



**UNIVERSITI PUTRA MALAYSIA**

***FACTORS AFFECTING CONSTRUCTION COSTS IN AFFORDABLE  
HOUSING FOR LOW-INCOME GROUP IN SANA'A, YEMEN***

**WA'EL ABDULMOGHNI MOHAMMED ALAGHBARI**

**FRSB 2010 5**

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**BY**

**WA'EL ABDULMOGHNI MOHAMMED ALAGHBARI**

**Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia in  
Fulfilment of the Requirements for the Degree of Doctor of Philosophy**

**March 2010**

## DEDICATION

*In The Name of Allah, the Most Gracious and Merciful*

*To My Beloved Yemeni People, ...*

*The Origin of Arabic Nation.*

*And To My Beloved Family*

- *To My Kind Parents: Who Provided Me Generously With Advice, Kindness, and Tenderness*
- *To My Nice Wife: My Journey Mate in Life*
- *To My Lovely Children: Where I See My Promising Future*
- *To My Excellent Brothers: Who Are My Good Example And Real Supporters*

Abstract of the thesis submitted to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Doctor of Philosophy

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**March 2010**

**Chairman : Ar. Azizah Salim Syed Salim, PhD**

**Faculty : Design and Architecture**

Yemen is one developing country in the Middle East, which suffers from housing shortage. Unprecedented rapid urban growth coupled with lack of infrastructure has led to the problem of housing shortage for the low-income group in Sana'a, the capital city of Yemen. Consequently, informal housing patterns are observed clearly in some sectors of the city. The low-income group has built this kind of housing urgently and in some cases immediately as the final and only solution, yielding serious implications on the quality and safety of the houses. The overriding objective of this study was to identify the significant factors, which have influenced the construction cost of housing in Sana'a to resolve the housing shortage for the low-income group. Specific objectives have included determining the factors causing housing shortage for low-income group in Sana'a; justifying the significant factors influencing the cost of low-cost housing; and recommending to relevant authorities in Yemen to improve housing policies to mitigate the housing shortage in Sana'a. An important contribution of this study is the analysis

of the construction cost of housing for the first time through the use of the Hedonic Regression Model (HRM).

Two different survey questionnaires were used to achieve the study objectives. The first was to examine the requirements of low-income group, while the second was to analyze the feedbacks from professionals attached to relevant housing agencies in Sana'a. Statistical analyses using the descriptive statistics - Chi- Square tests, T-tests, ANOVA, and HRM analysis were carried out to study the difference in the variables used. HRM for housing was developed and used to analyze the physical characteristics of location; characteristics of building - materials, finishing works and construction methods; and other external factors related to the choice of these characteristics.

This study has concluded that most householders were not satisfied with the quality of houses and associated services. They preferred to own new houses but could not afford to do so as obtaining financial assistance or loans have been difficult. In this context, the study has determined that the households wanted to get housing loan with at least 25 years installments. The analysis of professionals' questionnaire has concluded that the significant factors causing the shortage of low-cost housing were high cost of housing, poor handling of available economic resources, lack of legislation policy on housing, and lack of organization and co-ordination of activities related to housing.

Reinforced concrete frame structure was regarded as the best construction method and concrete blocks for internal and external walls as the best materials to build low-cost

housing in Sana'a. Significant factors affecting construction cost of housing in Sana'a included cost of land, cement and steel. Other factors influencing the shortage of low cost housing included economic condition and uncertainty in foreign exchange, construction materials availability in the market, and unstable political situations. The most important factor, related to construction method, and could also affect the construction cost of housing in Sana'a, was the concrete frame structure.

This study has significantly contributed to the housing industry. Firstly, it has employed HRM as a new tool in the field of housing economic to analyze cost of housing characteristics. Secondly, it has formulated valuable housing policies to be implemented by authorities in Yemen.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

**FAKTOR-FAKTOR TERPENTING YANG MEMPENGARUHI KOS  
PEMBINAAN PERUMAHAN MAMPU MILIK BAGI KUMPULAN  
BERPENDAPATAN RENDAH DI SANA'A, YEMEN**

Oleh

**WA'EL ABDULMOGHNI MOHAMMED ALAGHBARI**

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**Pengerusi: Ar. Azizah Salim Syed Salim, PhD**

**Fakulti: Rekabentuk dan Senibina**

Yemen adalah sebuah negara yang sedang membangun di Timur Tengah, yang menghadapi masalah kekurangan perumahan. Pertumbuhan bandar yang pesat dengan infrastruktur yang kurang telah mengakibatkan masalah kekurangan perumahan bagi kumpulan berpendapatan rendah di Sana'a, ibu kota Yemen. Pada akibatnya corak-corak perumahan yang tidak formal jelas terdapat pada beberapa sektor di kota ini. Kumpulan berpendapatan rendah telah membina perumahan jenis ini dengan segera dan pada kes-kes tertentu dengan serta merta sebagai penyelesaian muktamad. Ini dapat mengakibatkan implikasi-implikasi serius terhadap kualiti dan keselamatan rumah-rumah. Objektif utama kajian ini adalah untuk mengenalpasti faktor-faktor penting yang mempengaruhi kos pembinaan rumah di Sana'a bagi tujuan menyelesaikan masalah kekurangan rumah bagi kumpulan berpendapatan rendah. Objektif-objektif khusus termasuklah menentukan faktor-faktor yang dapat menyebabkan kekurangan perumahan bagi kumpulan berpendapatan rendah di Sana'a; mempertahankan faktor-

faktor penting yang mempengaruhi kos pembinaan rumah; dan mengesyorkan kepada pihak-pihak berkuasa yang relevan di Yemen untuk memperbaiki polisi-polisi perumahan bagi tujuan meringankan kekurangan perumahan di Sana'a. Penyumbangan penting dalam kajian ini ialah analisa kos pembinaan perumahan dengan penggunaan *Hedonic Regression Model (HRM)* pertama sekali.

Dua jenis soal-selidik siasatan telah digunakan untuk mencapai objektif-objektif kajian. Soal selidik yang pertama bertujuan memeriksa keperluan - keperluan kumpulan berpendapatan rendah sementara soal selidik yang kedua adalah untuk menganalisa maklumbalas-maklumbalas daripada pihak professional di beberapa agensi perumahan di Sana'a. Analisa statistik menggunakan statistik deskriptif - Ujian Chi Square, Ujian-T, Analisa Regresi Pelbagai dan HRM telah di jalankan bertujuan mengkaji perbezaan di antara pengubah-pengubah yang digunakan. HRM dibina dan digunakan bagi menganalisis ciri-ciri fisik lokasi; ciri-ciri bangunan - bahan-bahan, kerja-kerja kemasan dan keadah-keadah pembinaan; dan lain-lain faktor luaran yang berkaitan dengan pemilihan ciri-ciri tersebut. Kajian ini telah mengambil kesimpulan bahawa kebanyakan pemilik rumah tidak berpuashati dengan kualiti perumahan serta perkhidmatan-perkhidmatan yang berkaitan. Mereka berminat memiliki rumah baru tetapi tidak mampu kerana sukar memperolehi bantuan atau pinjaman kewangan. Dalam konteks ini, kajian ini dapat menentukan bahawa pemilik-pemilik rumah lebih suka memperolehi pinjaman perumahan dengan bayaran ansuran sekurang-kurangnya 25 tahun. Hasil soal selidik professional dapat mengambil kesimpulan bahawa faktor-faktor terpenting yang menyebabkan kekurangan perumahan kos rendah adalah kos



tinggi perumahan; pengurusan sumber-sumber ekonomi sediada yang lemah; kekurangan polisi perundangan perumahan; dan kekurangan organisasi dan kordinasi aktiviti-aktiviti mengenai perumahan. Strujtur rekabentuk konkrit yang ditambah kuat dianggap sebagai kaedah pembinaan yang terbaik dan blok-blok konkrit merupakan bahan-bahan dinding dalaman dan luaran yang terbaik untuk membina rumah kos rendah di Sana'a. Faktor-faktor terpenting yang mempengaruhi kos pembinaan rumah di Sana'a termasuklah kos-kos tanah, simen, dan keluli. Faktor-faktor lain yang mempengaruhi kekurangan perumahan kos rendah termasuklah keadaan ekonomi dan penukaran wang asing yang tidak menentu; ketersediaan bahan – bahan binaan di pasaran; dan situasi-situasi politik yang tidak stabil. Faktor yang paling penting, berkaitan dengan kaedah pembinaan yang telah memberi kesan terhadap kos perumahan di Sana'a, ialah struktur rekabentuk konkrit.

Kajian ini telah memberi sumbangan penting kepada industry perumahan. Yang pertama, ia dapat menggunakan HRM sebagai peralatan baru di lapangan ekonomi perumahan bagi tujuan menganalisiskan kos ciri-ciri perumahan. Yang kedua, ia dapat merumuskan polisi-polisi perumahan yang baik bagi tujuan pelaksanaan pihak-pihak berkuasa di Yemen.

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Finally, this journey to greater understanding of both theory and myself has reached a crossroad. Please accept my sincere thanks for the help of all those named above and all those unnamed but still remembered for their support and also for sharing part of your lives in moments of joy and struggle.

I certify that and Examination Committee has met (on date of viva) to conduct the final examination of Wa'el Abdulmoghni Mohammed Alaghbari on his thesis entitled “**DEVELOPING AFFORDABLE HOUSING FOR LOW-INCOME GROUP IN SANA’A, YEMEN**” in accordance with Universities and University colleges Act 1971 and the constitution of the Universiti Putra Malaysia [P.U. (A) 106] 15 March 1998. The Committee recommends that the student be awarded the Doctor of Philosophy.

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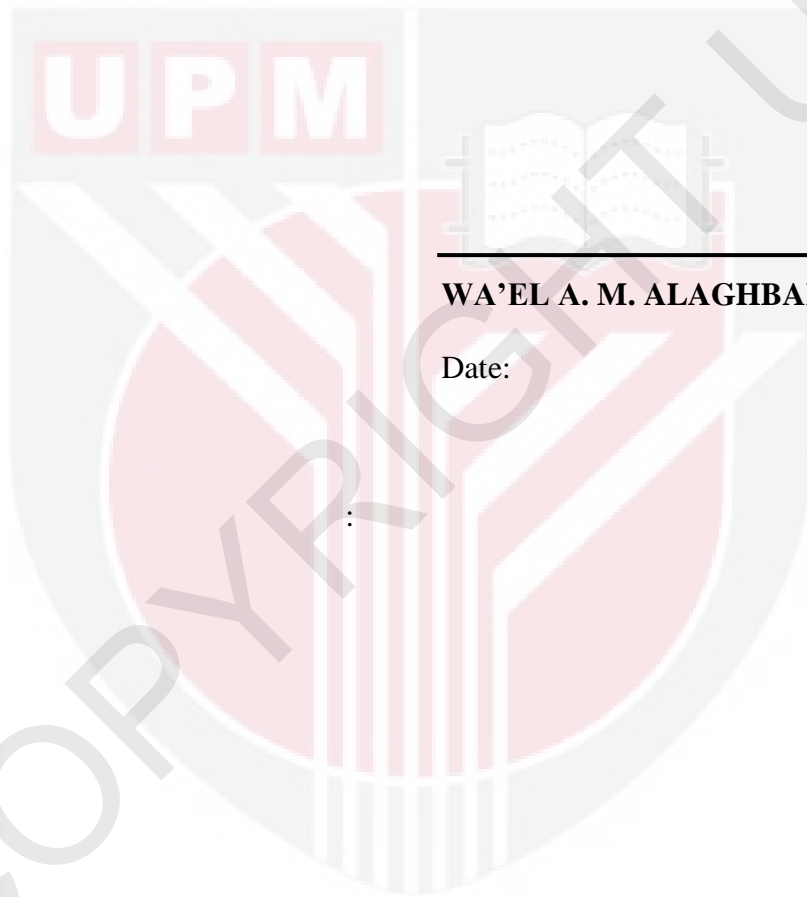
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## DECLARATION

I hereby declare that the thesis is based on my original work except for quotations and citations, which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UPM or other institution.



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**WA'EL A. M. ALAGHBARI**

Date:

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## LIST OF ABBREVIATIONS

|                 |   |
|-----------------|---|
| ANOVA           | Analysis of Variance  |
| LUDPs           | Land Use Development Plans                                      |
| HC              | Housing Cost  |
| HC <sub>a</sub> | Actual Housing Cost by Contractors                              |
| HC <sub>i</sub> | Estimated Housing Cost by Professionals                         |
| HCB             | The Housing Credit Bank   |
| HRM             | Hedonic Regression Model  |
| IBS             | Industrialized Building System                                  |
| LR              | Literature Review   |
| LUDP            | Land Use Development Plans                                      |
| MENA            | Middle East and North Africa                                    |
| MLRM            | Multiple Linear Regression Model                                |
| RM              | Research Methodology  |
| RQ              | Research Question   |
| S <sub>1</sub>  | Sample no. 1 prices (Contractor no. 1)                          |
| S <sub>2</sub>  | Sample no. 2 prices (Contractor no. 2)                          |
| S <sub>a</sub>  | The Average of S <sub>1</sub> and S <sub>2</sub>                |
| SLHCP           | Special Low-Cost Housing Program                                |
| USD             | United States Dollar  |
| Y <sub>CM</sub> | Dependent variable related to cost of construction methods used |
| Y <sub>EF</sub> | Dependent variable of cost related to external factors          |



|          |  |
|----------|--|
| $Y_{FW}$ | Dependent variable related to finishing works cost |
| $Y_{LC}$ | Dependent variable related to land cost            |
| $Y_{MC}$ | Dependent variable related to materials cost       |
| YBRD     | The Yemen Bank for Reconstruction and Development  |
| YR       | Yemeni Rial  |



# CHAPTER I

## INTRODUCTION

### 1.1 Background

Housing plays a very important role in human life and its society. It has a tremendous social and economic impact on our lives and the way we live. It has a direct and immediate influence on the health, education, economy, environment, political and social life of any society (Sinha, 1978). The problem of housing shortage for the low-income group in developing countries is of colossal magnitude. High level of poverty and unemployment, and increased cost of housing and land have contributed to the establishment of squatter settlements surrounding many urban centers in the developing world (Bordignon, 1998). This form of urban sprawl is typical of people, who have obtained employment in the city, but could not afford accommodation there (Basu, 1988).

Housing in the developing world was one of the major challenges faced by mankind in the last decade. More than 50,000,000 people were born in the world every year throughout the 1990s, representing an average growth rate of 3.4% per annum.

Currently, the major housing problem, confronting the world, is the shortage of affordable housing for the urban poor, which forms the low-income majority. Over the last three decades, most official housing planners have failed to reach a considerable proportion of this group, especially households in the lowest 20 or 40 percentiles of the population (Tipple and Willis, 1991).

## 1.2 Housing in Yemen

Yemen is one developing country, which has been suffering from the above mentioned housing problem. Its high population growth and the return of more than a million Yemeni immigrants after the 2<sup>nd</sup> Gulf War has increased significantly the demand for housing. This could also be due to the continuous use of conventional construction methods; the slow pace of construction; and increasing cost of housing. The problem has worsened as the Yemeni Government has not been formulating the necessary plans to meet the high demand for housing or to find alternative solutions.

The rapid urban growth has also made the need for adequate housing for the low-income people, a very important concern of the Yemeni Government, especially in Sana'a , the capital city of Yemen (Djebarni and Al-Abed, 2003), where the main problem lies in the immediate need for houses for the low-income group. This is reflected by the existence of informal housing patterns such as squatters and slums, which have been built to provide urgent shelters for this group of people. It is clear that there is a rapid and increasing demand for low-cost housing. In reality, Sana'a is confronted with a housing gap between the actual availability of low-cost housing and the shortage of housing supply for the low-income group.

The problem of housing in Yemen does not differ much from those experienced in other developing countries, particularly in terms of importance and causes. A group of variables that touch most aspects of life are related to housing. These were mentioned in the United Nations report of 1996. They are as follows:

1. The population: has increased from 1994 to 2007 - 15,804,665 (1994), 16,500,000 (1997), 19,607,000 (2002) and 20,727,063 (2005) as reported at the National Centre for Information, Yemen, 2007.
2. The mean yearly population growth rate of Yemen was 3.7% in 1994 (World Bank 2000) and 3.5% in 2005 (National Centre for Information, Yemen 2007).
3. Average family size of Yemen was 6.6 people in 1994 (Haglan 1998), and 6.9 in 2004 but the average family size of Sana'a was 6.5 people in 2004 (Census, 2004).
4. Number of housing units in Yemen was estimated to be 2,192,458 in 1994 and had increased to 2,834,437 in 2004, with 267,125 units in Sana'a (Census, 2004). Aldhabebi (2007) mentioned that the housing shortage in Yemen was 787,069 units, including the replacement of some unsuitable units. However, it excluded the rented units and the units owned by Islamic organizations (wakf), which were 512,919 units (Census, 2004). Therefore, the total housing shortage in Yemen was actually 1,299,988 units.
5. Yemen has no financial or human resources to start any housing projects to cater for the low-income group. It also does not have the necessary managerial expertise to handle these projects.
6. The city of Sana'a, the capital of Yemen has undergone tremendous urban growth in the last half century. It has the fastest growing townships in the nation as reported in the census of 2004. The report also shows that the number of population in Sana'a city had increased rapidly from 1,003,627 in 1994 to 1,747,627 in 2004 giving an annual growth of 5.5%, which was 2.5% more than the annual population growth of Yemen. The growth has

created a much higher urban land demand than in previous decades, leading to significant changes of landscapes and land uses.

Housing is a big problem in Yemen, especially for political, financial and social planners. For this reason, the problem is most noticeable in large cities, like Sana'a, which represents a typical example of the nature of the problem. The households of four main cities - Sana'a, Aden, Taiz and Hodaidah represent 12 % of the population of Yemen (World Bank, 2000). Urban dwellers comprised 28% of the entire population of the Yemeni Republic in 2002. Then, the growth rate of urban population in the four main cities was 10%, where 3% was due to natural growth and 7% to internal population migration.

Al-Ansi (2006) mentioned that the main causes of internal population migration are as follow:

1. Economic factors - most ministries and departments, public institutions, semi public businesses, and other private businesses are located in the cities, where jobs are available.
2. Political factors - cities being the centres for management, organisation and media outlets.
3. Social and cultural factors - provision of health, educational services, and a sense of cultural cohesion are better facilitated in the cities.
4. Buildings of 50 years and above are old and have started to deteriorate, and have to be rebuilt or replaced every year because of high land cost. The buildings that are demolished yearly represent approximately 2 % of the total

housing units in Yemen, estimated to be 2,192,458 housing units. As such, some 44,000 units have to be built annually as replacements.

5. The problem of housing had worsened during to the Gulf crisis, as tens of thousands of Yemeni expatriates had returned to Yemen from various Gulf countries especially from Saudi Arabia and Kuwait. This has led to a minor housing emergency, which has to be dealt with by the Yemeni authorities responsible for housing plans, and an immediate solution for this problem is inevitable.

### **1.3 The Housing in Sana'a after Yemeni Unification in 1990**

Yemen has a wealth of high quality traditional buildings, and these traditions and qualities can be seen at their best in the old quarter of Sana'a. Sana'a is a city located on a mountainous plateau. It is one of the most rapidly growing cities in Yemen. It has been transformed from a small town enclosed by walls into a metropolitan area in only about three decades. Housing construction has taken place everywhere in the city. Over the last decade spontaneous settlements have been a very visible element in the urban landscape of the city.

A delineation and study of the stages of development of Sana'a, and the reality of Sana'a's planning help one to understand the landscape of the city, the relationship between the function and the morphology, the internal structure of the city, and the reality of Sana'a's housing.

#### 1.4 Housing Strategy in Sana'a

There is no specific strategy to deal with the various aspects and problems of housing per se in Sana'a, but recently, there is a general strategy set for the planning of the city of Sana'a and proposed by the American company Berger/Kamsax (Al-Waraqi, 2001). This plan proposed several long-term strategies and recommendations, these include: land use, public transportation, housing, infrastructure, social activities, public parks and areas for recreation, restoration and preservation of historic buildings. The part which is of interest to this study is the housing, for which the plan set out several points:

- a) The general plan pointed out that there is a need to pay special attention to the provision of adequate housing, especially after the increase in the rate of internal migration of people from the countryside to urban areas.
- b) It was seen that the rising prices of land, labour and building materials have created a need for governmental aids to families with limited incomes.
- c) Even though the main strategy has chosen to provide conventional housing as its guideline, the financial factors will lead to the evaluation of alternative building materials, in different population density area which have population growth.

The general plan by Berger/kamsax in 1978 has proposed two strategies (directed) to deal with housing which are not enough and cannot meet the continual housing demands. These strategies (directed) are as follow:

- a) Maintenance and improvement of current categories of housing units, and allowing the growth of neighbouring housing units.

- b) Provision of appropriate housing to suit the needs of people of low, middle and upper levels of income.

### 1.5 Current Housing Situation in Sana'a

In Sana'a, housing projects were implemented using the cast-in-situ method or others construction methods. In the 1970s and 1980s the Government of Yemen implemented four public housing projects for those in the low-income group in Sana'a. However, after the Yemeni unification on 22<sup>nd</sup> of May 1990, the national housing strategy has changed to facilitate the different political systems of North Yemen (capitalistic) and South Yemen (socialist). Hence, there occurred housing projects carried out by the private sector not meant for the low-income group. These projects were not designed and built to solve the housing shortage of the low-income group in Sana'a and have resulted in many people living in rented and unsuitable units.

**Table 1.1: Dwelling units by type, tenure-ship, number of households of Sana'a**

| Dwelling Type  | Total     |         | Tenureship For Units |        |           |        |           |       |
|----------------|-----------|---------|----------------------|--------|-----------|--------|-----------|-------|
|                |           |         | Owned                |        | Rented    |        | Others    |       |
|                | Household | Unit    | Household            | Units  | Household | Unit   | Household | Unit  |
| House          | 79,852    | 85,883  | 51,527               | 55,702 | 26,318    | 27,598 | 2,007     | 2,583 |
| Apartment      | 37,931    | 41,341  | 12,807               | 14,543 | 24,012    | 25,233 | 1,112     | 1,565 |
| Public         | 2,234     | 2,289   | 455                  | 477    | 1,533     | 1,590  | 246       | 222   |
| Part Of Build. | 11,922    | 12,958  | 3,345                | 3,720  | 7,482     | 7,980  | 1,095     | 1,258 |
| Hut            | 321       | 336     | 119                  | 126    | 79        | 79     | 123       | 131   |
| <i>Sandaka</i> | 754       | 818     | 374                  | 419    | 185       | 199    | 195       | 200   |
| Tent           | 62        | 65      | 14                   | 16     | 30        | 31     | 18        | 18    |
| Establishment  | 7,018     | 7,685   | 659                  | 889    | 5,680     | 6,039  | 679       | 757   |
| Temporary      | 162       | 188     | 24                   | 41     | 41        | 44     | 97        | 103   |
| Cave           | 33        | 35      | 15                   | 17     | 11        | 11     | 7         | 7     |
| Others         | 372       | 446     | 55                   | 83     | 175       | 192    | 142       | 171   |
| Total          | 140,661   | 152,044 | 69,394               | 76,066 | 65,546    | 68,996 | 5,721     | 7,015 |

Source: Final results of 1994 census for Sana'a city - The second report



Table 1.1 shows the relevant statistics of the 1994 census of Sana'a. It is observed that nearly 50% of Yemenis were living in unsuitable units, 43% in rented units, and 27% owned units, which were unsuitable.

Tables 1.2 and 1.3, show that in the 2004 census, the housing problem still existed in Sana'a. The problem was most obvious from the number of rented units, estimated to be 127,460 units, that is, 48% of the total number of units. In the 1994 census of Sana'a, it was noted that there were 68,996 rented units, comprising about 43% of the total number of units.

**Table 1.2: Number and percent distribution of housing establishments in Sana'a by type of dwellings based on the 2004 census**

|        |      | Type of Housing in Sana'a (census 2004) |        |                           |                            |      |                         |       |              | Total  |
|--------|------|---|--------|---------------------------|----------------------------|------|-------------------------|-------|--------------|--------|
|        |      | House                                   | Apart. | boarding house (hostiles) | Resident building (guards) | Hut  | Habitable Establishment | Other | Un-specified |        |
| Sana'a | Unit | 150055                                  | 93423  | 2118                      | 16684                      | 375  | 576                     | 2528  | 1366         | 267125 |
|        | %    | 56.2                                    | 35     | 0.79                      | 6.25                       | 0.14 | 0.22                    | 0.95  | 0.51         | 100    |

Source: Statistical Year Book 2005, Central Statistical Organization, Ministry of Planning & International Cooperation, Yemen

**Table 1.3: Number and percent distribution of housing establishments in Sana'a by house ownership based on the 2004 census**

|             | Housing Ownership in Sana'a (census 2004) |    |        |    |                          |     |       |   |            |   |        |
|-------------|---|----|--------|----|--------------------------|-----|-------|---|------------|---|--------|
|             | Own                                       |    | Rented |    | Wakf (Islamic ownership) |     | Other |   | Not stated |   | TOTAL  |
|             | Units                                     | %  | Units  | %  | Units                    | %   | Units | % | Units      | % | Units  |
| Sana'a city | 124280                                    | 47 | 127460 | 48 | 1999                     | 0.8 | 7335  | 3 | 6051       | 2 | 267125 |

Sources: Statistical Year Book 2005, Central Statistical Organization, Ministry of Planning & International Cooperation, Yemen

In 2007, the new Government of the Republic of Yemen appointed a deputy minister to take care of the housing sector under the Ministry of Construction, Public Works and Highways. In addition, some government and non-government organizations have started to recognize housing projects for low-income group and employees. Furthermore, a Malaysian company also signed a contract with the Investment Agency of Yemen to build 40,000 units of houses for the low-income group during the period from 2009 to 2014.

### **1.6 Statement of Problem**

Currently, most families in Sana'a are financially incapable of purchasing houses in accordance with the building standards because they cannot afford these houses especially without credit availability. This has caused them to start building squatter housing in slum areas, randomly with bad conditions and without basic facilities (UN – Yemen, 2001; Al-Ansi, 2006; Aldhabebi, 2007). This situation arose because inadequate numbers of housing projects were developed in the last 30 years in Sana'a and yet they were not offered to the squatters. In addition, all housing projects were terminated after the Yemeni unification on 22 May, 1990. Therefore, the housing problem of the low-income group was further aggravated and this situation could be observed clearly through the existence of informal housing, which was built by this group of people, to resolve their housing problems especially in the absence of accurate policies and transparency of low-cost housing projects in Yemen (UN - Yemen, 2001; Al-Ansi, 2006; Aldhabebi, 2007).

The need for houses has been a persistent problem confronting the low-income group. There is serious housing shortage in Sana'a caused by both the rapid population growth and demand for housing. This, in turn, has made the problem more complicated because it has escalated housing prices in Sana'a. Therefore, urgent housing policies and strategies are needed in Yemen to reduce the housing shortage particularly for the low-income group. This study has focused on the significant factors that influence the cost of housing and recommended some housing policies to address the housing shortage for the low-income group in Sana'a.

### **1.7 Research Questions**

This study has attempted to explore the problem of housing shortage in Sana'a, Yemen by examining the factors that could contribute to the inability of low-income group to own houses. Hence, the main research question was:

- What are the significant factors influencing construction cost of housing in order to solve housing shortage for low-income group in Sana'a?

To answer the above question the researcher has formulated four sub-research questions as follows:

1. What are the factors contributing the housing shortage for low-income group in Sana'a?
2. What are the significant factors framing the Hedonic Regression Model for housing construction cost in Sana'a?

3. What are the housing requirements and architectural features suitable for low-income group in Sana'a in order to control construction cost of housing?
4. What recommendations can be given to authorities in Yemen to solve the housing shortage for low-income group in Sana'a?

## **1.8 Objectives**

The main objective of the study was to explore the significant factors, which could influence construction cost of housing in order to resolve housing shortage for the low-income group in Sana'a. Specific objectives identified, are as follows:

1. To determine the factors that have caused housing shortage for the low-income group in Sana'a;
2. To identify the significant factors influencing the Hedonic Regression Model involving construction cost of housing in Sana'a;
3. To develop minimal households' requirements and architectural features appropriate for affordable housing in Sana'a; and
4. To recommend the Yemeni authorities on how to improve housing policies in order to mitigate the housing shortage.

## **1.9 Scope of the study**

The study has focused on the housing situation in two public housing schemes, which were developed in 1980s for low-income group in Sana'a. It has identified households' requirements and characters; and has concentrated on developing the

affordable low-cost housing for low-income group covering Government employees with a monthly income between YR25,000<sup>1</sup> and YR50,000.

As with other researches, the present study has also been subjected to a number of limitations. This study has attempted to capture the relevant issues by using primary data related to housing requirements and households' needs, which were collected from respondents, who were residents in two public housing projects. In addition, specific data were also collected from selected professionals in the housing sector, who have been working in the Ministry of Construction, Public Works and Highways. This study did not include financial providers and developers because the housing finance industry is undeveloped in Yemen and the housing supply system now existing in Yemen is the self - built houses.

#### **1.10 Significance of the Study**

This study has adopted approaches to assist in the reduction of housing shortage for the low-income group in Sana'a. Factors that have caused the inadequate housing supply in meeting the high housing demand of the low-income group have been explored and investigated. This study has also implemented ways of increasing the supply of housing through the examination and evaluation of households' requirements for low-cost housing and the factors that have influenced the construction cost of housing s in Sana'a.

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<sup>1</sup> YR (Yemeni Rial): the currency of Republic of Yemen. USD 1 = YR 200 (in 2009).

The main findings of this study has included recommended alternatives of the techniques, construction methods, materials and types of housing units for use in low-cost housing for the low-income group. In addition, this study has also examined construction cost of housing using the hedonic regression model to analyze construction cost of housing. This model is relatively new in the field of housing economics in Yemen and is expected to derive valuable housing policies to be used by the authorities. Finally, this study has also considered new and required standards for low-cost housing for the low-income group published by the Ministry of Construction, Public Works and Highways in Yemen- Al-Ansi, (2006), Al-Qubati (2002) and Yemen Times (2008). This output of this study can be exported to other developing countries that have same conditions.

### **1.11 Thesis Organization**

The structure of this thesis is divided into five chapters with necessary appendices. The first chapter provided an introduction of the study. It discussed the background of the general housing situation in Yemen and briefly highlights the economic and demographic background, and some of the important housing issues that influence the housing problem in Sana'a. Furthermore, this chapter also identified the statement of the problem, the main research question and other sub-questions, the main and specific objectives of remedying the problem, the contribution and significance, scope, and limitations of this study.

Chapter two reviews some relevant studies in low-cost housing context and aims at providing the necessary historical and theoretical background for the subsequent

analysis. The basic theories of housing concept as well as housing demand theory and focus in low-cost housing for low-income groups were presented. Moreover, it presented the type of housing quality and housing characters in low-cost housing. These were used to identify the housing requirements for low-income. This chapter included relevant review of affordable housing definition and design. Finally, theoretical background for the hedonic model was presented. Chapter three demonstrated the methodology of the study, including discussions on conceptual framework, the types of empirical models, and the sampling and data collection methods used in this study. Developing hedonic model of construction cost in housing project was presented in this chapter.

Chapter four will present the result of descriptive analysis of the study. This chapter contained not only the explanation of the low-cost housing profile of households, but it also discussed and identified the households' requirements and the professionals' suggestions for low-cost housing projects in Sana'a. The significant factors influencing housing cost determined and the HRM result validated in this chapter. This chapter also discussed the findings of the study. The impact of the important variables to total expenditure was discussed. Chapter five presented summarizes and general conclusions of the study. It also highlighted recommendations for the issue of low-cost housing in Sana'a. The contribution, limitations of the study and future research needs were presented in this chapter.

Finally, the Appendices attached to support important parts of this study. Questionnaires, descriptive analysis result, Tukey's result, official documents, list of publications and bio-data of the student used attached in this study.

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