²	16.7%	25598 m ²	16.71%
9- Number of parking lots	487	29.3% apartment number	585	24.3% apartment number

5.4. Cost Reduction

The main concept for cost evaluation used by the researcher in this case study is based on percentages not absolute cost. The researcher aims to introduce an applicable method for cost reduction which can be used in other countries in which absolute cost of housing elements varies. Considering the developed approach, the main factors that affect the houses cost are as follows:

5.4.1. Cost Elements

From the available data at PHC and MPWH, it is cleared that the average land cost represents 10.4% of the total cost of any housing project. Table 5-8 illustrates the cost elements percentages for some of the PHC and MPWH projects.

Table 5-8 the cost elements percentages for some of the PHC and MPWH projects

Item	Cost elements percentage of total cost (%)					Average
	Ain-Jalout Phase one	Ain-Jalout Phase two	El-Qalaa	El-Karama Phase two	Austrian	
1- Land	10.1	10.1	10.1	13.0	8.6	10.4%
2-Building construction	79.3	77.5	75.26	74.0	76	76.4%
3- infrastructure and site works	9.15	9.7	10.19	10	13.5	10.5%
4-design and supervision	0.65	1.5	2.0	1.6	1.3	1.4%
5-license fees	0.8	1.2	2.45	1.4	0.6	1.3%
Total	100	100	100	100	100	100%

It is clear from Table 5-8 that building construction represents 76.4% of total cost, infrastructure and site works represents 10.5% of total cost, design and supervision represents 1.4% of total cost, and licenses fees represent 1.3% of total cost.

5.4.2. Cost Reduction for Each Element

5.4.2.1. Land Cost Reduction

In the original design, 105 m² is the share of land for each dwelling unit. On the other hand, 63.53 m² is allocated for each dwelling unit in the proposed design. The saving in land area per dwelling unit is equal to 39.5% of original land area. So that the saving in land cost equals 0.395×10.4 (Table 5-8) (4.11% of total cost).

5.4.2.2. Roads and Parking Cost Reduction

From the available data at PHC, it is cleared that the roads and parking paving item represent 9.9% from infrastructure and site works [Site layout files – PHC] which equal to $10.5 \text{ (Table 5-8)} \times 0.099$ (1.04% of total cost). Considering the developed approach, the reduction in the roads and parking paving is equal to 1.04×0.0442 (Table 5-7, item 2) = 0.046% of total cost.

The sewage and water networks represent 23.4% of infrastructure and site works cost [Site layout files – PHC] which equal to 10.5×0.234 (2.457 % of total cost). Considering the developed approach, the reduction in the sewage and water networks is equal to 2.457×0.137 (Table 5-7, item 3) (0.336% of total cost).

The lighting network represents 15% of infrastructure and site works cost which equal to 10.5×0.15 (1.575 % of total cost) [Site layout files – PHC]. Considering the developed approach, the saving in lighting network is equal to 1.575×0.137 (0.216% of total cost).

5.4.2.3. Paving Sidewalks Reduction

Sidewalks item represents 26.5% of infrastructure and site works cost [Site layout files – PHC] which equal to $10.5 \times 0.265 = 2.782\%$ of total cost. Considering the proposed approach, the saving in sidewalks items is equal to 2.782×0.0861 (table 5-7, item 4) which

equal to (0.24% of total cost). The saving cost in lighting network considering the reduction in sidewalks paving is equal to 1.575×0.0861 (0.136% of total cost).

5.4.2.4. Open Spaces Cost Reduction

Saving must be done to the plants and furniture elements. This saving will not be less than 50% from plants and furniture cost which represents 7% from site works cost [Site layout files – PHC]. This percentage represents a saving in the total cost equal to 0.367%.

5.4.2.5. Building Height Cost Reduction

Shortening 10cm from the height of the storey leads to reduce the building cost by 1.5% at Saudi Arabia residential building [Al-Absi, 2004]. Also, this rate is applicable at Palestine. The proposed height is 2.6 m and the original design height equal to 2.85 m. The proposed design creates a reduction in storey height equals to 0.25 m which represents 3.75% of the building construction cost. Building construction cost represents 76.4% (Table 5-8) of total costs. The total saving cost which resulting from the reduction is 76.4×0.0375 (2.865% of total costs).

5.4.2.6. Windows Area Reduction

The total windows area in the original design is equal to 12% from spaces area. This percentage reaches 10% of spaces in the proposed design. So that, the reduction can be reach 20% from total windows cost. From Table 2-16, the windows cost represents 4.1% of building construction cost which equal to 76.4×0.041 (3.13% of total cost). The saving cost can be reach 3.13×0.2 (0.626% of total cost).

5.4.2.7. Stair and Roof Boundary Walls Reduction

Concrete stair, blocks, plaster and roof boundary walls represents 45% of masonry works for the typical floor [Bill of quantities of the projects - PHC]. Typical floor masonry works represents 20% of total masonry cost. So that, stair and roof boundary reduction represents

$20 \times 0.45 = 9\%$ of total masonry cost, which equal to 11.4×0.09 (1.026% of total building construction cost) (see Table 2-16). This percentage is equal to 76.4×0.01026 (0.784% of total cost).

5.4.2.8. Module Effect

The proposed module 3.6 m leads to decrease the slab depth. The original design slab depth is 0.25 m and the proposed slab depth is 0.2 m. This will reduce the slab volume by 20%. Slabs cost represents 45% of skeleton cost which equal to $36.2 \times 0.45 = 16.29\%$ of building construction cost [Bill of quantities of the projects - PHC]. The saving is equal to $76.4 \times 0.1629 \times 0.2$ (2.4 % of total cost).

5.4.2.9. Finishing Material Reduction

The following points illustrate the main reduction in finishing materials items considering the developed approach:

1. Internal paints represent 4% of building construction cost (Table 2-16) which equal to 76.4×0.04 (3.056% of total cost). The reduction in the interior painting equals 80% of the interior paint cost. The saving equals to 3.056×0.8 (2.445% of total cost).
2. Insulation works represent 1.2% of building construction cost (Table 2-16) which equal to 76.4×0.012 (0.917% of total cost). The saving can be reach 50% of the insulation cost which equals to 0.917×0.5 (0.458% of total cost).
3. Tilling cost represents 11.5% of building construction cost (Table 2-16) which equals 76.4×0.115 (8.786% of total cost). The use of local tiles instead of marble tiles, local marble instead of granite, and using ceramic only for bathes reduces cost by 35% of tilling cost [Bill of quantities of the projects - PHC]. The saving can be reach 8.786×0.35 (3.07% of total cost).

5.4.2.10. Procurement Method

The use of Design/Build method can reduce the design and supervision costs by at least 30%, because of the using of Design/Build method which reduces the project time by nearly 30%. This leads to reduce the total project overhead. The saving in design and supervision cost can reach 1.4×0.3 (0.42% of total cost).

5.4.2.11. License Fees

License fees represent 1.3% of total cost. The localities can reduce the houses cost by the exemption from such fee for low income people while the fees for rich people can be increased.

5.4.3. Total Reduction

Considering the developed approach, the total reduction can be summarized as follows:

Reduction Item	Percentage (% of total cost)
1- Land	4.11
2-Roads and parking paving	0.046
3-Sewage and water network	0.336
4-Lighting network	0.352
5-Sidewalks paving	0.24
6-Plants and furniture of site work	0.367
7-Storey height	2.865
8-Windows area	0.626
9-Stair and roof boundary walls	0.784
10-Module	2.40
11-Finishing material (paint-insulation-tilling)	5.973
12-Procurement method	0.42
13-License fees	1.3
Total cost saving	19.82

5.6. Concluded Remarks

The application of the developed approach on the case studies indicated the following remarks:

1. Eleven projects were determined in order to conclude Palestinian housing experience during the previous thirteen years.
2. Only one housing project was included in the case study. In order to select this project, some requirements have been examined. The result is short list contains three projects.
3. The following criteria have been used to select one of the previous three projects for the case study:
 - a) Project location and project land price
 - b) The project size.
 - c) The neighborhood elements.
 - d) Availability of information.
 - e) The completion of all phases of the project.
4. The land condition of the selected project was used to create new planning and design taking into consideration the developed approach.
5. The proposed design contains the following characteristic:
 - a) Cluster concept for land subdivision.
 - b) Cluster concept for roads system.
 - c) Net density is 18 dwelling units/donum.
 - d) Nodal concept for housing estate patterns.
 - e) Collector and local streets width is 10 and 6 m respectively.
 - f) Average sidewalks width is 1.3 m.

- g) Type of residential building is walk-up apartment building which contains ground floor and four typical floors. Two types of building were used in the proposed design. The first type contains three apartments per floor and the second type contains four apartments per floor.
- h) Apartment's area is 80, 116, and 128 m².
- i) Buildings shapes are rectangle and square.
- j) Combined not detached building was used.
- k) Floor height is 2.6 m.
- l) Elevations element used is rectangular shape.
- m) Services and utilities area used is 8% of total land area.

A comparison between the original and proposed design was conducted by the researcher. This comparison aims to introduce the cost reduction. The total cost saving reached nearly 20% of total cost. This represents the minimum percentage which can be reached if the developed approach was used. El-Nada housing project designer used some elements like cluster concept for roads and combined building for housing estate patterns. This leads to minimize the saving. In the other projects, the saving can reach more than 20% of total cost when using the developed approach. The vast majority of housing project in Gaza Strip is high rise buildings of at least seven stories. This system requires electromechanical units like elevators, pumps, generator, etc. The developed approach provides more dwelling than the existing number in any project in Gaza Strip. In addition, using the developed approach will create high saving resulting from the unused electromechanical units.

CHAPTER 6

CONCLUSIONS AND RECOMENDATIONS

6.1. Conclusions

1. Housing affordability must be determined by making comparisons at the local level between the cost of housing and the income of households. The factors that affect the problem of providing low income people in Palestine with houses are:
 - a. Low level of income: The low-income people in Palestine don't earn enough to meet the expenses of feeding, clothing, transport to work, etc. There is no extra money to think of saving to buy or build a house.
 - b. High cost of building materials: The high cost of major building materials in Palestine is veritable source of serious concern. Most of the major building materials such as cement, reinforcement steel, paint, etc are imported from developed countries through Israel.
 - c. High interest rate of the local banks loans at Palestine which reach 7.5-12 %.
 - d. Land acquisition problem: To acquire a piece of land is not an easy task for the low-income people. Available land is always purchased by land speculators who hold for some time only to resell at higher prices where the low income cannot afford.

The main objective of this study is to develop an approach to lower the cost of housing project in Palestine while ensuring adequate environment and health conditions to Palestinian people. This will ultimately enable more people of limited income to own their houses.

2. This study discussed and investigated the main influencing factors that affect the cost of low-cost housing project in Palestine. These factors are similar to those factors that

affect the low-cost housing projects in the other countries of the world. These factors can be summarized as follows:

1. Planning and design.
2. Construction industry.
3. Utilizing of local building materials.
4. Building codes and regulation.
5. Land use and tenure.
6. Use of suitable financial programs.

Most of the previous studies investigated one, two or three factors only. The main advantage of this research is the investigation of the vast majority of the influencing cost factors that affect the total cost of low-cost housing projects.

3. The developed approach by the researcher to lower the cost of houses is the main output of this research. The developed approach satisfies the main objective of this study by lowering the housing cost approximately 20% of total cost. This saving represents a high percentage comparison with other studies which aims to reduce the total cost by 10-15%.
4. The main influencing factor that affects the reduction cost in the developed approach is Planning and Design which represent 62% of total reduction cost. The second factor is "utilizing local building materials" which represent 30% of total reduction cost.
5. The developed approach can be applied in other countries because the researcher used percentages not absolute value for the cost reduction elements.
6. This study indicates that the housing of low-income people requires the private and public cooperation. This study identifies also the role of each private and public sectors. The role of public sector is to create the infrastructure and the laws to facilitate

producing the units by private sector. In addition, laws should be created to encourage the private sector in the investment of low-cost housing and to develop standards and building regulation geared only for low-cost housing.

7. The study emphasizes the use of uncommon construction contract method (Design/Build) in order to reduce the total housing cost. Emphases should be placed on training programs in the construction field outside Palestine for each contractor and consultant to increase the knowledge in Design/Build method, also there is a need for further researches to adopt houses to be more economical.

6.2. Recommendations

The steps which are recommended by the researcher to follow by private, public, local banks, contractors and owners in order to facilitate the use of the developed approach are as follows:

6.2.1. General Recommendation

1. It is recommended to use the developed approach by private and public housing sectors.
2. It is recommended to repeat the same housing patterns by private and public housing sectors.

6.2.2. Recommendation for the Government

1. The Government needs to build legal framework if the developed approach to be used effectively.
2. The Government with the Municipalities and Engineer Association needs to develop separate standards and building regulations geared only for low cost housing.

3. The Government needs to encourage the investors to construct new low-cost housing project by the facilitation of the procedures, creation of laws and the creation of Government-Private sector partnership unit.
4. The governmental institutions need to approve the Design/Build procurement method in order to create legal framework for using this method.
5. The Government needs to create housing research centers to develop new construction methods and new materials that satisfy lowering the houses cost.
6. The Government needs to create national housing funds in order to create revolving fund and to create the insurance for depository institutions.
7. The Government needs to encourage the local factories to produce locally made production by creating laws to facilitate the import and export material in a free competitive market.

6.2.3. Recommendation for private and non-governmental sector

1. Non-governmental housing institutions like (PHC) need to create short-term finance programs that will not exceed five years.
2. The private and public institutions need to create training courses or workshops for contractors and consultants outside Palestine in order to increase the knowledge in Design/Build method.
3. The private and public institutions need to have good knowledge owner representative in order to increase the benefit of using Design/Build.

6.2.4. Recommendation for local banks

1. The local banks need to create long-term finance programs that the loan can be paid in 20-30 years.

2. The local banks need to facilitate the contractors bank guarantees in order to maximize the contractor benefit from down payment.

6.2.5. Recommendation for the contractors and consultants

1. The contractors need to use MS Project program and material estimation program (structural bill of quantity) to create good project schedule which leads to optimal using of workers and materials.
2. The contractors and consultants' needs to create one firm as join venture relationship in order to introduce the Design/Build firm.

6.2.6. Recommendation for the owners

1. The owner needs to facilitate the contractor payments by paying without any delay. Down payment for the contractors is recommended.
2. The owner needs to facilitate the approval of equivalent materials and information's needed by the contractors.

In addition, the following subjects are recommended by the researcher to be conducted in other researches:

1. Structural systems and construction materials used for low cost housing in Palestine needs more investigations.
2. Energy consumption at low cost housing projects in Palestine needs a lot of researches.

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Appendix A

City Planning Theories advantages and disadvantages [Haider, 1994 pages 88 to 132].

	<i>Theory name</i>	<i>Description</i>	<i>Advantages</i>	<i>Disadvantages</i>	<i>Applicability to low cost housing</i>
1	<i>Garden city theory.</i> <i>"Ebenger Howard"</i> <i>(1898)</i>	<ul style="list-style-type: none"> • It was appeared at the end of nineteenth century. • It depends on the combination between the urban and rural zoning. • It consists of five circular streets and six centralize street. • The idea depends on concentrate the utilities on the city center and the residential district constructed with a combination between the rural and urban development. • A green belt is around the city. 	<ul style="list-style-type: none"> • Population is limited at the city. • Healthy environment which is produced by the combination between the agricultural land and the residential district. 	<ul style="list-style-type: none"> • Low density. • Serviced utility is far away. • Long road network. • Future city extension is limited by the industry zone out side the city and the green belt. 	<ul style="list-style-type: none"> • It is not suitable for low cost housing because of low density and big open spaces and parks.
2	<i>Integrated residential district theory</i> <i>"Patrik Geddes"</i>	<ul style="list-style-type: none"> • A city is a part from region. • It considered that place, work, and folk are an integrated unit with a direct relationship with the city 	<ul style="list-style-type: none"> • These concepts were considered as the basic of modern city planning. 	<ul style="list-style-type: none"> • There is no clear design for these concepts. 	<ul style="list-style-type: none"> • There is no clear design for these concepts.

	(1910)	<p>planning.</p> <ul style="list-style-type: none"> • The residential district must reflect the functional, cultural and physical characteristic of the constructed site. • The principles of residential district must reflect the functional, cultural and physical characteristics of the sites. 			
3	<p><i>Satellite towns theory</i></p> <p><i>"Raymond Unwin"</i></p> <p>(1922)</p>	<ul style="list-style-type: none"> • Its look likes the Garden City theory. 	<ul style="list-style-type: none"> • Its look likes the Garden City theory. 	<ul style="list-style-type: none"> • Its look likes the Garden City theory. 	<ul style="list-style-type: none"> • It is not suitable for low cost housing because of low density and big open spaces and parks.

4	Grid extension theory "L. Hilber Seimer" At the beginning of the nineteenth century	<ul style="list-style-type: none"> • Depends on the horizontal extension instead of vertical extension. • Depends on transfer people outside the city. • Depends on the network planning. 	<ul style="list-style-type: none"> • The ease of city future extension. 	<ul style="list-style-type: none"> • Low density. • Services utilities are far away. • Long road network. 	<ul style="list-style-type: none"> • It is not suitable for low cost housing because of low density and long road network which will increase the total cost of houses.
5	Central places theory "Walter Christaller"	<ul style="list-style-type: none"> • Depends on planning a city and village at the region paper by a constant mechanical system. • This system determines the distance between the cities and its volume. • Every region has a big center. • Region land must be homogenous or without any topography difficulties. 	<ul style="list-style-type: none"> • It introduces high degree of logic and systematic for the creation of cities and region. 	<ul style="list-style-type: none"> • It needs an ideal (no different topography) land to create the cities and the regions. • It is not applicable. 	<ul style="list-style-type: none"> • There are no complete details about the neighborhoods content.
6	Neighborhood unit theory	<ul style="list-style-type: none"> • The volume of neighborhood depends on the population volume. 	<ul style="list-style-type: none"> • The vast majority of the world countries use this 	<ul style="list-style-type: none"> • Use the primary school as the center of the 	<ul style="list-style-type: none"> • It is applicable for low cost

	"Clarence Perry" (1929)	<ul style="list-style-type: none"> • Primary school is the center of the neighborhood and its capacity is 1000-1200 children. • The population live in the neighborhood is 5000-6000. • 10% from the total area is an open space for gardens. 	<p>theory.</p> <ul style="list-style-type: none"> • High density. • Services utilities near the residents. • It contains many of public services such as clinic unit, police station, fire station, etc. 	neighborhood.	housing because of high density and short road network which will decrease the total cost of houses.
7	Super Block theory. "Henry Wright and Clarence Stein" (1929)	<ul style="list-style-type: none"> • Depends on the neighborhood unit theory. • Main streets pass around the land. • Local streets are cul-de-sac. • The central area is far away from the transportation paths. 	<ul style="list-style-type: none"> • Separate the pedestrian paths and cars paths. 	<ul style="list-style-type: none"> • High percentage of open spaces. • Low density. 	<ul style="list-style-type: none"> • It is applicable for low cost because of the high degree of controlling density at the sites.
8	City of Tomorrow theory. "le Corbousier" (1922)	<ul style="list-style-type: none"> • The city has big gardens which contain a lot of high rise building. • The building consists of 60 floors. • These building represent 5% from the total area of the city. • Besides the high rise building, there is a low rise building and villas 	<ul style="list-style-type: none"> • The planner creates the basic principle of the modern city planning. • Big street. • Increase the building intensity and increase the green open spaces. 	<ul style="list-style-type: none"> • High percentage of open spaces. 	<ul style="list-style-type: none"> • It is applicable for low cost housing because of the using of high rise building which decreases the total cost of houses..

		out side the city.	<ul style="list-style-type: none"> • Classification of transportation instruments and organizes the paths in different levels. 		
9	<i>Radiant city theory.</i> <i>"le Corbousier"</i> <i>(1925-1950)</i>	<ul style="list-style-type: none"> • Depends on the increase of gardens and open spaces. • Depends on the combination between the rural and urban zoning. • Vertical extension. 	<ul style="list-style-type: none"> • Separation between cars paths and resident's paths. 	<ul style="list-style-type: none"> • Low density. • High percentage of garden and open spaces. 	<ul style="list-style-type: none"> • It is not suitable for low cost housing because of low density and high percentage of gardens and open spaces which will increase the total cost of houses.
10	<i>The broad acres city theory.</i> <i>"Frank Loyed Wright"</i> <i>(1932)</i>	<ul style="list-style-type: none"> • Depends on the distribution of industry, cultural, shopping, gardens, and farms zoning a long the city main street. • Depends on the dispersed sheet. 	<ul style="list-style-type: none"> • It depends on the horizontal extension. • It contains all human needs so that it was named as ideal city. 	<ul style="list-style-type: none"> • Low density. • High percentage of garden and open spaces 	<ul style="list-style-type: none"> • It is not suitable for low cost housing because of low density and high percentage of gardens and open spaces which will increase the total

					cost of houses.
11	<i>Ideal city theory.</i> <i>"Irik Golden"</i> <i>(1923)</i>	<ul style="list-style-type: none"> • Depends on the creation of equal circular cells. • The cell diameter is 2.4km. • The cell contains 100,000 people. • The cell has all services utilities. 	<ul style="list-style-type: none"> • It depends on the neighborhood unit theory. 	<ul style="list-style-type: none"> • Spaces were created between the cells, this leads to cut the continuity of the districts of the city. • Create equal cells is impossible in the nature. 	<ul style="list-style-type: none"> • It is impossible to create this theory.
12	<i>Dynamic theory.</i> <i>"Doxiadis"</i> <i>(1953-1959)</i>	<ul style="list-style-type: none"> • Depends on the integration between the cities to create big city, which called "ecomenopolice". • It considers the time factor as the main fourth factor affects the future city dynamic. 	<ul style="list-style-type: none"> • Introduce the development phases of the cities. 	<ul style="list-style-type: none"> • It doesn't consider the social, economic and physical conditions of people and the distribution patterns of people. 	<ul style="list-style-type: none"> • It is not suitable for low cost housing.
13	<i>future city planning development Theories</i> <i>"1959 till now"</i>	<ul style="list-style-type: none"> • These theories depend on the lack of agricultural areas, so the solution is to build a high rise suspend building and use another levels under earth surface. 	<ul style="list-style-type: none"> • Decrease the crowdedness at the earth and transfer it to the space by construct spaces building. 	<ul style="list-style-type: none"> • These theories create cities like dreams cities. • Until now the technology in the world cannot build it. 	<ul style="list-style-type: none"> • It is impossible to create this theory

Appendix B

1- Conventional zoning concept: controlled minimum lot size uniform density, and set back lines. The density determination for conventional single family residential zoning is based on minimum lot size requirements as provided by local ordinances. For planning purposes, the site planner can translate lot size to a net density figure which represents the total number of dwelling per acre within the site, after deducting for roads, parks, school sites, and other public facilities. Figure B1 illustrates the shape of conventional zoning concept.

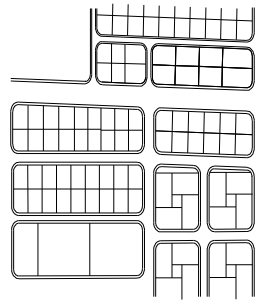
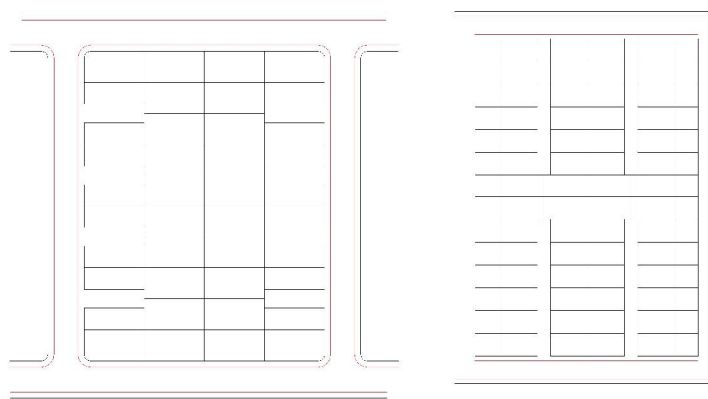


Figure B1 Examples of conventional zoning concept

2- Short passages or double built line method: this leads to create pedestrian network for services some lots. Figure B2 illustrates the shape of short passages method and closed sidewalks method.



(a) example of short passage.

(b) example of closed sidewalks

Figure B2 Example of short passages and closed passages methods

[Islamic Group, 1976, Page 45]

3- Closed passages method: it is produced through collect houses around pedestrian network. It is look like the cul-de-sac roads. Figure B2-b illustrates the shape of closed sidewalks method.

4- Cluster zoning concept: [some times called planned unit development "PUD"] controlled maximum density, mixed housing types, and planned open space. Figure B3 illustrates the shape of cluster zoning concepts, and some shapes of conventional zoning concept such as rectilinear and curvilinear.

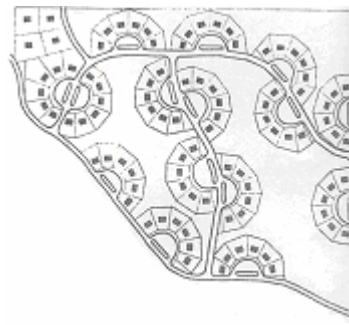


Figure B3 cluster and some shapes of conventional zoning concept

[Callender, 1966, page 1235]

The main advantages for cluster concept is that the linear feet of streets and utilities is half of other plans [Callender, 1966, page1235].

Appendix C

1- Row houses pattern: the blocks collect together in parallel rows. The blocks shapes is a square or a rectangle wake-up apartment building or escalator building.

The main disadvantages are the following item: [Islamic Group, 1976, page 55]

- This method needs not more thinking because it is the simplest way.
- It is not effective to satisfy the minimum social requirement for householders.
- It doesn't consider the site topography.
- The long way of the combined blocks.
- The poor of the visual view.
- Not suitable for human standard.

This way is the most economic method which represents the main advantage. Figure C1 illustrates this idea.

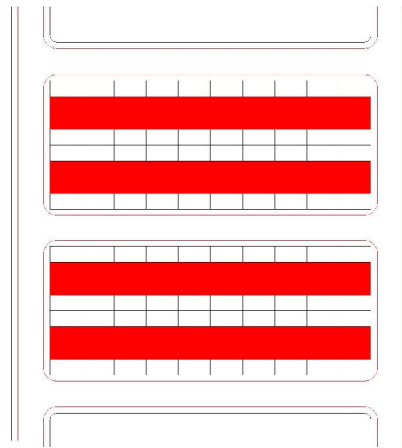


Figure C1 The row houses pattern [Islamic Group, 1976, page 55]

2-Graduated patterns [Untermann, and Small, 1977, page 207]: have a center (or several centers) from which units move out in concentric rings. Typically density decreases from center out and unit mix changes depending on how urban or rural the site is. Figure C2 illustrates this idea.

The main disadvantage which increases the initial cost of the housing project is the low of density which increases open spaces and streets.

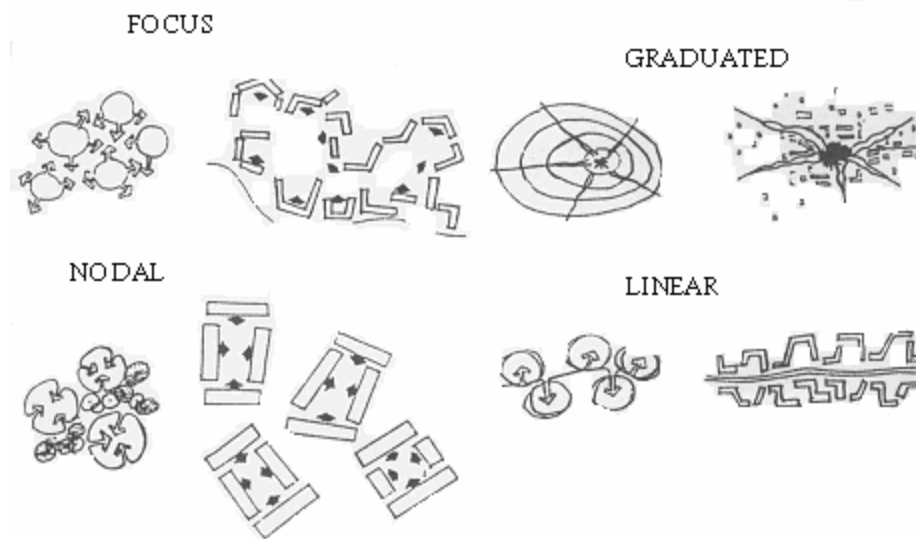


Figure C2 The types of housing state patterns [Haider,1994 , page 180]

3-Focus patterns [Untermann, and Small, 1977, page 207]: relate each cluster of level space to the open space which formerly separated it. Open space can either separate or bind clusters. In this case clusters are bound together by their focusing on open space. Figure C2 illustrates this idea.

The main disadvantage which affects the visual characteristics of the neighborhood is that there is no separation between the spaces from public space, semi-public space, semi-private space, and private space. In addition, this method increases the initial cost of the housing project because it introduce high percentage of open spaces.

4-Linear patterns [Untermann, and Small, 1977, page 207]: unite the level areas with circulation in a linear pattern. Figure C2 illustrates this idea. The main disadvantage which affects the visual characteristics of the neighborhood is that there is no separation between the spaces from public space, semi-public space, semi-private

space, and private space. In addition, it increases the initial cost of the housing project because of the low density which increases open spaces and streets.

5-Nodal patterns: relates each cluster to itself using the open space for buffer and separation. Figure C3 illustrates this idea. The main advantages are as follows:

[Untermann, and Small, 1977, page 207]

- Create flexibility patterns.
- The variance in the spaces and views.
- Clearance of visual views and personal sense.
- Suitable for human standards.

The main disadvantages are as follows:

- The difficulties face the design of combined blocks.
- It is not suitable for different topography.

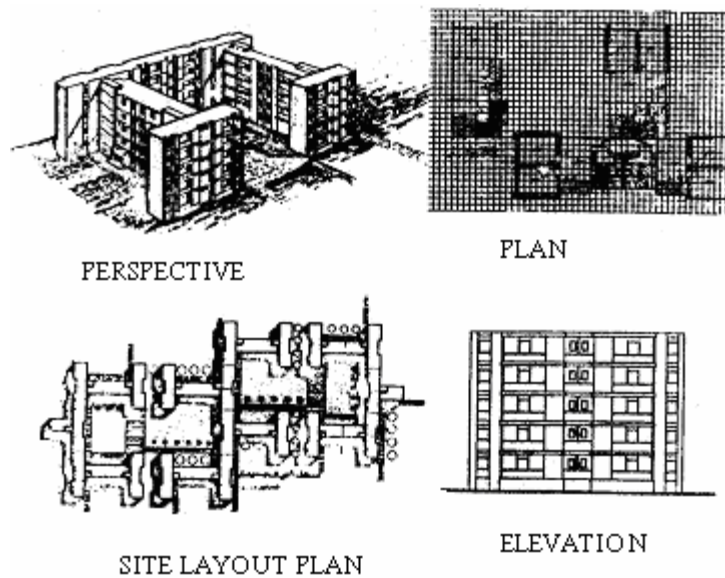


Figure C3 Low cost housing project at Egypt as an example of Nodal patterns

[Islamic Group, 1976, page 58]

Appendix D
بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ
Structured interview

Mr.

I am Hussam Kurraz working as an engineer at the Palestinian Housing Council (PHC). In addition, I'm doing my thesis for the Master Program requirement in the Islamic University of Gaza in the field of Construction Management.

The thesis title is " **Towards Lowering the Cost of Houses in Palestine; New Prospective**" and it is supervised by Dr. Mohamed Ziara. The main objectives of the research are:

1. Investigation of influencing factors that affect the cost of housing projects in all phases, which include planning, design, and construction.
2. Determinations of the criteria for economic housing taking into account all of the cost influencing factors.
3. In conclusion, proposing an approach to lower the cost of housing taking into considerations all cost influencing factors.

At this stage, I have proposed the draft approach attached.

Considering your rich practical and research experience in the housing sector, I have the honor to collaborate with you as one of the experts in housing sector for a structured interview.

The attached structured interview is divided into two parts as follows:

Part I: Questions related to the expert background.

Part II: Evaluation of the proposed approach.

6. Strategy Phase
7. Planning and design Phase
8. Procurement Phase
9. Execution Phase
10. Evaluation Phase

I would like to assure that your input will be used for this academic research only.

Thank you for your kind cooperation

Faithfully,
Hussam Kurraz
Gaza, Tel. 00970 599 420127
E-mail: hussam_ku@hotmail.com

Part I Primary questions related to the expert

(General Note: select one choice only unless otherwise stated)

1.1. Name:

1.2. Education

1.3. Years of relevant experience

1.4. Relevant experience.....

1.5. Your recent position in your institution is:

- Technical Manager.
- Projects Manager.
- General Manager.
- Others (identify)

1.6. Institution type?

- Governmental.
- International.
- Non-governmental.
- Municipality.
- University.
- Others (identify).....

1.7. What is the scope of work and what are your main tasks at your institution?

.....

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Part II Evaluation of proposed approach

(General Note: select one choice only unless otherwise stated)

1- Questions related to strategy phase

1.1. The most economic solution for low cost housing is:

- Construct new towns.
- Peripheral development.
- Intensification of existing development.
- Combination of Peripheral development and new towns.

Why:.....
.....

1.2. The role of government should be as follows:

- Direct subsidy for low income people.
- Facilitate producing housing units for low income people by private sector.
- Others (define).....
.....

1.3. Low cost housing financing policy should be based on: (Select one answer or more which have the same importance)

- Creating national housing fund in order to increase the contribution of the local banks.
- Create national housing fund for finance low cost housing projects as a revolving fund program. Fund sources are the following:
 1. Grants and donations.
 2. Receipts from sales and rent earning and benefits charges of government owned real state both rural and urban.
- Creating short-term finance programs that will not exceed five years to improve the living conditions of low and moderate income people.
- Others (define)
.....

1.4. The government can intervene for lowering the cost of houses through the followings: (Select one answer or more)

- Develop separate standards and building regulations, geared only for affordable housing development.
- Direct subsidies to the low cost housing developer by exemption from material and income taxes.
- Create government-private sector partner unit which aims to establish good relationship between the two sectors which reduces the housing cost.
- Others (define)

2- Questions related to planning and design phase

2.1. Identify planning and design elements that affect the total cost of houses as follow:

(Are there any other elements?)

3. Site layout elements which include land subdivision and density, housing estate patterns, open spaces and road and parking system.
4. Residential building design elements which include building type, residential unit design and finishing material.
5. Others (define)

2.2. Residential project elements ratio as follow: (Suggest as appropriate)

Item	Proposed range	New range if necessary
1-Net land density	18-21 dwelling unit/donum	
2-Road, sidewalks and parking area	25- 30% total area	
3-Services area	8-10% total area	
4-Number of parking lots	20% total apartment number	
5-Open spaces	18-20% total land area	

6-Build up ratio	45-50% total land area	
7-Land subdivision	Cluster concept	
8-Housing estate patterns	Nodal with combined building	
9-Building type	Five storey walk-up apartment	
10-Number of unit per floor	3-4 apartment per floor	
11-Construction method	-Cast-in-place reinforcement concrete method. -One way ribbed slab for slabs and roof system. -Fair face hollow cement block for walls system.	
12-Dwelling unit design	-30% total number of apartment is two bedrooms with 80m ² area. -70% total number of apartment is three bedrooms with 128 m ² area.	

2.3. Residential unit design is as follow: (Suggest as appropriate)

Space	Proposed size	New size if necessary
Kitchen	13 m ²	
Guest and living room	14-16 m ²	
Main bedroom	14-16 m ²	
Other bedrooms	12.5 m ²	
Toilet	1.6 m ²	
Bath	4 m ²	
Windows area	8-12% from space area.	

3- Questions related to procurement phase

3.1. The most economic procurement method is:

- Traditional methods (unit price / fixed price)
- Design/build
- Construction management
- Lease
- Others (define).....
.....

3.2. Contractor participation in the design phase (one team for design and construction)

will lead to: (Select one answer or more)

- Reduce variation order which will leads to decrease project cost.
- Faster schedule: this will leads to decrease administration cost in addition to decrease over head cost. In general, this will leads to decrease total cost of housing project.
- Increase contractor benefits.
- Decrease owner responsibility for design mistakes.
- Others (define)
.....

3.3. The most important disadvantages in participating contractors in design phase (one team for design and construction) are: (Select one answer or more)

- Less control to project specification.
- There is no full control to the execution party.
- Legal and governmental obstacles.
- Difficulty in gaining bidding competition.
- Others (define)
.....

**3.4. From your opinion, how can you develop a method to neglect these disadvantages?
Is the participation of owner representative in all project phases will solve the problem?**

.....
.....
.....
.....
.....

3.5. Single point responsibility in all project phases will lead to decrease project cost and implement the project in shorter time. (Select one answer)

- Strongly agree Agree No opinion Disagree Strongly disagree

3.6. Fixed price for design, construction and at the beginning of the project, thus reducing the potential for cost overruns. (Select one answer)

- Strongly agree Agree No opinion Disagree Strongly disagree

4- Questions related to execution phase

4.1. Can the following procedures be taken by the contractor and subcontractors in order to control the project cost during the execution phase? (Select one answer or more)

- Establish good storage system between the storage place and the site work.
- Use Ms Project program to create good project schedule which will leads to optimal using of the workers in the site within the approved time.
- Create good relationship with the owner project manager, leads to facilitate the executing of the project within the time.
- Contractor must not look for variation in order to gain some many, try to execute the work without any changes.
- Others (define) -----

4.2. Can the following procedures be taken by the contractor and subcontractors in order to reduce used material cost and waste during the execution phase? (Select one answer or more)

- Storage construction material in order to prevent any sudden increase.
- Establish good storage system in order to control the use of material.
- Use material estimation program (structured bill of quantity) which can be determine the approximate amount of material needs for the items in order to control the use of material.
- If the amount of material during executing phase begins to exceed the approximate amount, stop the work and begin to study the case and look for the reason in order to correct any mistake.
- It is highly recommended to use the professional workers in order to minimize the material waste.
- Others (define) -----

4.3. Can the following procedures be taken by the owner in order to reduce the project cost or prevent any increasing in the cost during the execution phase? (Select one answer or more)

- Investigate and create additional soil tests in the site work in order to minimize any claims related to the site conditions.
- Facilitates contractor's payments and it is highly recommended to give him down payment.
- Prevent any positive variation and approved negative variation in order to decrease the cost.
- Create good relationship with the contractor and follow up the project.
- Facilitate any information you have to be available to the contractor in order to shorten the time of the design and execution.

- Facilitate the approval of equivalent material especially when the original material doesn't exist.
- Others (define) -----

5- Questions related to evaluation phase

5.1. Can the following procedures be taken by the owner in order to evaluate all phases and evaluate apartment unit performance? (Select one answer or more)

- Separate evaluation for individual phases will be done at the end of each phase in order to determine the problems and look for solutions which will help in reducing the houses cost.
- Analysis and review of cost plan after the completion of the project.
- Post occupancy evaluation must be done in order to investigate the resident's satisfaction and evaluate apartment unit performance.
- Others (define) -----

6- General comments and suggestions by expert:

7- General comments by researcher related to the interview:

