



PROJECTS OF PRINCE MOHAMAD BEN FAHD BEN ABDULAZIZ  
FOR AFFORDABLE HOUSES IN EASTERN PROVINCE

جامعة الملك سعود  
بالمنطقة الشرقية



**The First Symposium of Charitable and Affordable Housing in Saudi Arabia**

April 18-19, 2006, Al-Khobar

**Book of  
Research and Working Papers**

Projects of Prince Mohamad Ben Fahad Ben Abdulaziz  
For Affordable Houses in the Eastern Province

College of Architecture and Planning  
King Faisal University

جمعية البر  
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Charitable and Affordable Housing  
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**20-21 Rabea I, 1427 / 18-19 April, 2006  
Le Meridian Hotel, Khobar**

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**In the Name of Allah**  
**The most Merciful the most Compassionate**

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**PREFACE OF THE FIRST  
AFFORDABLE AND CHARITABLE  
HOUSING SYMPOSIUM**





*All praise is to Allah (SW) the Facilitator and Provider of all our needs and the source of our guidance. Prayers are on Prophet Mohammad (PBUH), the Messenger of mercy to all humankind.*

*After food and drink, the provision of a proper house can be considered an essential need for any human being. It constitutes a sizable financial burden on individuals in general, and on the poor and needy segment of the society in particular. Therefore, the problem of providing houses has become one of the biggest problems in modern times. It creates a financial and administrative burden, which the government cannot bear. As time passes, population increases, resources are reduced, and the housing problem escalates.*

*Because the provision of housing is time and effort consuming from the government, it becomes essential that wealthy individuals, groups and institutions participate in facilitating and providing houses for eligible citizens of the society.*

*The concept of affordable housing is a primary approach to facilitate housing for low-income citizens, who are a considerable part of society. While, charitable housing is an approach to provide housing for the poor and needy segments.*

*From here, emerged the idea of this symposium, which aims at discussing and researching issues related to “affordable and charitable housing,” as legitimate approaches in the provision of economic houses for low-income and less capable Saudis.*

*The directions of His Royal Highness Prince Mohammad Ben Fahd Ben Abdul Aziz to Alber Society to hold this symposium in cooperation with King Faisal University, represented in the College of Architecture and Planning, have expressed the support of the role of KFU in serving the society and the trust in its ability to organize scientific forums and activities.*

*Holding the symposium constitutes a real support of the efforts spent by charitable institutions and societies sponsoring the construction housing projects for less capable citizens. Alber Society is a distinguished institution in this regard. The symposium studies several issues related to charitable and affordable housing. One issue is concerned with approaches to develop design, planning and structural policies, criteria and conditions, which set ways to produce proper plans and designs. Another issue is related to finding better financial sources and project management techniques. The symposium is an opportunity to assess the existing situation and propose effective future policies to develop and improve the quality of charitable and affordable housing project.*

*This book includes a summary of research and working papers presented in the symposium. The full text of the papers will be published in the proceeding volume. We pray to Allah that the book will be for the benefit of all those who are concerned with the topics of the symposium. We hope that this scientific gathering will help propagate and upgrade the concepts of Charitable and affordable housing.*

**Dr. Mohammed Masood Alabdullah**



Chairman of The Scientific Committee  
Dean of College of Architecture and Planning  
King Faisal University,  
Dammam, Saudi Arabia



# **KEYNOTE SPEECH: AFFORDABLE HOUSING: THE ROLE OF NON-PROFIT ORGANIZATIONS**



# **AFFORDABLE HOUSING: THE ROLE OF NON-PROFIT ORGANIZATIONS**

**Nohad Tolan, Ph. D., F AICP**

Dean Emeritus, School of Urban Affairs and Public Administration  
Portland State University, Portland, U. S. A.

## **Abstract:**

*Since the inception of the United States Federal Public Housing in the 1930's affordable housing became identified with government. The only charitable organizations that continued to supply low-income housing were mostly church based and they focused their attention on populations with special needs. Much of their housing activities were focused on Skid Row areas. Housing supplied was primarily single room occupancy (SRO) units suitable only for single men and women but primarily men with addiction problems or anti-social behavior. In many ways, these organizations were concerned as much with the need to reform as to provide shelter. Low-income families fell outside the domain of these organizations and government became the primary provider of low-income housing*

*This situation began changing in the mid 1970's when federal and state housing programs began moving away from direct provision of housing in favor of assisting families make their own choices. With this change, a new door was opened for non-profit organizations to become involved. Tax incentives to corporations and privatization of Fannie Mae meant that resources are now available for private non-profit organizations to enter the market supplementing and sometimes replacing dwindling government programs. Today we have a wealth of information about non-profit housing organizations including what works and what does not. This presentation addresses many of the lessons learned over the past two decades and how these lessons may be applicable to the Kingdom of Saudi Arabia.*

## **Keywords:**

*Sustainable Development, Development Programs, Affordable Housing, Needy Residents of the Society, Design Criteria.*

It is, indeed, a great honor and pleasure for me to be asked to join in this First Symposium on Affordable Housing in the Kingdom. I left Portland n hours ago and it has been a long journey but nothing would have kept me away and I thank Allah for giving me, at my age, the ability to endure. This is a country that has always been dear to my heart. It is of course the birthplace of the Prophet Peace be on Him and his message. This alone is more than enough to endear it to any and all Muslims. But this is also a country where I have many friendships, family ties, and memories that are not easy to forget. Over a period of thirty years, I took pride in my modest contributions to the health and livability of several Saudi cities. I was fortunate enough to be involved in the early generation of large-scale city and regional plans initiated in the seventies. It was with God's blessings that I devoted two years of my life for the preparation of the Mecca Region Comprehensive Development Plan. However, it all started in this City about thirty years ago when we began working on the Dammam Region Comprehensive Development Plan. When I compare what we had to work with then and what you have now I am amazed as to how much you have accomplished. My only hope is that, through the many of my students, I may have contributed one or two small stones to the foundation of this great transformation of Saudi cities.

As urban planners, we have a great deal to be proud of. Ours is a profession that seeks to make cities prosperous, safe, and healthy for all their residents whether they are poor or rich, old or young. But more important, we are obliged to leave for our children and their children cities that are as livable

as or more livable than what we have for ourselves. There are many ways through which we contribute to the vitality of our communities but for today, I will focus on one area that many of us, sometimes, ignore by simply taking it for granted. This is the importance and centrality of affordable housing to the social and economic wellbeing of our cities.

Of course, I know something about housing policies and programs in the Kingdom. Nevertheless, in recent years I have not been as frequent a visitor as I used to be and as a result, it will be presumptuous from me to focus on Saudi Affordable Housing programs and activities. I am hoping that by the end of the Symposium, I will have learned enough from you to be able to contribute. For this presentation, however, I will address the changing nature of affordable housing programs in the United States and the challenges we are facing while attempting to understand and meet the growing needs of low and increasingly middle income families. Because of the emphasis of this Symposium I am, obviously, focusing my attention on the role of non-profit and charitable organizations. I will conclude my remarks by highlighting some of the similarities and differences between our situation and yours.

The United States has a very long history of relying on charitable organizations to assist the poor with their housing needs. Most of these organizations existed only in the large cities and their activities were neither coordinated nor comprehensive. Many approached housing not as an entitlement but as charity to be handed down to individuals whose poverty is the result of their inner social and moral failures. It is not surprising, therefore, that social reformers viewed the activities of such organizations with suspicion and disdain. With the onset of the New Deal in 1934 and the establishment of the Public Housing Administration, affordable housing for the poor became very much identified with government. The shift came about as a result of the economic collapse that began in 1929 and the growing realization that housing affordability is no longer the problem of the few. The problem had spread among most economic classes and revitalizing the housing market became a central building block in the Roosevelt Administration's efforts to reignite the national economy. Of course, it did not hurt that by focusing on housing assistance; the administration was also helping the banks regain their footing.

Until that time the only charitable organizations supplying low income housing were mostly church based and they focused their attention on populations with special needs. Much of their housing activities were focused on Skid Row areas. Housing supplied was primarily single room occupancy (SRO) units suitable only for single men and women but primarily men with addiction problems or anti-social behavior. In many ways, these organizations were concerned as much with the need to reform as to provide shelter. Low-income families fell outside the domain of these organizations and government became the primary provider of low income subsidized and market rate affordable housing.

Similar to all government programs our approach to affordable housing was continuously changing. Sometimes this is done to reflect political realities but more often, it is in response to growing awareness of emerging economic and social trends. For almost forty years, the federal approach focused on the construction of renter occupied public housing for the poor and mortgage insurance program to make home ownership affordable for middle-income families. This split approach created many unanticipated problems not the least of which is the middle class movement to the suburbs and the decline and, in many eastern cities, the abandonment of entire neighborhoods. However, this is a subject for a different speech.

This situation began changing in the mid 1970's when federal and state housing programs began moving away from direct provision of housing in favor of assisting families make their own choices. This came about for two reasons. On one hand, there was the growing awareness of the failure of inner city housing programs and on the other hand was the acceptance of the need for affordable housing to be integrated in a more coordinated approach for community development. Included among the new programs was a voucher system designed to give low-income families the opportunity to avoid the negative aspects of concentrated public housing projects. They also included, for the first time, programs designed to move low-income families into the mainstream of home ownership. Unfortunately, this change happened at a time when the federal government began to reduce its

assistance to the cities and to minimize its direct involvement. However, such shift was not all negative. Federal funding took the form of block grants that allowed for greater local involvement and initiative. With this change, a new door was opened for non-profit organizations to become involved. Tax incentives to corporations and privatization of Fannie Mae, the federal agency that was established to trade in secondary mortgages, meant that resources are now available for private non-profit organizations to enter the market supplementing and sometimes replacing dwindling government programs. Over the years federal and state funding became available to support activities of non-profits. Today we have a wealth of information about non-profit housing organizations including what works and what does not.

Before addressing the contribution and the challenges facing these organizations it is important for me to point that they stepped in the segment of the housing market that public housing was and is trying to address. They are doing some but not much to assist the middle-income families for whom mortgage insurance was supposed to help. For too long the term affordable housing did not apply to the housing needs of these families. It was taken for granted that the market, assisted by FHA insurance is capable of addressing their needs and little or no intervention was needed. Unfortunately, it is increasingly evident that this is no longer the case. The rediscovery of the city by the wealthy and upper middle classes that moved to the suburbs in the fifties, sixties, and seventies is contributing to large scale gentrification that is making the city less affordable to the middle and low middle income families. Rising prices and stagnating incomes are major causes of the widening affordability gap in our city. I am only bringing up this problem to alert you to the slowly changing nature of the debate on affordable housing that is going on in American society today.

As you know, affordability is a function of the relationship between income and prices. It is measured city by city using median incomes and median prices. These are moving targets that depend on many externalities that mayor may not be influenced by the internal dynamics of the housing market itself. My own city, Portland, which has consistently been ranked as one of the two or three most livable cities in the country is also one of the least affordable housing markets. Twenty years ago, it was one of the most affordable markets. Because of our nationally and internationally acclaimed success in land use planning and the effectiveness of our urban growth boundaries, it is often argued that ours is a unique situation. The common argument is that rapidly rising home prices are directly related to strict land use regulation that favor increased densities. Only those, who want to see growth boundaries abolished, will argue along those lines and they offer no explanation for rising prices in Phoenix Arizona that has no growth boundaries and Dallas Texas that has no zoning regulations. The fact is that globalization of the economy is causing structural dislocations in traditional employment patterns with considerable impact on incomes. This is happening at a time when the rate of inflation in the housing market is consistently outpacing the rate of growth of the national economy as a result of forces that go beyond local rules and regulations. As an example, the current median home price in Portland of \$ 262000 represents a 17.5 percent increase in one year. During the same period the median income rose by less than 3 percent and the population grew by no more than 2 percent.

As a result, affordability of housing, today, is a serious challenge and is the subject of significant national and local debates. It is a problem that is not likely to go away in the foreseeable future if at all. Obviously, government has a significant role to play in addressing the problem but it cannot do it alone. There are many players in the field but none is growing as fast as community based non-profit organizations. So who are these organizations, what housing do they provide, whom do they serve, from where do they get their money, and what are the challenges facing them? These are some of the questions I will address in the rest of my presentation. In doing so I am relying on data and information provided by a recent study of Sustainable Non-profit Housing Development sponsored by the Fannie Mae Foundation seven years ago.

Based on what we know of these organizations it is very difficult to draw a typical profile. They are active in both the rental and home ownership markets. They could be as small as a one-person operation and as large as mid-size development companies that employ more than fifty individuals.



For those concentrating on rental housing their employment could exceed 250 workers. Their budgets could vary from under \$100,000 to near \$50 million.

Among organizations dealing with owner occupied housing many maintain some kind of relationship with their developments over time. They do not simply close the deal and disappear. They continue to provide services to homeowners such as maintenance and repairs if requested. Some go as far as assisting with community organizing, employment counseling and job training. In developments organized as cooperatives, they serve as general manager and service provider. Many organizations attempt to assist their prospective clients by offering lease-purchase options. Under such arrangement, a portion of the rent is applied towards the purchase price. The natures of developments sponsored by these organizations differ widely. Most take the traditional approach to home ownership; outright purchase and fee simple ownership. In this case, the single family home is the typical type. Townhouses and apartments tend to be the dominant types in cooperative developments.

Developments vary by size from less than ten units to several hundreds. Some organizations rely heavily on new construction while others prefer rehabilitation, remodeling, and conversion of existing structures. These are found mostly in the inner city neighborhoods. Most of them work in close association with Community Development Corporations (CDC's) as part of a larger community revitalization effort. All developments are intended to provide home ownership opportunities to underserved groups in targeted markets and sub-markets. They concentrate heavily on first time buyers that have no other means of achieving homeownership. These households vary from very low income, low income, to moderate income. Many target minority groups and single parent households that can benefit from available support and social services.

The most important aspect of these developments is the innovative financing mechanisms utilized by the sponsoring organizations. Similar to most low-income housing providers, non-profit housing organizations rely on multiple sources of funding to put together financial packages that maximize affordability. These are drawn from federal, state, local, and private entities. The most important among these is the Affordable Housing Program of the Federal Home Loan Bank. Other sources include the Department of Housing and Urban Development Community Development Block Grants, the Department of Agriculture Rural Housing Program, corporations, and private foundations. First time homebuyers are usually encouraged to take second and sometimes third mortgages but in most cases, these are forgiven after few years. The idea is to ensure the long-term affordability of home ownership. Owners however are required to pay back second and third mortgages if they sell their homes before the end of a predetermined period.

Obviously the success or failure of non-profit housing organizations is the ultimate test they face. From all indicators, they seem to be doing better than most low income housing programs. Foreclosures are rare and delinquencies are below average. Owners satisfaction with their housing environment is high and most organizations report that with the passage of time building conditions are the same or better than when the units were sold. This is actually better than the average for the market at large. Whenever, owner dissatisfaction is noted it usually relates to the lengthy and complicated administrative procedures that they must undergo before assuming ownership.

Owners' satisfaction is only one aspect of the picture. There are other factors that enhance or hinder success. For the sake of time, I will only list some of these factors without much elaboration. These include:

- Stability of the organization's leadership.
- Conditions of the local market and the nature of the demand for affordable housing.
- How careful and thorough are buyers screened.
- How much resident involvement is allowed and or encouraged.
- The quality of design and construction and finally
- Finance and marketing.

Organizations dealing with rental housing face similar but not exact challenges. Most provide conventional rental projects, few will mix ownership and rental housing, and still fewer rely on mutual housing associations. Compared to homeowners, tenants tend to be more diversified. They include

single parents, elderly, and families with physically handicapped members. Racial and ethnic composition usually mirrors that of the local community. Almost all such organizations rely on multiple sources for their permanent finance but to ensure affordability many will seek outright grants to fund certain aspects of their capital or operating costs. Equally important to the ability of these organizations to function is the availability of low-income housing tax credits. In current real estate market conditions tax credits can be the one yard that separates success from failure.

In terms of overall performance, rental projects are not much different from ownership projects. The same factors that determine success in the later are equally important to the former. In addition, one thing seems to be evidently clear. The way a non-profit organization is run determines the potential success or failure of the housing projects it sponsors. Inability to innovate and to understand the special needs of its clients is a shortcut to certain failure. Successful organizations are those that recognize that their clients, while not entitled to have luxury housing, are nevertheless deserving of decent and secure housing environment that affords them dignity and respect. Many of them view their efforts not as a contribution to charity but as one milestone on the road to building equitable and healthy communities. It is this aspect that distinguishes the non-profit organizations of today from the church based charitable organizations of the nineteenth and early twentieth centuries.

Today there is enough in the literature about the lessons to be learned from thirty years of experience with non-profit housing. These lessons relate to issues that are both internal and external to the projects. We now know that a badly managed organization will go nowhere in its efforts to provide affordable housing. Affordable housing is more complex to develop than most other types. As a result, we need to be careful and transparent in the way we project construction and operating costs and to recognize that it takes longer to put such projects together. In the housing market, nothing is free as a result to start with the assumption that deep subsidies are not necessary is simply wishful thinking. In many ways, the success of affordable housing is highly dependent on the way it meets the needs of its residents. It must be designed to foster a sense of community and located in areas that provide the types of services needed by low-income families. These include easy access to employment, schools, social and support services, and public transport.

Affordable housing is an integral part of the larger community. The sponsoring organization must work for the surrounding community's acceptance to avoid resentment and alienation and to gain the confidence and support needed to ensure long-term success. In this area, other community organizations can play an important supporting role. Government also needs to be proactive. Technical as well as administrative assistance in the early stages of a project can go a long way towards ensuring its success and stability. Finally, I conclude by reminding ourselves that affordable housing is not an area for inexperienced developers and managers. It is not an easy task and requires considerable commitment and devotion to the cause. Done properly, however, it is very rewarding. Non-profits in reality are moving us slowly towards the unfulfilled dream of a decent home for every family that was first stated in the 1949 Housing Act. An Act of Congress that many of us thought it signals the end of slums and substandard housing with all the social ills they produce. Unfortunately, it was never funded and the dream remains unfulfilled.

Before, I end my remarks I want to say some few words about the relevance of all this to conditions in the Kingdom. First, I want you to know that one of the first things I did when I accepted to come here was to search the web for charitable housing. You may be surprised as I was when I discovered how many of the available information relate to Saudi organizations that are active in the field. You have your own wealth of information from which to draw conclusions. This is a small world, however, and there is no country, which is an island unto itself. In our planning schools, we have long recognized this important fact and global planning education is now one of the essential criteria used in evaluating academic planning programs. With the exception of some of the unique aspects of finance most of the issues and lessons I highlighted in this presentation are applicable to your projects. Of course, any of our programs that rely on tax deferral and tax increment finance are likely to be of little relevance to you. On the other hand, approaches that we use to package private and government funds could be very much applicable to your circumstances especially if appropriate ways are found to utilize zakat as a funding source for affordable housing. Successful management

and experiences in good planning and design are also applicable to your situation. However, as I said it is not a one-way exchange. I have no doubt that many of the lessons you learn are equally important to us. You just have to share them. As a former dean I therefore close by urging those of you who are active in the academy to share your experiences. Our journals are hungry for good scholarly work from other countries. With this somber note I again thank all of you for your patience, my apologies for speaking in English, and my best wishes for a successful symposium. I look forward to it.

# **SECTION 1: EXISTING AND FUTURE STRATEGIES, POLICIES AND PLANS**



# **1-1 DEVELOPMENT PROGRAMS AS A BRANCH TO SUSTAINABILITY: LEARNED LESSONS FROM KING ABDULLAH BEN ABDULAZIZ FOR HIS PARENTS INSTITUTION FOR HOUSING DEVELOPMENT**

**Fahd Hamad Al Maghlouth, Ph. D.**

Social Consultant and Manager of Development Programs  
King Abdullah Ben Abdulaziz for his Parents Institution for Housing Development  
Riyadh, Saudi Arabia

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\* This paper was presented in the symposium as a working paper; written text is not available. To get a copy of the presentation (in Arabic Language), contact the Symposium secretary.

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## **Abstract\*:**

*The paper aims at participating in conveying the lessons gained in King Abdullah Ben Abdulaziz for his Parents Institution for Housing Development concerning the projects and programs carried out to house the neediest residents of the society.*

*The paper covers several aspects of the experience, namely:*

- *The concept of sustainable development and its significance and connection to the programs and projects of the institution,*
- *The hindrances and obstacles which may face housing programs of the poor and needy residents of the society,*
- *The main criteria which should be taken into consideration during the design of development programs, and*
- *The types of development programs and conditions for selecting among them.*

## **Keywords:**

*Sustainable Development, Development Programs, Affordable Housing, Needy Residents of the Society, Design Criteria.*

## 1-2 REHABILITATION OF HOUSING QUARTERS IN THE OLD CITIES AND ITS ROLE IN HOUSING AFFORDABILITY

**Soliman Mohammed Al Fortea, Ph. D.**

Associate Professor  
Department of Architecture  
College of Architecture and Planning - King Faisal University  
Dammam – Saudi Arabia  
smfortea@yahoo.com

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\* This paper was presented in the symposium, then refereed and accepted for publication. Full Arabic text of the paper is available in the Arabic section of this book: (صفحات ١٢-٢٦)

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### **Abstract:**

*The old cities provide wide variation of materials in relation to architectural designs and originality brought by the inhabitants' long years of social, environmental and traditional interactions with their surroundings. The cultural and basic heritage brought by these old cities characterizes the materials used in the construction of the buildings and houses as it represents the affiliation of the people in these communities with their environment. These structures have long been a major source of great traditional architecture and designs. Residential buildings in the old cities present a vast cultural heritage as it form a high ratio of up to 60%. These cities made available the needs of the inhabitants in terms of living, religious, services and transportation until the recent time. Due to the urban growth and the consequent requirements of modern day living, its inhabitants were forced to migrate to other areas where basic services can be easily accessed. Many historical cities have completely become shantytowns or deserted areas because of physical deterioration of buildings while the poor population remained to occupy these historical cities.*

*The primary objective of this research is to study the built environment and the possibility of development in the old cities. It is intended to reactivate these old cities with provisions of basic services for modern day living and develop these historical cities to make it attractive residential areas so that it will address the problems in housing. The methodology of the research will be based on the theoretical study in the first part, this followed by experimental theoretical field study to analysis photographs, and surveys and random interviews from settlers. The survey is focused on understanding the problems of housing in old cities, looking at three case studies. These cases are in Old Tripoli, Gadamis City in Libya and Al-Ahsa in the Kingdom of Saudi Arabia. The findings and suggestion are aimed to help rehabilitate old cities in order to facilitate housing then recommendations are respectively provided in this study.*

### **Keywords:**

*Old Residential Neighborhoods, Urban Degradation, Urban Rehabilitation, Housing Affordability.*

## 1-3 SOCIO-ECONOMIC PLANNING FOR CHARITY HOUSES

**Saeed Ahmed Al Owaes, Ph. D.**

Assistant Professor  
Department of Landscape Architecture  
College of Architecture and Planning - King Faisal University  
Dammam – Saudi Arabia  
alawaissaed@yahoo.com

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### **Abstract:**

*Building charity houses is away to show the practical social cooperative concept of Islam. Both Quranic verses and Prophet Mohammad teachings call upon people to help those who live under certain hard conditions that drive them away from meeting heir rights to obtain certain basic living needs. Islamic teachings make it very clear that those who help the needy people will be given high status in this life and in the hereafter.*

*Without no doubt, building for accommodating the poor people of the society is considered to be a great work. Yet, it will cost a lot of money. Therefore, designers, planners, engineers and other concerned professionals need to spend a lot of time and effort in studying and taking into consideration the various related socio-economic issues before starting projects of such nature to become able to achieve the highest level of achievement of the development goals.*

*This paper is an attempt to highlight some of the socio-economic issues of planning that must be consider before and during the process of developing any charity housing project. This will help achieve the objectives of individuals, families, and the society as a whole.*

### **Keywords:**

*Social and Economic Planning, Charitable Housing, Low-income Housing, Solidarity in the Muslim Society.*



## **1-4 THE CONCEPT OF GROWTH CENTERS AS AN APPROACH FOR CHARITABLE AND AFFORDABLE HOUSING: THE CASE OF ASEER REGION**

**Abdullah Ali Aftan**

Member of Aseer Region Council, Supervisor of Growth Centers  
Representative of King Faisal Charity Institution in Aseer Region  
Aseer – Saudi Arabia

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\* This paper was presented in the symposium as a working paper; written text is not available. To get a copy of the presentation (in Arabic Language), contact the Symposium secretary.

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### **Abstract:**

*at the Arabian Peninsula' level, Aseer Region is one of the oldest settlement areas. Ancient Arabian immigrations occurred on its lands. So did the caravans and trips coming from the South as well as the North of the Arabian Peninsula. Because Aseer is characterized with its severe terrains and huge height mountains, there has always been a severity and difficulty providing the residents of the region with public services and utilities. It becomes essential from the very beginning to found human settlements whose locations are carefully selected to become attractive and sustainable centers for its residents and beneficiaries. This is called "Growth Centers."*

*This paper attempts to present the concept of "Growth Centers" and its application as an approach for charitable housing in Aseer Region. This is achieved through the recognition of five issues. The paper starts with explaining the basic criteria and objectives of selecting a "Growth Center." Then it reviews the main growth centers developed in Aseer Region over the period from 1398-1426 on three stages. The paper discusses the basic conditions and criteria for charitable housing eligibility in the developed growth centers. Finally, the paper summarizes the results of a social field survey carried out before and after housing the residents of the growth center of Hablh and Haridhah villages. The survey shows the transformation in social and living attitudes which occurred to the beneficiaries.*

### **Keywords:**

*Growth Centers, Charitable and Affordable Housing, Site Selection Criteria, Housing Eligibility Criteria, Social Transformation, Aseer Region, Saudi Arabia.*

## **SECTION 2: PLANNING, URBAN DESIGN AND ARCHITECTURAL DESIGN CONSIDERATIONS**

## 2-1 IMPACT OF ENVIRONMENTAL CONDITIONS ON LOW-COST HOUSING IN NEW TOWNS IN EGYPT: THE CASE STUDY OF NEW BORG EL-ARAB

**Dalia Hussain Eldardiry, Ph. D.**

Assistant Professor, Department of Interior Design  
College of Architecture and Planning - King Faisal University  
Dammam – Saudi Arabia  
dalia\_eldardiry@yahoo.com

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\* This paper was presented in the symposium, then refereed and accepted for publication in this Proceedings Book in its final form as follows:

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### **Abstract:**

*Because of the housing crisis in Egypt, the desperate need for new houses and the continuously increasing housing demand exceeding its supply, the housing problem is considered one of the major contemporary problems. New Borg EL-Arab is a new town designed as a magnet, to absorb the increase of population in Alexandria by creating new job opportunities and building affordable houses to help low-income people and youth find suitable houses and solve their housing problem. In addition, there is a very serious problem in the structural conditions of houses in the city due to bad of the quality of building materials causing quick deterioration of these houses. Hence, low-income people and youth refused to leave the big city and move to the new town. Houses are directly affected by the adverse environmental conditions of this region, such as climate and lighting. The envelope of a house prevents the effect of climatic elements. This external envelope of a building creates indoor environmental conditions that differ from that of the outdoor environmental conditions.*

*The research aims to assess the environmental conditions which affect the houses in New Borg EL-Arab, and to suggest recommendations which could lead to improve the housing conditions in houses built under the same environmental conditions, integrating buildings with the surrounding environment, achieving better levels of human comfort, improving residents' satisfaction and attracting more people to live in the houses.*

*A detailed study of housing categories, data collection for the environmental conditions (measuring air temperature, humidity, lighting and determining the wind direction) outside and inside the houses, and analyzing them with interpretation of results, To find recommendations to improve the affordable houses. Human comfort can be achieved through a good design of the house using the suitable local building materials available within the same region, taking into consideration all the environmental housing conditions.*

### **Keywords:**

*Environmental Determinants, Building Conditions, Low-cost Housing, New towns, Egypt.*

### **INTRODUCTION**

The excessive urbanization in the developing countries undoubtedly has numerous drawbacks manifested in the continuous growth of major cities at rates exceeding the population growth rates in these countries. This gives rise to many problems in meeting the requirements of these ever increasing numbers in housing [1].

Egypt is one of the third world countries, suffers from the rapid increase of the population growth and its concentration in the Nile valley and delta. There is unbalance in the geographical distribution of the population. The housing problem is considered as one of the major contemporary problems which are caused by the continuously increasing housing demand exceeding its supply. The acute shortage of housing in Egypt has been worsened by the effects of war, which consumed a considerable amount of national financial resources.

New Borg EL-Arab is a new town designed as a magnet, to absorb the increase of population in Alexandria by creating new job opportunities and building houses to help low-income people and youth to find suitable houses and solve their housing problem. After more than 20 years from its beginning as a new town, it could not attract the people to live in. Only the first-stage houses have been already constructed. There has been a great shortage in the population in spite of there were houses for youth and low income people, and the employers and employees prefer to return daily to Alexandria.

Because of the long duration of building, the houses are directly affected by the adverse environmental conditions of this region, such as climate (air temperature, heat, humidity, precipitation, and wind), and lighting. The envelope of a house prevents the effect of climatic elements. This external envelope of a building creates indoor environmental conditions, which differ from that of the outdoor environmental conditions. In addition, there is a very serious problem in the structural conditions of houses in the new town due to bad of the quality of building materials causing quick deterioration of these houses. Hence, low-income people and youth refused to leave the big city and move to the new town.

Human comfort can be achieved through a good design of the house using the suitable local building materials available within the same region, taking into consideration all the environmental housing conditions.

#### **Research Aim:**

The research aims to assess the environmental conditions that affect the houses in New Borg EL-Arab, and to suggest recommendations that could lead to improve the housing conditions in houses built under the same environmental conditions, integrating buildings with the surrounding environment, achieving better levels of human comfort, improving residents' satisfaction and attracting more people to live in the houses.

#### **Research methodology:**

The methodology of the research is based on the analytical approach from field surveys as follows:

- Collecting for the required information and maps for housing categories of New Borg EL-Arab from the Authority of New Communities, New Borg EL-Arab Town. using interviews with the authorities and engineers of the new town. applying a detailed study of housing categories.
- Data collecting for the environmental basis (air temperature, humidity, lighting and determining the wind direction) in the region from the Meteorological Authority of New Borg EL-Arab, Analytical monitoring for the data collected using statistical Excel program.
- Measuring the indoor environment in three cases study, using the suitable equipments from the department of environmental studies, institute of graduate studies and research, university of Alexandria.
- Analytical Comparisons between the outdoor and indoor environmental housing conditions of the three cases study with interpretation of results, to find recommendations to improve the houses built under the same environmental conditions, to attract the people to live in.

#### **Research Plan:**

The plan of the research has been designed to achieve the aims, which were set for the research. Therefore, the consequential steps were grouped into three main stages:

- A study of theoretical background for the housing categories of Egypt and the housing conditions of New Borg Al-Arab including construction methods and building materials.

- Analyzing of the relationship between the surrounding environment in the new town and the internal housing conditions in the three housing categories (low cost, economic and medium) of New Borg EL-Arab.
- Providing conclusion of the research and recommendations to improve the housing conditions in houses built under the same environmental conditions,

## 1- THEORETICAL BACKGROUND

Throughout time, the population density was concentrated along the Nile valley and Delta, keeping million of kilometers in the desert abandoned and undeveloped. The housing problem grew and is considered as one of the major contemporary problems that is caused by the continuously increasing housing demand exceeding its supply. Because of the housing crisis, and the desperate need for new houses, the Egyptian government introduced the new town program as a national policy. Hence, the Ministry of Development, New Communities, Housing and Utilities has designed new towns in the desert to reduce the over crowded population in urban centers and redistribute the over concentrated industrial activities outside the Delta region.

The new towns contain four significant elements: self-containment economic base, efficient land use pattern, provision of services, and commuting behavior. The community's economic base strongly influences its character: a community with a diversified economic base has a wide range of socioeconomic groups and provides a variety of job opportunities. The degree of these two factors sets the degree of a community's self-containment. Largely, the economic base also determines a community's range of social activities, transportation intensity, and power structure. Diversified land use largely supports the development of an assortment of socioeconomic activities.

One of these new towns is New Borg EL-Arab. It is designed as a magnet, to hold the increasing population in Egypt by absorbing the increase of population at Alexandria and Behaira Governorates by creating new job opportunities and preventing the urbanization growth of towns over the rural area. Although, New Borg EL-Arab has been created since 1979, it has not been completed yet. Earlier, the economical policy of Egypt was that of habitation i.e. a construction policy not a development policy. May be that was due to the rapid increase of population and their extreme need for housing. That is why the government has planned for the construction of new towns to absorb this increase in population and to overcome the shortage of housing in the central towns and cities.

### 1-1 Housing categories of Egypt

After the Egyptian revolution in 1952, the first five years plan established four different categories according to the economic class [1]:

- Public housing: It is defined as an economic housing for people with low income, it is established by the government within an area that ranges from 30 to 60 m<sup>2</sup>, and the rooms are between one to three, with the lowest cost.
- Medium housing: It is established by the government within an area of 50 to 90 m<sup>2</sup>, the rooms are between one to three, with kitchen, bathroom, hall and terrace. The finishing materials are better than the public housing.
- Upper medium housing: This category is established by individuals or companies. The area of this category is from 57 to 125m<sup>2</sup>, the rooms are between one to three rooms, with kitchen, bathroom, toilet, living area, and big terrace and the finishing materials are very good compared with the other two types.
- Super housing: This category is established by individuals and the construction companies. The areas, specifications and finishing materials are the best, and there is no maximum limit for them

The classification that depends upon the economical class was cancelled, because there was a great socioeconomic variation through the last 25 years. The ministry of New communities established a new classification depending upon housing areas, specifications, and finishing materials.

- Low cost housing
- Economic housing
- Medium housing

- Upper medium housing

The ministry of new communities added the low cost housing category to the other three categories which are implemented by the government. There is no big difference between the low cost housing and the economic housing. Also, the ministry allows the construction companies, individuals and investors to build the super housing in the new town.

### 1-2 New Borg Al-Arab town

New Borg EL-Arab is one of the industrial new towns, which was built within the national plan of the government. It was established to absorb the over crowded population, aiming to habitat the youth and the low income people to establish new development communities, and directing the urban development in the north – western part of the delta with the provision of new job opportunities for the youth and the low income people of both Alexandria and Bahaira governorates.

New Borg EL-Arab location is between the two cities, Alexandria the main harbour, and Matrouh is in the west of Egypt. The entrance of New Borg El-Arab is well designed with a lot of trees and landscape. It makes a first good impression to the new visitor. Also, the streets are wide, with the presence of long green areas; The town is not completed until now. Figure 1 shows the location and Master Plan of the New Borg EL-Arab City. It lies 60 km South West of Alexandria, at a distance of 7 km from the Mediterranean Sea. It is between the two cities, Alexandria and Matrouh. The gross area is 225 km<sup>2</sup>. The city has 9 residential districts and 5 industries sectors. It was planned to accommodate 500,000 inhabitants and provide 160,000 job opportunities in 20 years [1].

After 18 years from the beginning of New Borg EL-Arab (1979-1997), the new town could not attract the people to live in, only the first stage has been already constructed, there was a great shortage in the population in spite of there were houses for youth and low income people. However, the employers and employees prefer to return daily to Alexandria in spite of the presence of different kind of houses in this new town. This could be justified due to the lack of services, which is a result of the long-duration of the implementation of New Borg EL-Arab town, in addition to the little government's investments (Figure 1).



Source: [3] Authority of new communities.

**Figure1 The location and Master plan of New Borg EL-Arab**

The defects in New Borg EL-Arab services are:

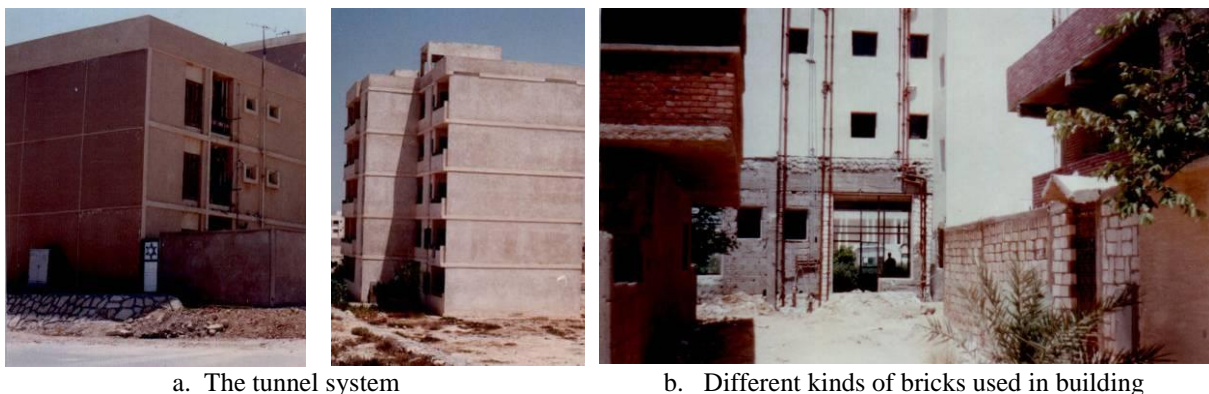
- There is no sufficient medical services and shortage of modern equipment in spite of the presence of a main hospital in the new town
- There is no recreation area that could attract people to live in.
- There is no transportation is available at night between New Borg EL-Arab and the nearest towns.
- There are many wooden shops are constructed by some venders in a separate place in an open area, Because of the delaying in opening the main shopping center within the town, The place is called the Wednesday market. Actually, these random shops are a positive action from the venders to cover one of the vital needs of them.

- The shortage of architectural consciousness and the lack of control to the construction of the private houses in the sold land, create some kind of a visual pollution for the region. This could be noticed in the difference of forms and colors of the house in the same region.

From (1997-now) Ministry of Development, New Communities, Housing and Utilities in Egypt changed its policy in the housing implementation from habitation, i.e. a construction policy to development policy because of the long duration of building according to the little financial resources. Thus, the investments and private sector was invited to share in the residential areas, also, to complete and improve the defects in New Borg EL-Arab services, to minimize the pressures on the government. The only job for the Ministry of Development, New Communities, Housing and Utilities is to complete the utilities of the land, dividing it and selling it to the people, allowing the construction companies, individuals and investors to build the super housing in the new town.

### 1-2-1 Construction methods

The houses in New Borg AL-Arab are implemented by the two construction methods. The first method is the traditional method of reinforced concrete. It is called skeleton construction, with brick infilling. The buildings are painted externally. This method was adapted in 85% of the houses of the first stage, in New Borg AL-Arab. The conventional methods of reinforced concrete construction have been widely replaced, in many major housing and commercial developments by a variety of heavy industrialized systems of constructions, with story-height pre-cast concrete wall panels or tunnel systems using mobile form work, Figure 2. This method was adapted in the remaining 15% of the houses of the first stage in New Borg AL-Arab.



a. The tunnel system

b. Different kinds of bricks used in building

Source: All photos are photographed by the author unless noted .

**Figure 2 The tunnel system and brick types used in building the houses in New Borg EL-Arab**

### 1-2-2 Building materials

Each stage for constructing a building needs its own building materials. It is necessary that, the quantities of building materials should be balanced with the demands of design and building plans to prevent and avoid any problem that might obstruct the work. Building materials must be available by the national market and if not, plans for its importation must be ready to import materials from its sources in order to have a suitable stock [1].

The building materials are classified into three groups:

- Natural materials; sand, stone, and natural rocks.
- Synthesized materials; concrete, steel, bricks, wood, lime, and glass
- Complimentary materials; wooden and metallic doors and windows.

The traditional construction method increases the demand of the classical building materials; sand, stone, brick, wood and also concrete and steel. On the other hand, the industrialized construction methods are in great demand for concrete and steel with other modern building materials; aluminum,

plastic and hollow block to cover the need for massive production of the formal units. The materials used in building the houses of New Borg EL-Arab are available in the region and the surrounding area. The bricks used are cement bricks and a lime stone, Figure 4 shows the different kinds of bricks used in building the houses in New Borg EL-Arab.

The external finishing materials are plaster. The internal finishing materials vary according to the housing category from low cost and economic housing to upper medium housing. The medium and upper medium houses are painted with oil based paint. And the economic and low cost houses are painted with lime. Doors are wooden and windows are with wooden frames.

## **2- A BACKGROUND OF ENVIRONMENTAL CONDITIONS IN NEW BORG EL-ARA.**

In designing and planning for the hot dry areas, it is necessary not only to understand the needs of people, but also to study the indoor environment and control it to make it suitable for a healthy and comfortable living, especially in residential areas. The environmental housing conditions depend on the quality of the surrounding environment (climate and lighting). Man has always tried to overcome the severe conditions of the weather and create a comfort environment inside his building.

Although, the comfort zone for human being is defined as a subjective assessment of the environmental conditions, the limits of the zone based on a physiological basis; the range of conditions under which the thermo-regulatory mechanisms of the body are in a state of minimal activity. Comfort, which is also dependent not only on the air temperature and that of the surrounding surfaces, but also on the relative humidity of the air and air movement, can not be expressed in terms of any one of them as they affect the body simultaneously and the influence of any one depends on the levels of the other factors [1]. The most important factor that affects the indoor climate of the house is the orientation. Most of the houses in New Borg El-Arab are perpendicular to the North West direction. The orientation of a building is determined by the climatic factors of wind and solar radiation as well as by the view, noise and requirements of privacy.

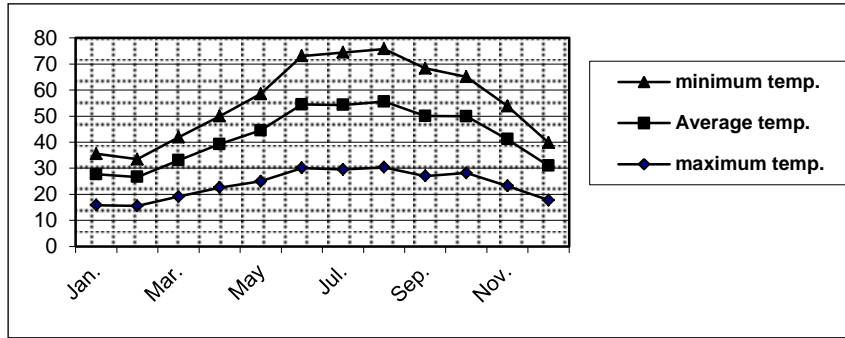
The climate in New Borg EL-Arab is characterized by an increase of temperature and a decrease in humidity with the presence of a big difference diurnal temperature. Thus, it needs a special treatment to overcome the problem of balancing the temperature in buildings to provide comfort to the occupants, beside the use of natural means which improve the internal climatic conditions and decrease the energy consumed.

New Borg EL-Arab is exposed to the direct sun rays all the year round. These sun rays generate high heat energy which could be made use of. The weather is very dry in the town as it rises approximately 60m above sea level, besides having a very small amount of precipitation in winter only. It is exposed to a big amount of wind especially in summer. The prevailing wind is from the North West direction. The four wind roses show that the amount of wind in summer is bigger than the amount of wind in winter. The wind in summer is of small speed, but the high speed of the wind in winter causes the changes of weather.

Human comfort was taken as a standard to be followed in the study as a parameter to evaluate the climate in New Borg EL-Arab. The cold, moderate and hot periods are determined in relation to human comfort region 21-28oc (60), which are the effective periods for the human beings. Figure 3 shows that the effective periods in New Borg EL-Arab are in the months, April, May, September, October, and November. It is approximately 5 months (41.6% of year). This period may extend to include one or two of the summer months by using a good design to minimize bad environmental conditions. So, the effective periods may extend to be approximately 7 months (66.6% of year). Figure 4. shows the distribution of the average relative humidity throughout the year, Figure 5. Shows the distribution of the cold, moderate and hot periods all over the year

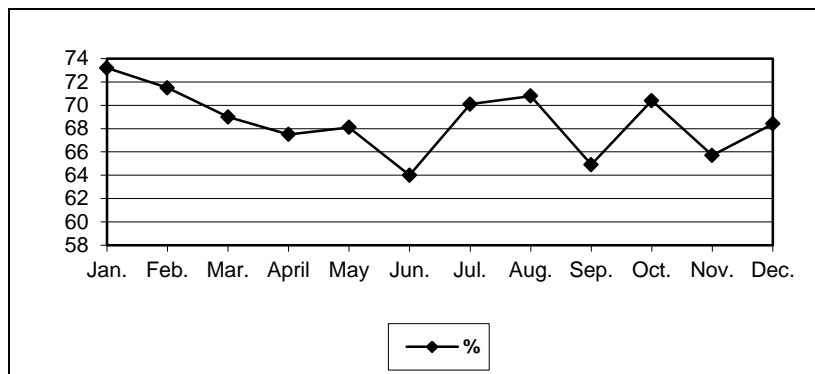
Along this period air conditioning by mechanical methods could not be needed in the inner spaces, thus, decreasing the energy consumed and provide comfortable conditions without the use of expensive. That the choice of suitable building materials, well designed houses and the landscape around the house can protect the inhabitants from climatic changes Also, the energy-consuming mechanical equipment (Figure3 and Figure 4).





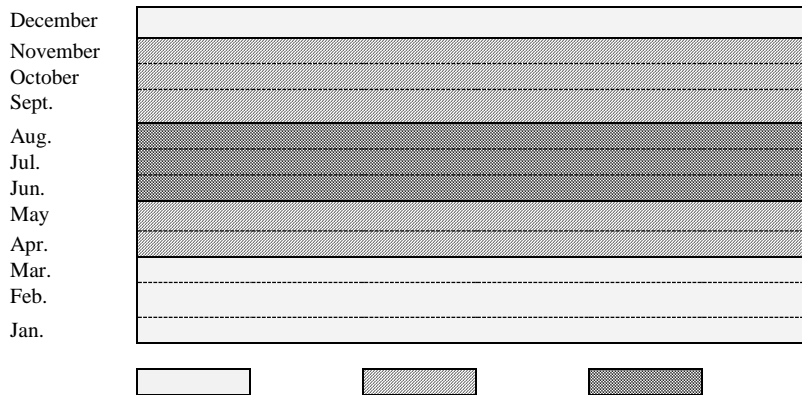
Source: Figure created by the author based on [1], [2].

**Figure3 The distribution of the average temperature throughout the year**



Source: Figure created by the author based on [1], [2]

**Figure 4 Distribution of the average relative humidity throughout the year**



Source: Figure created by the author based on references from [1], [6]

**Figure 5. Distribution of the cold, moderate and hot periods all over the year**

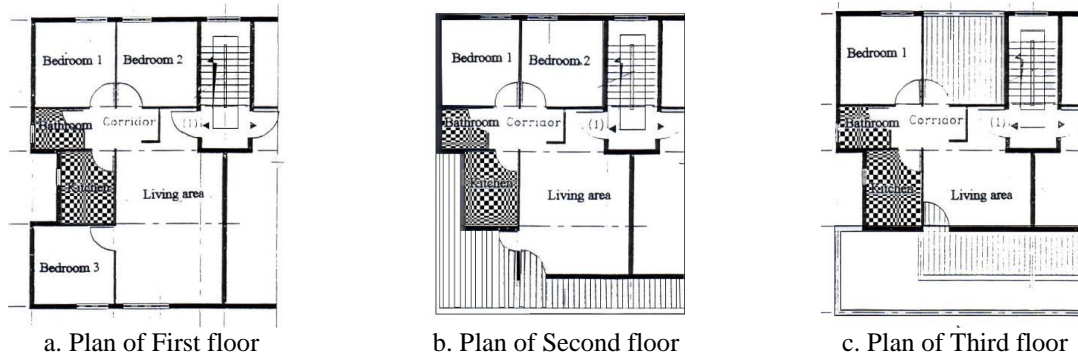
### 3- ENVIRONMENTAL HOUSING CONDITIONS OF THE CASES STUDIES

Three cases were chosen to be studied in this research. Cases were chosen related to the type of housing, which are classified according to the house’s area, construction methods and finishing materials; Case no.1 Example of low cost housing, case no.2 Example of economic housing, case no.3 Example of medium housing.

#### 3-1 Low cost house

In the low cost house, there is a variation in the areas of the low cost house. The floor has only one apartment. These areas are the total gross areas; they include the building service (stairs and building entrance ...ex) which is approximately 10-12m<sup>2</sup>. That means the apartment in the third floor is too small to live in for a family, approximately 32 m<sup>2</sup> [3]. Figure 6 shows the plans of case no.1 and table 1 shows their total gross areas.

The external finishing material of low cost house is plaster and the internal finishing materials vary according to the housing category, the low cost houses are painted with lime. The ratio of window's area to room's area (from 14.77% to 16%) in bedrooms, It is a large area for the windows. All the glazing materials for the windows are sheet glasses, the glazing bars from wood, the cill height is 1.00m in the entire apartment except in the services areas (kitchen and bathroom) the surrounding areas are empty with no green areas, and the ground cover with Asphalt and sand. Table 2 shows the housing variations affecting the environmental conditions inside the house.



Source: [3] Authority of new communities.

**Figure 6: Plans of the floors of low-cost house case No. 1**

**Table 1: The areas of low cost house (case no. 1).**

	First floor	Second floor	Third floor
Total area	79.19 m <sup>2</sup>	61.19 m <sup>2</sup>	43.63 m <sup>2</sup>

Source: Created by the author based on [3].

The construction methods are traditional methods; Construction methods directly affect the building economy. This appears through the direct relation between demand and supply of building, workers and materials. From the measurements of the air temperature inside low cost house, it was found that the apartment of the first floor, rooms no. (1) And (2) have the same temperature (27.5oc) because they have the same room's area, window's area, and orientation. Room no. (3) has a higher temperature (30oc) because of its orientation (to the South East). At the second floor the living room has a lower temperature (29oc) than that of the first floor (29.5oc) because of its good ventilation through the terrace. Table 3 shows the difference between interior and exterior temperature in a low cost house. At the third floor, rooms have a greater temperature (29.5oc) than the same of other floors because their roofs are not covered by reflective or insulating materials. On the other hand, the living room has a lower temperature (28oc) than that of other floors because it has two windows with different orientation, one is to the North East direction and the other is to the South East direction. This dual direction of windows leads to good ventilation, increase air movement and decrease the interior temperature. Figure 7 exemplifies the environmental housing conditions in first, second and third floors of low-cost house case No. 1

It was found that the temperature and the ventilation inside the room affect the percentage of relative humidity. At first floor, The percentage of humidity in the Southern East room, bedroom (3), and the living area (62%) are higher than the percentage of humidity in the Northern rooms (58.5%), Because they have a high temperature and bad ventilation. Also, for the same reason, the percentage of humidity in the living area at second and floor (60.5%) is higher than the percentage of humidity in the Northern rooms (58.5%). Table 5.21 shows the relationship between the relative humidity in the house and the human comfort, the comfortable zone is less than 59%, the semi-comfortable zone is from 59% to 62%, and the uncomfortable zone is more than 62%.

The position of low cost house is perpendicular to the dominant wind (North West) direction. The house receives the full sweep of the velocities. This type of layout is desirable for avoiding winter wind affects. Houses planned in row arrangements. Wind shadow is caused over the subsequent units and passed by the later units. In addition, the speed of the wind inside the house depends on the main orientation of the window, the room's area, and the presence of the window and the door in the opposite direction. The orientation of the house assists achieving well ventilation and refreshing the

interior air of the house. But, the odors and bad smells would enter the rooms and the living area through the passage with the air moving out from the kitchen and the bathroom.

**Table 2: The housing variations affecting the environmental conditions inside Low cost house.**

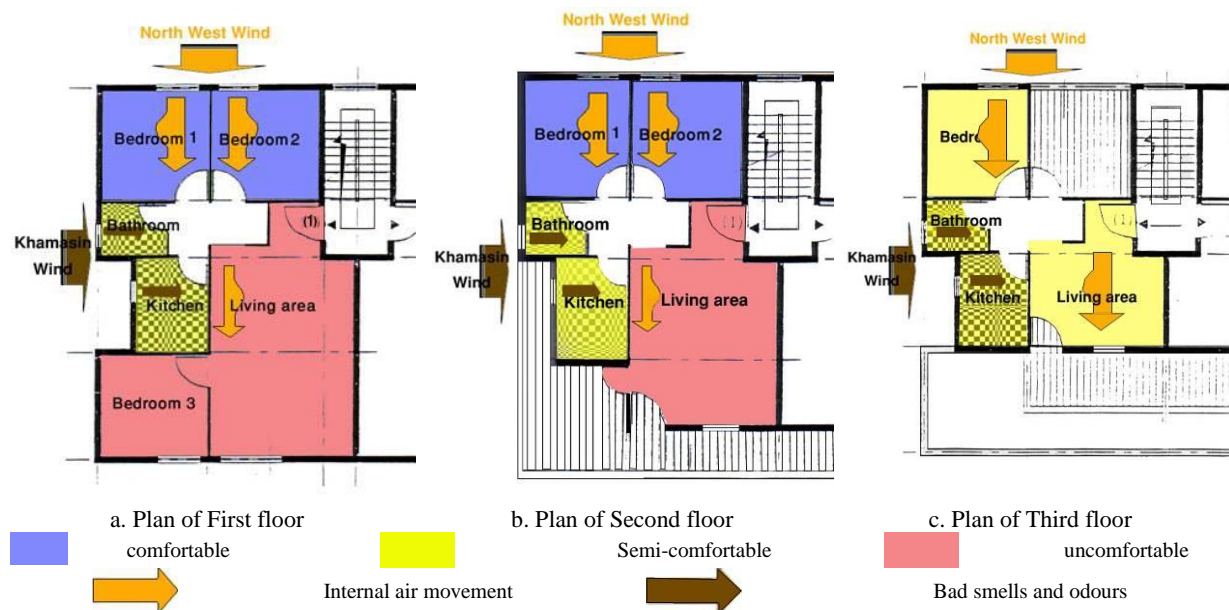
First floor	Bedroom (1)	Bedroom (2)	Bedroom (3)	Living area	Kitchen	Bathroom
Room's area	9.75 m <sup>2</sup>	9.75 m <sup>2</sup>	9.00 m <sup>2</sup>	23.20 m <sup>2</sup>	4.76 m <sup>2</sup>	2.70 m <sup>2</sup>
Room length.	3.00 m	3.00 m	3.00 m	5.80 m	2.80 m	1.50 m
Room depth.	3.25 m	3.25 m	3.00 m	4.00 m	1.70 m	1.80 m
Walls and ceiling painting	lime	lime	lime	lime	lime	lime
Window's orientation	N.W.	N.W.	S.E.	S.E.	S.W.	S.W.
Ratio of window's area to room area	14.77%	14.77%	16.00 %	7.76%	16.80 %	13.30%
Window's area	1.44 m <sup>2</sup>	1.44 m <sup>2</sup>	1.44 m <sup>2</sup>	1.80 m <sup>2</sup>	0.80 m <sup>2</sup>	0.36 m <sup>2</sup>
Window width.	1.20 m	1.20 m	1.20 m	1.20 m	0.80 m	0.60 m
Glazing materials.	Sh. glass	Sh. glass	Sh. glass	Sh. glass	Sh. glass	Sh. glass
Glazing bars.	wood	wood	wood	wood	wood	wood
Cill height.	1.00 m	1.00 m	1.00 m	1.00 m	1.20 m	1.30 m
Clean lines of site location.	Clean area	Clean area	Clean area	Clean area	Clean area	Clean area
Ground cover.	Asphalt	Asphalt	Sand	Sand	Sand	Sand
Finishing materials of the external obstruction.	Yellow plaster	Yellow plaster	Yellow plaster	Yellow plaster	Yellow plaster	Yellow plaster

Source: Created by the author based on the field survey

**Table 3: Relation between temperature, humidity, illumination and human comfort in a low cost house.**

Floor	First floor			Second floor			Third floor		
	Temp.	Hum.	Lighting	Temp.	Hum.	Lighting	Temp.	Hum.	Lighting
Bedroom (1)	-0.5 °c	-1.5%	Normal	-0.5 °c	-1.5%	Normal	1 °c	-0.5%	Normal
	comfortable			comfortable			semi-comfortable		
Bedroom (2)	-0.5 °c	-1.5%	Normal	-0.5 °c	-1.5%	Normal			
	comfortable			comfortable					
Bedroom (3)	2 °c	2%	High						
	uncomfortable								
Living area	1.5 °c	1%	High	1 °c	0.5%	High	0	0	adequate
	semi-comfortable			semi-comfortable			comfortable		
Kitchen	2 °c	2%	High	2 °c	2%	High	2 °c	2%	High
	uncomfortable			uncomfortable			uncomfortable		
Bathroom	2 °c	2%	High	2 °c	2%	High	2 °c	2%	High
	uncomfortable			uncomfortable			uncomfortable		

Source: Created by the author based on the field survey



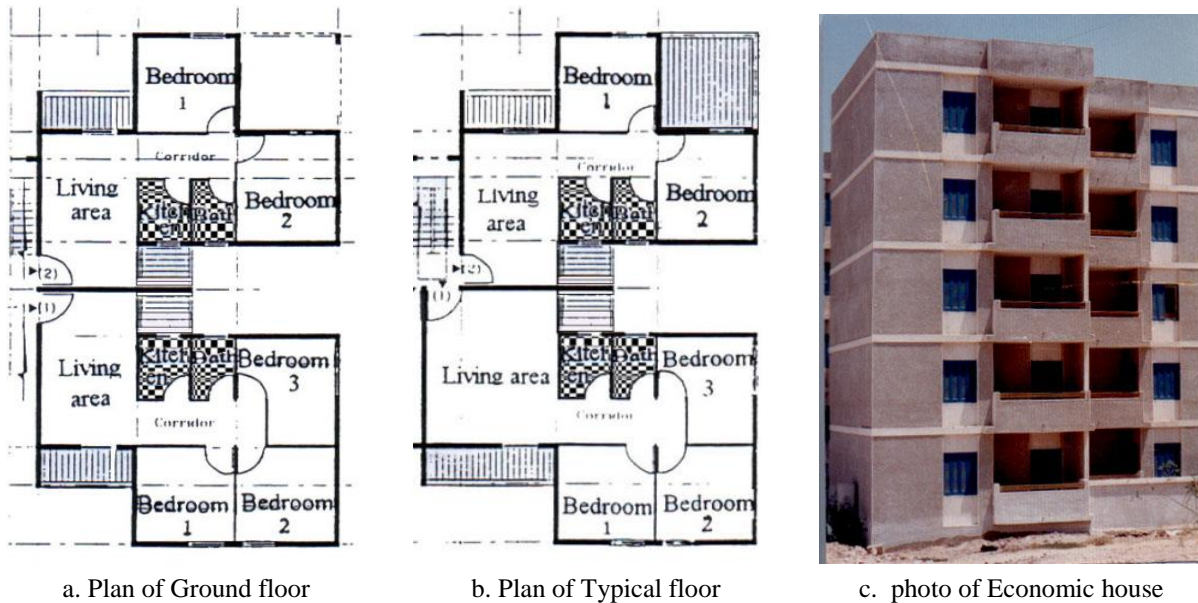
Source: Created by the author based on the field survey

**Figure 7: Environmental housing conditions in first, second and third floors of low-cost house case No. 1**

It was found from the results of a simplified computer program which is used to calculate the day lighting levels inside the house, that there are too much glare all areas, except the illumination of the living rooms are adequate.

### 3-2 Economic house

From the field survey, it was found that there is a variation in the areas of the economic house. The floor has two apartments. These areas include the building service (stairs and building entrance...ex) which is approximately 10-12m<sup>2</sup>. The total gross areas of the apartments in economic houses are similar as the total gross area of the low cost house except the 3rd floor [1]. Figure 8 shows the plans and a photo of economic house of case no.2. Table 4 shows their total gross areas.



Source: [3] Authority of New Communities.

Source: photographed by the author

**Figure 8 Plans of the ground and typical floors and a photo of low-cost house case No. 1**

In the finishing materials of the apartment 1 in economic housing; the external finishing material is plaster and the internal finishing materials are painted with lime too like the low cost houses. Also, The ratio of window's area to room's area (from 13.63% to 14.90%) in bedrooms, It is a large area for the windows. All the glazing materials for the windows are sheet glasses, the glazing bars from wood; the cill height is 1.00m in the entire apartment except in the services areas (kitchen and bathroom). The surrounding areas are empty with no green areas, and the ground cover with sand, the construction methods are traditional methods like the low cost houses. Hence, there is no big difference between the low cost and the economic houses. They have same areas, finishing materials, construction methods.

From the measurements of the air temperature inside an economic house, it was found that the ratio of window's area to the room's area is high at this house. Therefore, the penetrations of the high heat energy inside the house are increased specially in the Southern rooms. The temperature is higher in apartment (1) than apartment (2) on the same floor, because the windows' orientation of apartment (1) is to the South East where there is not too much air movement, and the windows' orientation of apartment (2) is to the North West where there is the prevailing wind. Therefore, apartment (1) is too cold during wintertime while apartment (2) is comfortable, and visa versa. In addition, the temperature of the last floor is higher than the temperature of the other typical floors. Table 6 shows the relation between air temperature, the percentage of humidity, illumination and human comfort in the house.

**Table 4: The areas of economic house (case no. 2).**

	Ground floor		Typical floor	
	Apartment 1	Apartment 2	Apartment 1	Apartment 2
Total area	73.04 m <sup>2</sup>	62.17 m <sup>2</sup>	79.33 m <sup>2</sup>	62.17 m <sup>2</sup>

Source: The author based on [3]

**Table 5: The housing variations affecting the environmental conditions inside an economic house**

Apartment (1) in typical floor	Bedroom (1)	Bedroom (2)	Bedroom (3)	Living area	Kitchen	Bathroom
Room's area	10.56 m <sup>2</sup>	10.56 m <sup>2</sup>	9.66 m <sup>2</sup>	17.06 m <sup>2</sup>	3.82 m <sup>2</sup>	3.15 m <sup>2</sup>
Room length.	3.25 m	3.25 m	3.25 m	4.25 m	1.70 m	1.40 m
Room depth.	3.25 m	3.25 m	3.25 m	5.25 m	2.25 m	2.25 m
Walls and ceiling painting	lime	lime	lime	lime	lime	lime
Windows orientation	S.E.	S.E.	N.E.	S.E.&N.E.	N.W.	N.W.
The ratio of window's area to room's area	13.63%	13.63%	14.90%	10.55%	20.94%	11.42%
Window's area	1.44 m <sup>2</sup>	1.44 m <sup>2</sup>	1.44 m <sup>2</sup>	1.80 m <sup>2</sup>	0.80 m <sup>2</sup>	0.36 m <sup>2</sup>
Window width.	1.20 m	1.20 m	1.20 m	1.20 m	0.80 m	0.60 m
Glazing materials.	Sheet glass	Sheet glass	Sheet glass	Sheet glass	Sheet glass	Sheet glass
Glazing bars.	wood	wood	wood	wood	wood	wood
Cill height.	1.00 m	1.00 m	1.00 m	1.00 m	1.20 m	1.30 m
Cleanliness of site location.	Clean area	Clean area	Clean area	Clean area	Clean area	Clean area
Ground cover.	Sand	Sand	Sand	Sand	Sand	Sand
Finishing materials of the external obstruction.	Yellow plaster	Yellow plaster	Yellow plaster	Yellow plaster	Yellow plaster	Yellow plaster

Source: The author based on the field survey

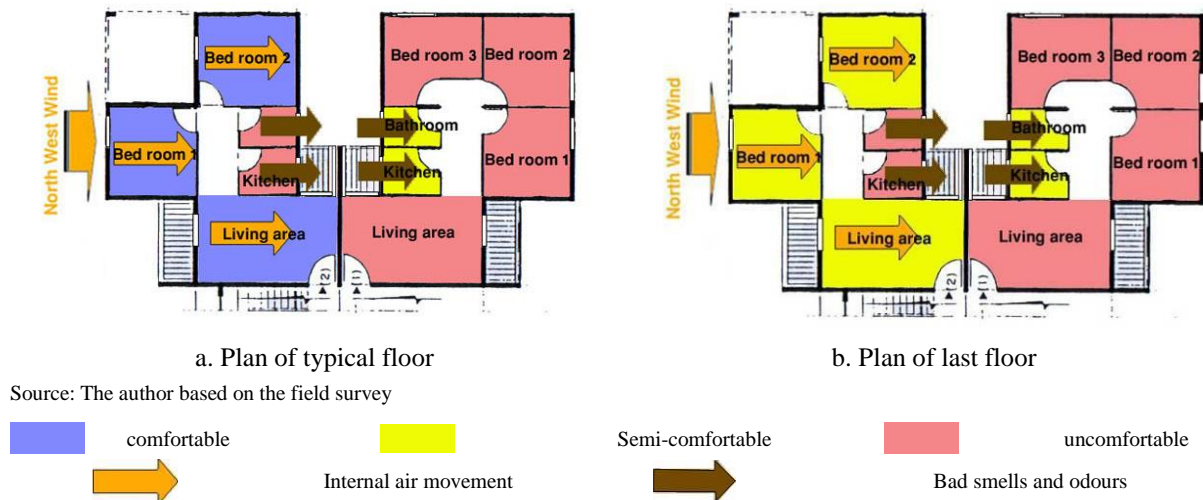
**Table 6: Relation between temperature, humidity, illumination and human comfort in an economic house.**

Floor Apartment	Typical floor						Last floor					
	(1)			(2)			(1)			(2)		
Env. basis	Temp.	Hum.	Light	Temp.	Hum.	Light	Temp.	Hum.	Light	Temp.	Hum.	Light
Bedroom (1)	1.5 °c	2%	high	-1 °c	-1.5%	high	2 °c	2%	high	0	1%	high
	uncomfortable			comfortable			uncomfortable			semi-comfortable		
Bedroom (2)	1.5 °c	2%	high	-0.5 °c	-1.5%	high	2 °c	2%	high	0	1%	high
	uncomfortable			comfortable			uncomfortable			semi-comfortable		
Bedroom (3)	1.5 °c	2%	high				1 °c	2%	high			
	uncomfortable						uncomfortable					
Living area	1.5 °c	2%	Adeq.	-1 °c	-1.5%	low	1.5 °c	2%	Adeq.	0	1%	low
	uncomfortable			comfortable			uncomfortable			semi-comfortable		
Kitchen	-0.5 °c	0	low	1 °c	1%	low	0	1%	low	1.5 °c	2%	low
	comfortable			uncomfortable			semi-comfortable			uncomfortable		
Bathroom	-0.5 °c	0	high	1 °c	1%	high	0	1%	high	1.5 °c	2%	high
	comfortable			uncomfortable			semi-comfortable			uncomfortable		

Source: The author based on the field survey

It was found that the percentage of relative humidity in apartment (1) is higher than that in apartment (2) at the same floor. This is because of the different windows directions for both of them; at apartment (1) the orientation of windows is to the South East and at apartment (2) the orientation is to the North West.

The position of case no. 2 is perpendicular to the direction of the prevailing wind. The house receives the full sweep of the velocities. The houses are planned in row arrangements, and wind shadow is caused over the subsequent units and passed by the later units. The orientation of the house differs from one apartment to another. These different orientations cause some problems in terms of levels of ventilation of the house. The orientation of apartment (2) has good ventilation at all its areas. Also, the window of the kitchen and the bathroom is to the South, so, the bad smells could not enter the apartment. But, the orientation of apartment (1) causes bad ventilation at the Southern bedrooms. In spite of the kitchen and the bathroom have good ventilation, but they are on the wrong direction, because the odours and bad smells would enter the bedrooms through the corridor via the air moving out from the kitchen and the bathroom (Figure 9).



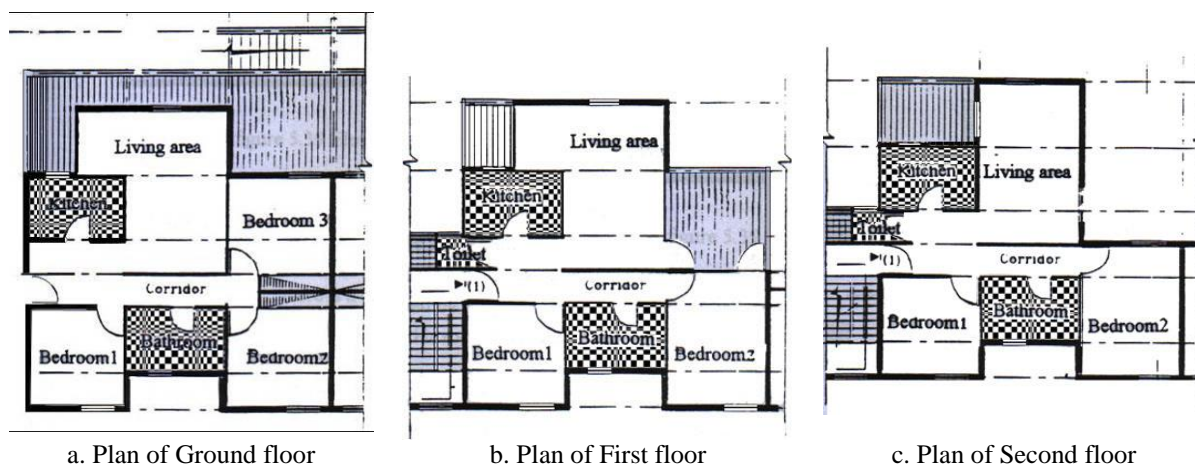
**Figure 9 Environmental housing conditions in typical and last floor in economic house**

It was found from the results of a simplified computer program which is used to calculate the day lighting levels inside the house, that there are too much glare at bedrooms and bathrooms. The illumination of the kitchen and the living areas of apartment (2) is low. And the illumination of living areas of apartment (1) is adequate.

**3-3 Medium house**

From the field survey, it was found that there is a variation in the areas of the medium house. The floor has only one apartment. The total gross areas include the building service (stairs and building entrance...ex) which is approximately 12-15m<sup>2</sup>. The total gross areas of the apartments in medium houses are different from the total gross area of the low cost and economic house. Figure 10 show the plans of case no.3, table 7 shows their total gross areas. Table 8 shows the housing variations affecting the environmental conditions inside a medium house.

In the finishing materials in medium housing; the external finishing material is plaster like the low cost and economic housing, but the internal finishing materials are painted with oil, which is different from the two previous housing categories. It is different from low cost and economic houses. The ratio of window's area to room's area is (13.63%) in bedrooms. All the glazing materials are sheet glasses, the glazing bars from wood. The surrounding areas are empty with no green areas and the ground cover with sand and Asphalt, the construction methods are industrial methods, and this is clearly appearing between the previous housing categories and the medium housing. Table 9 shows the relation between air temperature, the percentage of humidity, illumination and human comfort in an economic house.



**Figure 10 Plans of Ground, first and second floors of case no. 3.**

Source: [3] Authority of New Communities.

**Table 7: The areas of medium house (case no. 3).**

	Ground floor	First floor	Second floor	Third floor
Total area	94.00 m <sup>2</sup>	82.20 m <sup>2</sup>	79.54 m <sup>2</sup>	54.00 m <sup>2</sup>

Source: The author based on [3].

**Table 8 The housing variations affecting the environmental conditions inside a medium house**

Second floor	Bedroom (1)	Bedroom (2)	Living area	Kitchen	Bathroom	Toilet
Room's area	10.56 m <sup>2</sup>	10.56 m <sup>2</sup>	10.56 m <sup>2</sup>	14.81m <sup>2</sup>	6.50 m <sup>2</sup>	6.50 m <sup>2</sup>
Room length.	3.25 m	3.25 m	5.25 m	3.25 m	3.25 m	1.60 m
Room depth.	3.25 m	3.25 m	3.25 m	2.00 m	2.00 m	1.00 m
Walls and ceiling painting	Oil	Oil	Oil	Oil	Oil	Oil
Windows orientation	S.E.	S.E.& N.W.	N.W.	N.W.	N.W.	N.W.
The ratio of window's area to room's area	13.63%	13.63%	13.63%	12.15%	12.30%	5.53%
Window's area	1.44 m <sup>2</sup>	1.44 m <sup>2</sup>	1.44 m <sup>2</sup>	1.80 m <sup>2</sup>	0.80 m <sup>2</sup>	0.36 m <sup>2</sup>
Window width.	1.20 m	1.20m&1m	2*1.20 m	0.80 m	0.60 m	0.60 m
Glazing materials	Sheet glass	Sheet glass	Sheet glass	Sheet glass	Sheet glass	Sheet glass
Glazing bars.	wood	wood	wood	wood	wood	wood
Cill height.	1.00 m	1.00 m	1.00 m	1.20 m	1.30 m	1.30 m
Cleanliness of site location.	Clean area	Clean area	Clean area	Clean area	Clean area	Clean area
Ground cover	Sand	Sand	Asphalt	Asphalt	Sand	Asphalt
Finishing materials of the external obstruction.	Yellow plaster	Yellow plaster	Yellow plaster	Yellow plaster	Yellow plaster	Yellow plaster

Source: The researcher from the field survey.

**Table 9 Relation between temperature, humidity, illumination and human comfort in a medium house.**

Floor	Ground floor			First floor			Second floor			Third floor		
	Temp.	Hum.	Light	Temp.	Hum.	Light	Temp.	Hum.	Light	Temp.	Hum.	Light
Bedroom (1)	2 oc	2%	high	2 oc	2%	high	2 oc	2%	high	2 oc	2%	high
	uncomfortable			uncomfortable			uncomfortable			uncomfortable		
Bedroom (2)	2 oc	2%	high	-0.5 oc	-1.5%	high	-0.5 oc	-1.5%	high			
	uncomfortable			comfortable			comfortable					
Bedroom (3)	-0.5 oc	-1.5%	Adeq.									
	comfortable											
Living area	-0.5 oc	-1.5%	low	-0.5 oc	-1.5%	Adeq.	1 oc	-1.5%	low	-0.5 oc	-1.5%	low
	comfortable			comfortable			comfortable			comfortable		
Kitchen	-0.5 oc	-1.5%	low	-0.5 oc	-1.5%	low	-0.5 oc	-1.5%	low	0	-1.5%	low
	comfortable			comfortable			comfortable			comfortable		
Bathroom	1.5 oc	2%	high	1.5 oc	2%	high	1.5 oc	2%	high	2 oc	2%	high
	uncomfortable			uncomfortable			uncomfortable			uncomfortable		
Toilet	-0.5 oc	-1.5%	high	-0.5 oc	-1.5%	high	-0.5 oc	-1.5%	high	0	-1.5%	high
	comfortable			comfortable			comfortable			comfortable		

Source: The author based on the field survey

The ratio of windows area to the rooms' area is high. The penetration of heat energy inside the house is increased specially in the Southern rooms. On the ground floor, there is a big difference in the temperature of the bedrooms (1) and (2) (29.5oc) and the other areas of the apartment. On the first and second floor, the bedroom (2) has a lower temperature (28.5oc) than the other areas because it is characterized by the presence of two windows with two different orientations. The temperature of the rooms on the third floor (30oc) is high like the same temperature of the other floors. However, the living area has good temperature because it has a limited area with inadequate ventilation in comparison to the other floors.

It was found that the percentage of relative humidity in the Northern side of the house is low because the high speed of the air movement in this direction. On the ground floor, the relative humidity of bedroom (1) and (2) (62%) is higher than bedroom (3) (58.5%) in the same apartment, because of the rise of temperature and the slow of air movement in it. On the first and second floor, the relative humidity is decreased in bedroom (2) (58.5%) because of the presence of two different orientations for the windows.

The position of medium house is perpendicular to the prevailing wind (North West) direction. The house receives the full sweep of the velocities. This type is desirable for avoiding winter wind effects. Also, houses are planned in row arrangements. Wind shadow is cast over the subsequent units and passed by the later units. The orientation of the living area of this house is North West. It cannot avoid the North West wind in winter. But, this orientation assists achieving a good ventilation and for the

interior of the house. But, there are problems in the ventilation of the kitchen and toilet, meaning that the wind blowing from the North West window passes to the living area and the Southern rooms carrying the odors from the kitchen and the toilet covering the whole area of the house.

Also, table 9 shows that there is too much glare all areas except the living area and the kitchen. The illumination of the living areas and the kitchens are low.

From the detailed study of the environmental housing conditions in New Borg El-Arab, it can be summaries as it is shown in table 10.

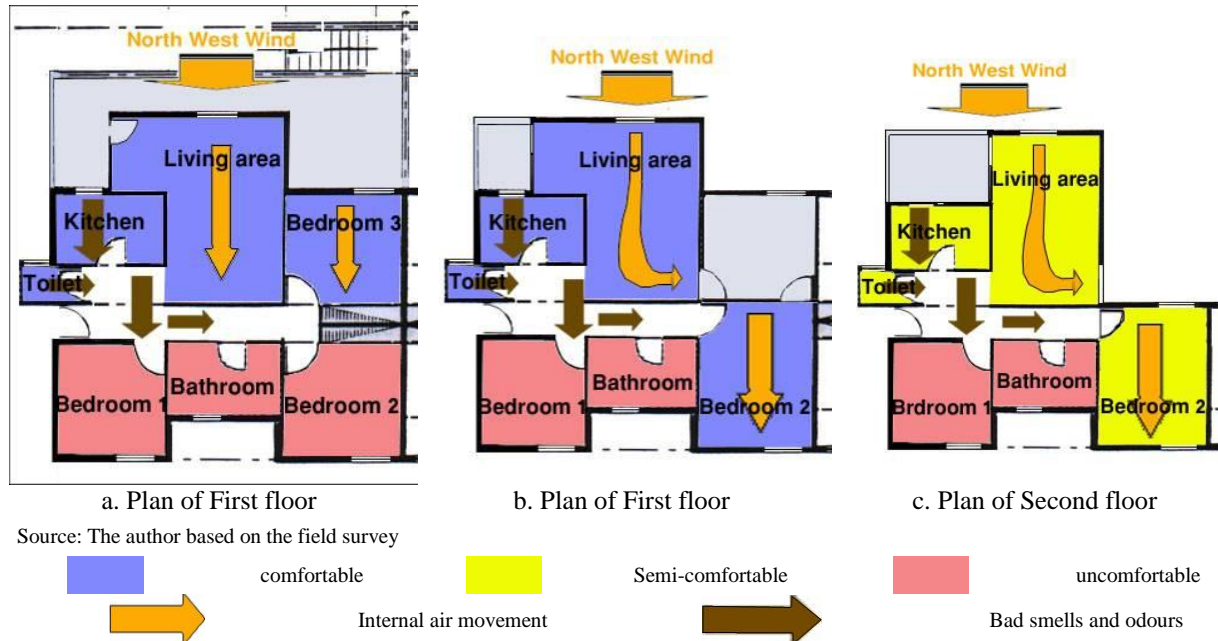


Figure 11 Environmental housing conditions in ground, first and last floors of case no. 3

Table 10 the environmental housing conditions in the cases studied of New Borg El-Arab

		Temperature	Humidity	Wind	Daylighting
Low cost house	First floor				
	Second floor				
	Last floor				
Economic house	Apert.(1) Typical floor				
	Apert.(1) Last floor				
	Apert.(2) Typical floor				
	Apert.(2) Last floor				
	Ground floor				
	First floor				
Medium house	Second floor				
	Last floor				

comfortable      Semi-comfortable      uncomfortable

Source: The author from the resulted of the analytical studies

#### 4- CONCLUSION

In the past, the economical policy of Egypt was that of habitation, i.e. a construction policy not a development policy. May be that was due to the rapid increase of the Delta and Nile valley's population and their extreme need for housing. That is why the government has planned for the construction of new houses in new towns to overcome the shortage of housing in the central towns and cities and to habitat the youth and the low-income people who can't find suitable houses in their existing cities. However, Gaps always appear in reaching the main aim of establishing the houses in



New Borg El-Arab, because of the lack of cooperation and coordination between the ministries in this field. From the field study, it could be observed that the employers and employees commute daily to Alexandria in spite of the presence of the different kind of houses. This could be attributed to the lack of services that is a result of the long duration of the implementation of New Borg El-Arab, in addition to the small governmental investments.

The construction methods are classified into traditional and industrialized methods. Construction methods directly affect the building economy and building conditions. This is clearly appearing through the direct relation between demand and supply of the building, workers, and materials. The building materials needed in the different stages of building differs according to each stage.

From analyzing the meteorological data of the environmental housing conditions in New Borg El-Arab, it could be observed that the climate is characterized by an increase of temperature and a decrease in humidity with the presence of a big difference in diurnal temperature. The humidity is suitable for human being activities. Rain occurs in winter only. Prevailing wind in New Borg El-Arab is from the North West direction. There is too much glaring most of the housing areas in New Borg EL-Arab.

The temperature, the ventilation and orientation of the house are the most important factor that affects the indoor climate and affect the percentage of relative humidity inside the house. Also, the results of the simplified computer program show that glare is detected inside all the case study houses. The effective periods for the human being outdoor are about 41.6% of year. These periods change internally. They could be increased to 66.6% of the year or decrease to 33.3% of it. This change depends on the building materials, the design of the house elements, and the site of the house.

Table 11 shows the relationship between the environmental bases; temperature, relative humidity, precipitation, wind, and day lighting and the housing external and internal elements.

**Table 11 The relationship between the environmental conditions and housing elements**

Housing elements		Temperature	Rel. Humidity	Orientation	Day lighting
Layout	compact with groups				
Orientation	rooms	north			
		north east			
		south east			
		south			
		south west			
		north west			
	services	north			
		south east			
		south			
		south west			
outdoor areas	sandy area				
	green area				
Roofs	humidity insulated	No		No	No
	non heat insulated		No	No	No
Walls	concrete			No	No
	bricks			No	No
openings	large dimension				

 comfortable
  Semi-comfortable
  uncomfortable

Source: The author from the resulted of the analytical studies

#### 4-1 Air Temperature

Measuring showed a great difference between the temperature of the southern and the northern rooms of the same apartment in the three cases of the study. Ventilation plays a great role in controlling the interior temperature, so the bad orientation of the house leads to insufficient ventilation, improper air currents speed and increases the interior temperature.

#### 4-2 Humidity and Precipitation

There is harmful effect of the humidity and precipitation to the exterior and the interior finishing materials of the low cost and economic houses, that because there is no maintenance for the

government houses. Rehabilitation of the building must be put into consideration to keep the building in a good comfortable shape.

#### 4-3 Wind

The position of the three examples of the house is perpendicular on the North West wind. The wind velocity is 100%. This position is not the best position. They could not avoid the North West wind in winter and could not get the benefit of the good north wind all over the year. Houses are planned in row arrangements causing a wind shadow over the subsequent units. In addition, the windows of the kitchens, bathrooms and toilets in the economic houses are oriented to the south. So, the bad odors do not spread in the house. But, in the low cost and medium house, the odors and bad smells would enter the living area with via the air moving out from the kitchen and bathroom.

#### 4-4 Day Lighting:

The sky is almost clear blue all the year round. Glare is detected inside the bedrooms of the low cost, economic and medium houses. However, the living areas have lower illumination than the bedrooms. That means that the fenestration is unsuitable whether in size or treatment. This problem could be solved by many ways.

**Table 11 The relationship between the environmental conditions and housing elements**

Housing elements		Temperature	Rel. Humidity	Orientation	Day lighting
Layout	compact with groups				
Orientation	rooms	north			
		north east			
		south east			
		south			
		south west			
	services	north			
		south east			
		south			
		south west			
		north west			
outdoor areas	sandy area				
	green area				
Roofs	humidity insulated	No		No	No
	non heat insulated		No	No	No
Walls	concrete			No	No
	bricks			No	No
openings	large dimension				

comfortable

Semi-comfortable

uncomfortable

Source: The author from the resulted of the analytical studies

From the detailed study of the environmental housing conditions in New Borg El-Arab, it could be observed that the well-designed houses, the choice of suitable finishing materials and the landscape around the house can protect the inhabitants from climatic changes and much glare. In addition, they can provide comfortable conditions without the use of expensive, energy – consuming mechanical equipment, particularly contributing to the low-income residents.

#### 5- RECOMMENDATIONS

When designing Affordable houses for youth and low income people, it should be done within developing policy not habitation policy. That mean services and job opportunities should be

established at the same time with the habitation to attract the youth and the low-income people and support them to live in. The architects should integrate the affordable housing with the surrounding environment in terms of human comfort. That can be achieved through a good design for the house using the suitable building materials available within the same region, taking into consideration all the environmental housing conditions. The three main recommended criteria of houses design resulted from the conclusion of the study are:

- The house design
- The finishing materials
- The landscape around the house

### **5-1 The house design:**

- Layout: Compact planning for groups of buildings to provide mutual shading and minimum exposure to the sun. The most suitable buildings should have inner courts.
- Orientation: The large dimensions of the building and the windows of the house should be perpendicular to the North South direction. The best position of the house is at 45 degree to the North West wind. The wind velocity is reduced to 50%. This position is better than the other positions because it could avoid the North West wind in winter and get the benefit of the good north wind all over the year.
- Rooms: Should ideally open onto an inner court and should be characterized by a large size area.
- Services: Kitchens should be insulated against heat, separately ventilated and oriented well.

### **5-2 The finishing materials:**

- Roofs: The upper roofs surfaces should be covered with reflective or heat insulating materials, The roofs could be designed as a double roof with an air gap between them, The under surfaces of the external roofs must be covered with heat absorbing materials, Domes and vaults could be used to cover some buildings to minimize the area exposed to the perpendicular rays.
- Walls: The simplest solution is to follow the traditional thick walls, Double wall could be used to prevent the penetration of the heat inside the building, the surfaces must be chosen from smooth surfaces with light colors, to reflect heat.
- Openings: An air draft should be created by opening a lantern in the upper roof of the staircases; furthermore, small fanlight should be also located in the door of the apartment.
- Horizontal louvers could be used especially in the Southern facades to decrease the heat pressure on the walls and windows by shading them during the day when the heat energy is very strong.
- The windows should be placed in the direction of the suitable wind to direct hot air away before affecting the temperature of the room.
- Use long narrow windows, as they give evenly distributed light over the room, and prevent pools of glare.
- Use the above windows at the corner of the room, as this will throw light onto the adjacent perpendicular wall surface thus providing a large apparent source of a lesser luminance than the window, which will enhance the daylight level within the space.
- Use heat absorbing glass to reduce heat and glare, but because of reducing illumination levels.
- Use light shelves instead of the traditional overhang, with its upper part painted white or mirrored, to reduce glare and reflect daylight deep into the room, thus balancing the light gradients.
- Use Venetians blinds with vertical slats, which can be adjusted as needed, thus preventing glare while still reflecting light into the interior.

### **5-3 The landscape around the house:**

- Green areas around the building have a moderate reflections factor; it is better than sandy lands.
- Buildings must be surrounded by trees and shrubs which are evergreen for obstructing the sun rays before reaching buildings by making shadows and acting as an air filter to sand and dust.
- Providing areas of water pools around the buildings, to decrease the heat pressure on the buildings.

## **AKNOWLEDGMENT**

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## 2-2 NEIGHBORHOOD SOCIAL CENTERS AND THIER ROLE IN DEVELOPING SOCIO-ECONOMIC ASPECTS OF AFFORDABLE HOUSING COMMUNITIES

**Khaled Ibrahim El-Arfaj, MURP**

Lecturer in Department of Urban and Regional Planning  
College of Architecture and Planning, King Faisal University  
Kialarfaj@yahoo.com

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### **Abstract:**

*It is noticeable that the changes which have been taking place lately in the world's societies (generally) and in the Saudi Arabian Society (in particular) are numerous and rapid. The most prominent of such changes are the weakening of social role of the mosques in Muslim society. These changes resulted in negative phenomena, which have negatively affected the various aspects of life; the social, economic, safety, etc. This leads to an essential necessity for the rise of non-governmental voluntary institutions to take care of all these aspects in the society in order to lessen these negative phenomena and cure them well. This research significance arises from the importance of voluntary charitable work to the success of social development. Voluntary charitable works are distributed, regional efforts, which follow a gradual planning method. They are carried out with self-motivated, effective and constructive participatory manners. to support the government in its efforts to improve social, economical and safety, and other public qualities of the society.*

*This research aims to present a proposed vision to build "Neighborhood Social Centers" (NSC) through voluntary charitable work, especially in affordable housing communities. These communities are in real need for voluntary works through a number of social, economic and safety activities, which are directed towards the desired improvement of the standards of life. To cover its aim, the research depends on secondary data derived from a literature review of previous relevant works. It also made use of personal observations and experience of the researcher, having been involved in charitable, voluntary work in the Eastern Province of Saudi Arabia for more than decade. The paper covers several issues including: (1) a historical background on the directions and methods of voluntary work in the Kingdom; (2) an acknowledgment of the concept of "Neighborhood Social Centers" NSC's; (3) the aim of building NSC's in the time where the Saudi society suffers from the negative social, economic and safety problems; (4) the necessity of the existence of NSC's in the Kingdom of Saudi Arabia, especially in Affordable Housing Communities, and (5) a highlight on the future view of the growing role of NSC's. The research ends with a general summary of results and the recommendations.*

### **Keywords:**

*Voluntary Work, Neighborhood Centers, Affordable Housing Communities*

## 2-3 INCORPORATING LIFE STYLE THEORIES INTO AN INQUIRY PROCESS FOR AFFORDABLE HOUSING IN SAUDI ARABIA

**Ashraf M. Salama, Ph. D.**

Professor in the Department of Architecture  
College of Environmental Design, King Fahd University of Petroleum and Minerals  
Dhahran, Kingdom of Saudi Arabia  
asalama@kfupm.edu.sa or asalama@gmail.com

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### **Abstract\*:**

*The conventional approach for investigating affordable housing views cost reduction as one single determinant. Other crucial factors such as lifestyles of the targeted populations, people satisfaction of their current houses and residential environments, and their aspirations and preferences in future houses are always oversimplified or superficially addressed. Therefore, the aim of this paper is to develop and present a comprehensive approach for investigating affordable housing in Saudi Arabia. Such an approach is based on a new paradigm of research: trans-disciplinarity; a form of inquiry that crosses the boundaries of different disciplines.*

*An argument on the impact of trans-disciplinary thinking on understanding affordable housing is developed, and then is placed within the perspective of how lifestyle theories and their underlying concepts including place attachment, appropriation, visual preferences, and people satisfaction, can be incorporated into a comprehensive investigatory process. In turn, a framework of inquiry is developed while reflected on affordable housing knowledge types. An interpretation of the framework into a survey tool is conceptualized. The tool is introduced in the form of a questionnaire to be implemented in the context of Saudi Arabia. The testing of the questionnaire as a tool of inquiry reveals its validity, corroborates the value of integrating different knowledge types into the investigatory process of affordable housing, and accentuates the value of introducing lifestyle theories as a new form of knowledge necessary for future inquiry on affordable housing.*

### **Keywords:**

*Lifestyle Theories, Trans-disciplinarity; Place Attachment; Appropriation, Preferences, Affordable Housing*

### **1- INTRODUCTION**

The rising demands on affordable housing in Saudi Arabia and the increasing interest of developers to invest in affordable housing projects mandates a clearer understanding and appreciation of the lifestyles and cultural values of the local society. Dealing with affordable housing as products or commodities only results in less than appealing and depressing environments that do not meet basic needs or satisfy the preferences of potential users.

In Saudi Arabia, there has been a declining income from oil production that continued during the nineties, which has led to reduction in government revenues. As well, the influx of rural and desert population into urban areas have exacerbated the problem of providing affordable housing to the populace. However, the recent boom in oil prices and the flourishing economy led to a surge in the construction of housing environments where many projects are currently undertaken by government agencies and through many private sector initiatives.

The Saudi environmental and socio-cultural contexts demand that affordable housing should not aim at merely providing shelters to lower income populations, it should also offer design solutions that are sensitive to the local context. Issues such as privacy, social cohesion, and perceptions on residential density, preferences, and the lifestyles of the target populations should be considered in providing desirable, affordable and sustainable housing.

The basic premise of this paper is that affordable housing has not been addressed in a comprehensive manner; it has been approached from a professional milieu as well as from an academic perspective. At the two levels, it has been an issue of debate where numerous conferences, publications, and consultancy reports have addressed different aspects of affordable housing. Investigating the literature that has been developed over the past two decades reveals critical arguments on the way in which such an important subject has been approached in practice, or debated in academe over the years.

Discussions and methodological research on housing and affordable housing included took place through six approaches [1] : aesthetic or formal interpretation, the typological approach; evolutionary theories and physical explanations such as building technology and climatic aspects; social explanations such as defense theory and household structure; socio-cultural factors; and religious practices. In the Arab world including Saudi Arabia, debates around housing of all types seem to have drifted into two domains that seldom meet [2]: A) technical discussions about the problems of mass housing including land acquisition, services, credit, finance, and urban planning, or B) stylistic discussions of the cultural authenticity of housing production. However, issues are always addressed in isolation and many factors, critical to the success of affordable housing projects and essential for developing knowledge about existing projects, are oversimplified, superficially addressed, or ignored. Therefore, a new innovative and alternative approach is obviously needed; an approach that has the capacity to address multiple issues at a time while reflecting the thinking spirit of the present era that is based on trans-disciplinarity; the integration of different types of knowledge.

## **2- THE CRUX OF THE ARGUMENT: CONCEPTIONS AND MISCONCEPTIONS IN THE TYPICAL COVENTIONAL APPROACH**

Despite the current surge in the construction of housing environments in the kingdom, the quest for affordable housing remains elusive for a large segment of Saudi society. Descent, affordable housing is emerging as a critical issue toward the social and economic well being of the kingdom of Saudi Arabia. Demands for such housing continue to far outstrip supply and those projects that are currently built suffer from severe cost constraints, while lacking important qualities that relate to people needs and cultural aspirations.

To many architects, engineers, and developers, the terms “affordable housing”, “design”, and “the preferences and lifestyles of the targeted populations” are exclusive and are looked at in isolation. Once the goal of providing quality design and once the goal of understanding people preferences and their lifestyles enter the discussion, it is generally assumed that the cost will automatically increase. When production techniques are developed to provide genuinely affordable housing, effort is often focused on cost reduction only while preferences and lifestyle aspects are overlooked. Theorists like Alexander, and Burnham argue that it has proven difficult to strike a harmonious balance.

While recently there have been notable developments in housing design that demonstrate our increased understanding of social issues and construction techniques, cost efficiency is perceived as contradictory to the overall design quality and the lifestyles of potential users. There have been many explanations given. Most often it is first blamed on a lack of funding. However, another underlying reason may stem from the public perception of what affordable housing should look like. Some well-designed projects make people uncomfortable because they are ‘too nice’. “The underlying belief is that people who do not have a lot of money do not deserve to live in nice housing” [3]. This notion is a flaw since it is believed that quality design and meeting the preferences of users are critical to instill a sense of pride in potential occupants. “It must also bestow on its inhabitants a sense of dignity... To ignore this aspect of housing or to consider it a prerequisite for only those who can afford market-rate housing, is to invite both social and financial disaster” [4].

People need to have a personal psychological investment in their houses and are well aware when asked to live in impersonal housing. Unattractive housing directly affects the self-respect of the occupants. "All people want to see themselves reflected, to express themselves on paper or canvass and in speech, dance, and their choice of car, clothing or built environment." [5]. If people are consistently told, through the kinds of housing offered, that they are only worthy of a certain level of quality, they may come to believe it. Understanding preferences and the lifestyles of people gives architects and planners the chance to create a sense of individual expression and thereby a pride at an affordable cost [6].

The preceding discussion conveys that there are misconceptions in the conventional approach where affordable housing worldwide in general and in Saudi Arabia in particular is always understood from the perspective of cost reduction only as one single determinant, while other critical determinants such as the lifestyles of the targeted populations, their satisfaction of their current houses, and their preferences of the future houses need to be addressed. This, in essence, requires an alternative approach that integrates these concerns in a comprehensive manner.

### 3- THE CRUX OF THE ARGUMENT: TOWARD A PRODUCTION OF TRANS-DISCIPLINARY KNOWLEDGE

*".... Architects who have aimed at acquiring manual skills without scholarship have never been able to reach a position to correspond with their pains..."*

*Marcos Vitruvius Pollio, Ten Books on Architecture, 100 B.C.*

Theorists and practitioners have been discussing the issue of architectural knowledge for several decades. Recent years, however, have witnessed an intensive debate in built environment literature. Donald Watson attempted to define a demand for knowledge in architecture and built environment. He argues that: "*The discipline of architecture needs a rigorous knowledge base by which to support its premises and principles that define the relationship between human and community health, and between building and urban design,*" (Quote from [7]). Henry Sanoff confirms this view when he argues that architecture should be based on knowledge of people needs; it should not be based just on the creative impulses of architects [8].

To date, the development of rigorous theory/knowledge building has been at the edge of the profession and frequently marginalized as something separate from the profession of architecture, that is: environment-behavior studies, building sciences, environment-technology studies, etc. As a result, most practitioners are not well equipped or even interested to understand the value of their professional services. Concomitantly, the standing of the profession is marginalized in the eyes of the public. That is, without research, scholarship and a rigorous knowledge base, the profession cannot take stands on significant health, economic, social, political or ethical issues.

Watson argues for the need for a rigorous knowledge base in architecture. He believes that this knowledge could strengthen architects potential to understand the object proper of their professional expertise and its value in relation to other fields of expertise [9]. Along the same line of Watson's thinking Amos Rapoport (1994) argues for the need for the discipline of architecture to develop a quantifiable body of knowledge based on qualitative measures by calling for a dramatic departure from the art metaphor that the profession and its education are based upon to one based on science and research. Rapoport introduced a number of questions underlying the heading of "knowledge about better environments"; these are: what is better, better for whom and why it is better? [10] and [11].

Recently, John Habraken introduced an argument similar to those of Watson, Rapoport, and Sanoff, but with a focus on the education of future professionals. Habraken argues, and rightly so, that "*We need to teach knowledge about everyday environment. How it is structured, what we can learn from historic and contemporary evidence, how different examples compare, how it behaves over time and responds to change of inhabitation or other circumstances... Teaching architecture without teaching how everyday environment works is like teaching medical students the art of healing without telling them how the human body functions. You would not trust a medical doctor who does not know the human body. Knowledge of everyday environment must legitimize our profession...*" [12].



In essence, the preceding eloquent arguments call for a more stable basis for knowledge in architecture and in the creation of built environments and affordable housing is no exception. Such basis would be in the form of a more balanced and integrated types of knowledge. Therefore, an elaboration upon these arguments in the context of recent discussions on different modes of knowledge production and on different types of knowledge in architecture and the built environment is needed.

#### 4- MONO-DISCIPLINARY, MULTI-DISCIPLINARY, AND TRANS-DISCIPLINARY KNOWLEDGE: TWO MODES OF KNOWLEDGE PRODUCTION

Planning and architecture, like other fields of vocational expertise, can be classified as professional disciplines, especially when we regard them as fields of inquiry [13]. Ulf Sandström has followed the development in profession-related studies since he identified two trends in research and knowledge production in the field of professional expertise: one which is oriented towards the production of mono-disciplinary academic knowledge, and the other which is directed towards subjects derived from concrete life situations, these being solution-oriented [9].

King and Burnell offer a broad and convincing representation of what constitutes an academic discipline. They propose several aspects that include a community, a network of communications, a tradition, a particular set of values and beliefs, a domain, a mode of inquiry and a conceptual structure [13]. Another definition, by Toulmin, focuses more on epistemological considerations, presenting disciplines like this “...each is characterized by its own body of concepts, methods and fundamental aims”[13]. In his important work on trans-disciplinarity, Gibbons describes two parallel and competitive modes of knowledge production [14]. He described them as outlined in Table (1).

**Table 1 Definition of modes of knowledge production**

<b>Modes of Knowledge Production</b>	<b>Descriptive Definition</b>
<b>Mode 1 Mono-Disciplinary Multi-Disciplinary</b>	The complex of ideas, methods, values and norms that has grown up to control the diffusion of the Newtonian model of science to more and more fields of inquiry and ensure its compliance with what is considered sound scientific practice.
<b>Mode 2 Trans-Disciplinary</b>	Knowledge production carried out in the context of application and marked by its: trans-disciplinarity; heterogeneity; social accountability and reflexivity; and quality control, which emphasize context – and use-dependence. It results from the parallel expansion of knowledge producers and users in society.

The definition of Mode 2 introduces the notion of trans-disciplinarity that can be described like this: Trans-disciplinarity is a new form of learning and problem solving involving co-operation among different parts of society and academia in order to meet complex challenges of society. Trans-disciplinary research starts from tangible, real-world problems. Solutions are devised in collaboration with multiple stakeholders. Thus, trans-disciplinarity is about transgressing boundaries of disciplines.

As a practice-oriented approach, trans-disciplinarity is not confined to a closed circle of scientific experts, professional journals and academic departments where knowledge is produced. Through mutual learning, the knowledge of all participants is enhanced, including local knowledge, scientific knowledge and the knowledge of concerned industries, businesses, and non-governmental organizations. The sum of this knowledge will be greater than the knowledge of any single partner. In the process, the bias of each perspective will also be minimized [15] and [16].

The trans-disciplinary type of knowledge is partly based on epistemological research. While mono-disciplinary and multi / inter-disciplinary research is clearly encompassed by Mode 1, trans-disciplinary knowledge production is the very essence of Mode 2. Gibbons maintains that Mode 1 has its role mostly for providing a stable basic educational training and for instilling in individuals a sense of disciplinary identity. On the other hand, he argues that there is a demand for the aptitude to co-operate with experts from other fields and for the ability to see problems in a complementary manner. Such faculties rest upon the capacity to assume multiple cognitive and social identities. Thus, both modes of knowledge production are in demand and should find a mutual balance [14] and [17].

## **5- THE IMPACT OF TRANS-DISCIPLINARITY ON UNDERSTANDING AFFORDABLE HOUSING**

The preceding discussion on trans-disciplinarity as a thinking paradigm reveals that “trans” in the term is about transition and movement where the rigor of research and knowledge production is matched by the concerns for establishing connections and inter-relationships. This means that there is a “middle zone” of exchange between disciplines. It also means shifting the grounds of research in both the sciences and the arts from a concentration on disciplinary needs and history of things/issues, to an emphasis on how needs of one discipline are connected to knowledge goals and aspirations of other disciplines. In other words, it can be argued that no discipline can make strong claims anymore about its own direction, value, and output in isolation from what is happening in other areas of research.

Looking at the latest literature on sustainable affordable housing as a field of research, one could trace its trans-disciplinary nature [18], [19], [20], [21], [22], [23], [24], and [25]. It involves research paradigms that range from policy making, economics and financial concerns, to environmental and cultural aspects, to planning, design, management, and operations. This is due to the fact that the provision of sustainable affordable housing is always constrained by the need to consider social, environmental, and economic implications.

Affordable housing can be viewed as a web of influences and inter-relationships of a wide spectrum of issues and this reflects the trans-disciplinary nature of sustainable affordable housing investigation or development. For example, it is acknowledged in the literature that the morphology of residential production influences the development of cities and concomitantly generates environmental impacts and infrastructure stress. It is also acknowledged that the typology of houses influence the social and environmental performance of neighborhoods. These inter-relationships mandate a comprehensive understanding of sustainable affordable housing where the creation of trans-disciplinary tools of inquiry would be indispensable.

Within the preceding context it should be noted that while research studies on affordable housing highlight the multifaceted nature of the process of investigating or creating affordable housing projects, little emphasis was placed upon addressing the socio-cultural, economic aspects in an integrated manner and the way in which they influence one another as different disciplinary issues. This is clearly evident where one could see studies that place emphasis on policy and economic issues without looking at the impact on other critical concerns such cultural and environmental aspects. On the other hand, the author notices other types of studies that place emphasis on the physical characteristics of dwellings or neighborhoods, again, without clear indicators of how physical aspects can be linked to socio-cultural concerns [26].

While social and cultural issues are introduced in the literature as successful determining factors, very little is offered on how to introduce such issues either when investigating sustainable affordable housing in a research process, or when attempts are envisioned to develop sustainable affordable housing projects in a developmental process. The fact that affordable housing is always defined in economic terms or by the relationship between household's income and expenditures does not mean that other issues, such as socio-cultural concerns including people preferences, lifestyles, and cultural aspirations are oversimplified or addressed in isolation. This suggests that creating affordable housing projects and that producing knowledge about affordable housing requires a new paradigm of thinking, which is based on trans-disciplinarity that crosses the boundaries between wide spectrums of issues that stem from different disciplines. In this context, the author asserts that the typical approach for investigating affordable housing adopts the perspective of cost reduction only as one single determinant, while other critical determinants such as the lifestyles of the targeted populations, their satisfaction of their current houses, and their preferences of the future houses are typically absent from the inquiry process. Therefore, emphasis is placed upon integrating economic, cultural, social, and behavioral aspects in addition to other contextual measures within which sustainable affordable projects are created.

## **6- AN ALTERNATIVE APPROACH: INCORPORATING LIFE-STYLE THEORIES INTO A COMPREHENSIVE INVESTIGATORY PROCESS**

Since the intention of this paper is to develop a new approach for investigating affordable housing in Saudi Arabia, it is essential to redefine the nature, direction, and orientation of knowledge about

affordable housing to be more relevant to the socio-economic and cultural context of the kingdom. It is therefore proposed that adopting a trans-disciplinary thinking requires that trans-disciplinarity is viewed as a realm of research that differs from other forms of inquiry. Concomitantly, investigating affordable housing in a transitory fashion that crosses the boundaries between different disciplines is paramount. It is also envisioned that the unique characteristics that the kingdom enjoys in terms of economic, social, and cultural particularities necessitates a comprehensive mechanism that addresses the misconceptions, which characterize other conventional approaches of inquiry that rely heavily on knowledge types emerging from one single discipline. Thus, a number of perspectives is incorporated in a proposed alternative approach, derived from different disciplines while at the same time crosses the boundaries between them. Such an approach is based on introducing lifestyle theories.

### 6-1 Life Style Theories

The proposed approach involves the introduction of lifestyle theories into other concerns including financial, cost reduction, and affordability issues. Understanding how the issue of affordability may relate to people preferences and lifestyles mandates an understanding of lifestyle theories that emerged from other disciplines and branches of science such as ethnology, anthropology, and sociology. Ethnology is defined as “*the science that analyzes and compares human cultures, as in social structure, language, religion, and technology*”, while anthropology is defined as “*the scientific study of the origin, the behavior, and the physical, social, and cultural development of humans.*” [27]. It should be noted in this context that ethnology is also defined as a branch of anthropology that addresses cultural issues thereby is often referred to in the literature as “*cultural anthropology.*” On the other hand, sociology is defined as “*The study of human social behavior, especially the study of the origins, organization, institutions, and development of human society.*” [27]. Sociology involves the analysis of a social institution or a societal segment as a self-contained entity or in relation to society as a whole.

Literature on lifestyle and social issues as they relate to geography and place reveals important perspectives [28], [29], and [30]. Giddens in 1984 introduced the theory of structuration in his book “*The Constitution of Society: Outline of the Theory of Structuration.*” His theory is based on establishing a dynamic perspective of how different elements of a society interact. Such a work is based on a critical understanding of people, organizations, agencies, and the power that each element of a society would have [28]. The introduction of the theory of structuration generated an intensive debate on linking issues that pertain to the relationship between the structure of society and the physical environment, namely the concept of place. Allan Pred in his article titled: “*Place as Historically Contingent Process: Structuration and the Time-Geography of Becoming Places*” introduced a framework that is based on an integration of time-geography (place) and the theory of structuration. He conceptualized place as a human product as well as a set of features visible on the landscape. In essence, what should concern researchers in this regard is the term “*human product*” [29].

The views introduced by Giddens and Pred on the one hand, foster a deeper insight into affordable housing. For example, the assemblage of buildings in a housing environment, land use patterns, and arteries of communication that constitute that environment as a place cannot emerge fully or formed out of nothingness, stop or grow rigid, or indelibly etched in the once-natural landscape; they represent a human product. In other words, such an environment is seen as a place that involves an appropriation and transformation of space and nature; processes that are inseparable from the reproduction and transformation of society. On the other hand, such views invigorate an understanding that the social aspects of everyday life can be seen as rich realm that offers valuable theoretical, epistemological, and substantive contribution to how affordable housing environments can be investigated.

Three major theories appear to have influenced recent conceptions about lifestyles and human preferences. These are of the Danish ethnologist: Thomas Hojrup; the British anthropologist: Mary Douglas; and the French sociologist: Pierre Bourdieu. Thomas Hojrup introduced the concept of life-mode in his book “*State, Culture, and Life-Modes: Foundations of Life Mode Analysis (2003)*”. He argues that our values are constrained by cultural-relational dialectics and are product of cultural life modes [31]. He attempted to address the problem that different cultural values conflict when they are brought together. The three life modes he introduced are: self-employed life mode, wage earner life mode, and career oriented life mode.

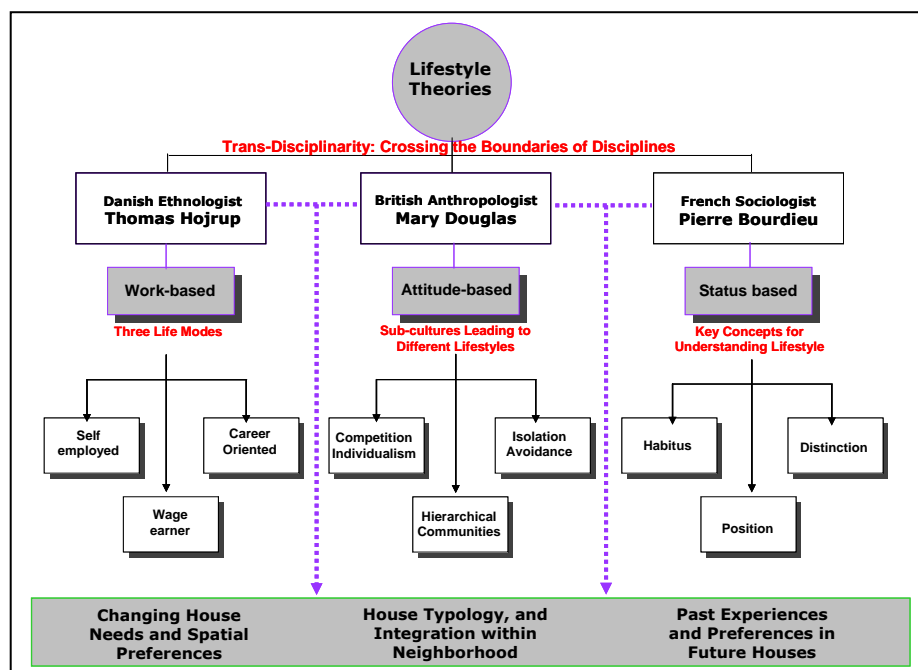
The preceding classification shows that based on income level, work sector, and work style of an individual, house needs and preferences vary dramatically. Putting these three life modes into a house/home, or affordable housing perspective, one could relate them as follows:

- **The first mode** is *self-employed* where means of production are owned and included within the house. Therefore, the house acts as both living and working place, and no separation between working time and space time.
- **The second mode** is *wage-earner* where the house is either regarded as a primary place serving recreational purposes, or as a place where important spare-time activities are undertaken.
- **The third mode** is *career oriented* where ideally the house reflects the personal progress in order to reflect position, social status, and past and recent experiences.

In 1996, Mary Douglas introduced a similar life style theory. Four different sub-cultures stem from this theory; these are: competition and individualism; isolation and avoidance of social controls; equity and negotiation; and hierarchical communities [32]. These sub-cultures relate directly to how affordable housing environments could be understood and investigated. Housing typology in terms of house size, house integration within the neighborhood and the community, and the overall house image are important elements when reflecting this theory on affordable housing.

Pierre Bourdieu's theory corresponds with Douglas's theory since he introduced in 1984 three key concepts for understanding the concept of lifestyle; these are: habitus, position, and distinction [33]. Habitus refers to past experiences and embedded preferences as well as socio-behavioral practices. Position means what agents have in terms of different kinds of capital and he means by agents people and institutions. Distinction involves being distinguished and being an individual. This understanding can be linked to affordable housing investigation, especially when developing mechanisms of inquiry about what housing environment people have experienced and what housing environment people would like to live-in in the future; inquiry about issues that reflect people past experiences and social practices and preferences of the future.

It is apparent that the three theories are based on different set of interests under different lifestyles aspects. Therefore, Hojrup's theory can be labeled as a work-based theory; Douglas's theory can be labeled as attitude based theory, while Bourdieu's theory can be labeled as status based theory. All are conceived to dramatically influence the understanding of affordable housing in physical and social terms. Thus, they should be included in any inquiry aimed at knowledge production about affordable housing. Such understanding is illustrated in Figure (1).



**Figure 1 Incorporating trans-disciplinary thinking into a comprehensive investigatory process of affordable housing: Lifestyle Theories**

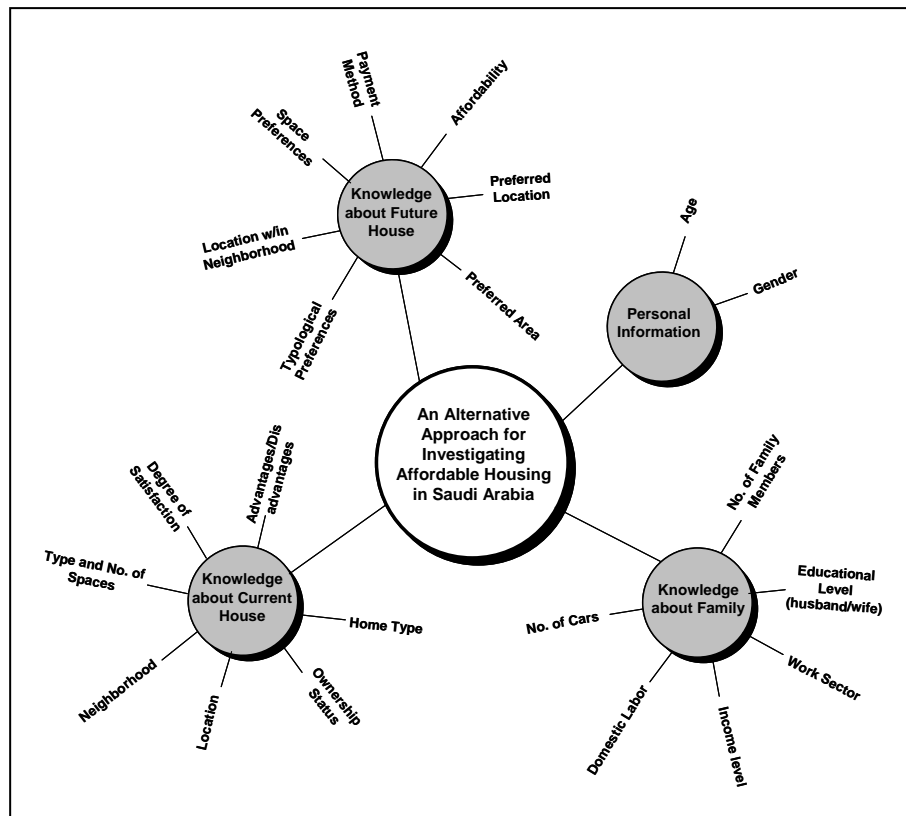


Figure 2 Framework for inquiry about affordable housing in Saudi Arabia.

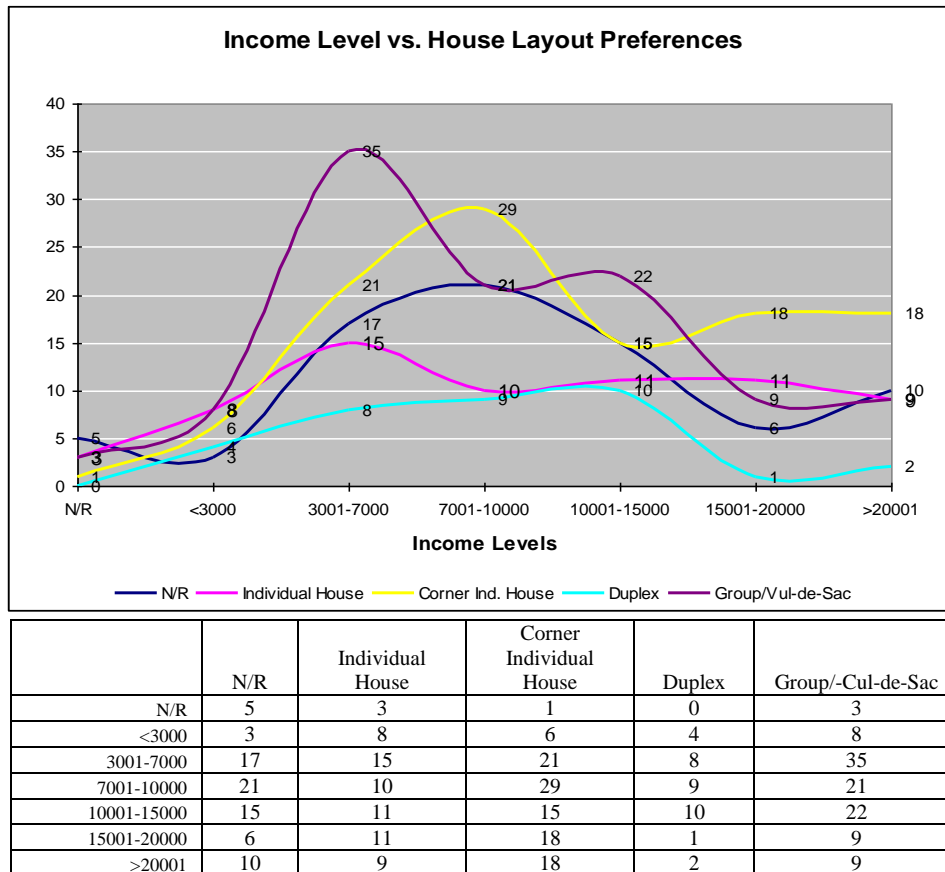
The four clusters of the framework can be outlined as follows:

- Cluster (1): addresses personal information including gender and age.
- Cluster (2): aims at developing knowledge about family that reflects different life-modes among other issues. It includes issues that pertain to number of family members, educational level, work sector, income level, presence of domestic labor, and number of cars used by family members.
- Cluster (3): investigates issues toward developing knowledge about current home that translates key concepts of understanding lifestyles including issues that pertain to appropriation and place attachment. Such issues are translated into a number of questions that involve home type, ownership status, space availability, and the degree of satisfaction.
- Cluster (4): seeks out the development of knowledge about future home that reflects the three life style theories. It includes issues related to future space needs, position within the community/neighborhood, and home typological preferences.

The proposed framework is translated into a survey tool in the form of a questionnaire, developed and designed based on the structure of the framework. In this questionnaire, questions are categorized in a manner that follows the sequence of the four clusters. The questionnaire was developed in Arabic since the intention is to address the Saudi context, and therefore it was examined in the same context. The city of Jeddah was selected for testing its validity. A large number of questionnaire sheets were distributed in a real estate exhibition where many real estate development companies display their projects; many of which are affordable housing projects. It should be noted in this context that sampling was not of concern since the main aim was to examine the validity of the framework and the tool. Also, it should be noted that no generalizations are drawn in the context of the whole country, rather it is only limited to the testing sample. Strikingly, over three hundred and fifty questionnaire forms were gathered from potential home buyers.

Several relationships that manifest a trans-disciplinary thinking and that establish links between wide varieties of issues can be conceptualized based on the responses received. An example of how

more than one issue of concern to affordable housing knowledge production can be illustrated by developing a relationship between income level and house layout preferences. In terms of the layout and the overall house type, 27% of the respondents prefer a corner individual house (overlooking two streets) and the same percentage prefer living in a house within a group of houses that overlooks a public garden. 17% prefer to live in a typical private (individual) house that has its own boundaries, and only 9% prefer the duplex house type. Some interesting results are drawn when linking these figures to income levels as shown in Figure (3).



Source: Developed based on testing the survey questionnaire and the responses received.

**Figure 3 Relationship between income level and house layout preferences**

Linking house layout preferences to income levels, the following relationships can be drawn as follows:

- 15 respondents out of 64 who prefer individual house that has separate boundaries have income in the range of 3001-7000 SR a month.
- 29 respondents out of 87 who prefer individual corner house (overlooking two streets) have income in the range of 7001-10000 SR a month.
- 10 respondents out of 34 who prefer duplex type house have income in the range of 10001-15000 SR a month.
- 35 respondents out 104 who prefer a house within a group of houses that overlooks a public garden have income in the range of 3001-7000 SR a month.

## 8- CONCLUSION

It is clearly evident that a new paradigm of thinking is emerging where no one theory or discipline would have the upper hand in developing a comprehensive understanding of affordable housing. In the old paradigm, the value of affordable housing is assumed to be in the quantifiable attributes of dwellings and their related cost, while in the new paradigm affordable housing inquiry can be viewed within relationships between the process, the product, and the socio-cultural aspects of the targeted populations. Simply, the old paradigm views affordable housing in terms of what it is, rather than what

it does for the local populations and the way in which they perceive their current environment and aspire to environments more responsive to their social needs and lifestyles.

This study aimed at developing a comprehensive innovative approach for investigating affordable housing in Saudi Arabia. Such an approach was based on introducing a new paradigm of research: trans-disciplinarity as a form of inquiry that crosses the boundaries of different disciplines. An argument on the impact of trans-disciplinary thinking on understanding affordable housing was developed and placed within the perspective of how lifestyle theories and their underlying concepts can be incorporated into a comprehensive investigatory process. In turn, a framework of inquiry was developed while reflected on affordable housing knowledge types.

The proposed framework was conceptualized and translated into a survey tool, which was then devised in the form of a questionnaire to be implemented in the context of Saudi Arabia. The tool was tested in the city of Jeddah since it was distributed in one of the major real estate exhibitions. The testing of the questionnaire as a tool of inquiry reveals its validity, corroborates the value of integrating different knowledge types into the investigatory process of affordable housing, and accentuates the value of introducing lifestyle theories as a new form of knowledge necessary for future inquiry on affordable housing.

It is important to shed light on the fact that the proposed approach involves a number of correlations that aim to reach reliable results. The approach represents a structured method for investigating affordable housing in Saudi Arabia that is based on a critical understanding of the issues involved. As well, it incorporates novel ideas where issues derived from different disciplines are integrated. The importance of such an approach lies in the value of how trans-disciplinary thinking in built environment related realms can be introduced, where the boundaries of different disciplines are crossed. In essence, planning and architectural aspects, social and cultural issues, and cost and financial issues are all incorporated into one mechanism toward a comprehensive inquiry on affordable housing.

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## 2-4 FOSTERING COMMUNITY PARTICIPATION IN SUSTAINABLE HOUSING DEVELOPMENT USING VIRTUAL ENVIRONMENTS

**Rabee M. Reffat, Ph. D.**

Associate Architecture Department, College of Environmental Design  
P.O. Box 1817, KFUPM, Dhahran, 31261, Saudi Arabia  
rabee@kfupm.edu.sa

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### **Abstract:**

*Successful development of sustainable housing requires effective community participation in the process of housing development from briefing, designing, marketing, construction, maintenance and management. House-buyers are often more concerned with the stylistic considerations and initial costs, than the spatial considerations, long-term suitability and lifetime costs of new houses. Marketing of housing projects focuses attention on glossy images. However, virtual environments could be used to take attention away from the architectural style and show the consumer the spatial layout of new houses and the potential for change over time. Simulation also allows for a more participatory design and planning processes. Virtual environments could be used to allow house-buyers to view the wider range of choices.*

*This paper introduces the advancement of virtual environments in fostering community participation to ensure sustainable housing development. Some of these include 3D virtual world, four-dimensional site management model, and Collaborative Virtual Reality. The paper presents applied examples of these virtual environments in housing developments along the benefits of their applications. The paper reflects on the constraints of fostering community participations in computer-based communication in design and planning and the potential role of networked community in overcoming such constraints. The paper enforces the role of municipalities and real-estate developers in utilizing and supporting the application of virtual reality in fostering community participation in housing development from briefing to construction, operation and maintenance.*

### **Keywords:**

*Design/Planning/Development Processes, Sustainable Housing, Community Participation, Virtual Environments, Computer-based Communication in Design and Planning.*

### **1- THE ROLE OF COMMUNITY PARTICIPATION IN DESIGN AND PLANNING**

The theory and practice of participatory design is well established in the architecture and planning professions, dating back to the 1960s when pioneers like John Turner, Lucien Kroll, Rod Hackney and Ralph Erskine first began to extol the benefits of user involvement in the design process. In addition, there is a growing body of literature examining tools and techniques that can be used to promote public participation in architecture, urban design and planning [1], [2], [3], and [4]. The purposes of community participation vary from acquiring local knowledge, via improvements of plans and having decisions accepted, to promoting a sense of community [2]. Design and planning developments is looked at as purposeful activities aimed at creating a product or process that changes an environment or organization. Community participation should be a right of all people potentially affected by such

design and planning developments. Community or users participation in design and planning developments has been fitfully discussed over half a century. However, in most design development and especially housing development, the prevalent perspective of design and planning developments is that active involvement of users is either superficially integrated or mostly avoided. Therefore, it becomes the responsibility of design professionals to identify what is best for users. More surprisingly when participation is politically demanded (as in the case of public housing design), it is often practiced ineffectively with different interest groups [5] and [6].

In the traditional approach to community participation in design and planning developments, user needs are delegated to planners and designers to appropriate and account for. It is assumed in this approach that active user involvement comes after the design process is completed. In this perspective, a producer creates a product and the success or failure of this product in the market might be catered for either in the form of modifications or for future developments. Product users' are perceived as essentially consumers of products and have little or no direct role in creating the products themselves or even communicating their own needs and ensuring that they have been met. The stance for promoting participation may take various forms depending on the required level of participation. Such levels include [7]:

- *Information*: merely telling people what is planned.
- *Consultation*: offering some options, listening to feedback, but not allowing new ideas.
- *Deciding together*: encouraging additional options and ideas, and providing opportunities for joint decision making.
- *Acting together*: not only do different interests decide together on what is best, they form a partnership to carry it out.
- *Supporting independent community interests*: local groups or organizations are offered funds, advice or other support to develop their own agendas within guidelines.

Effective community participation plan development is based on the philosophy that people have both the desire and ability to plan and carry out development programs to enrich their lives. The degree to which this is accomplished depends on people having opportunities to learn and apply knowledge, imagination, and experience toward solving mutual problems. Therefore, there is a need to develop sound and proactive ways to develop programs and plans using a community participation process. Some major benefits of a community participation plan as part of the design and planning development processes are [8]:

- Keeping development professionals in direct touch with the people that developments are designed to benefit.
- Increasing the quality and effectiveness of developments because the knowledge, creativity, and leadership skills of many people are utilized. People feel a greater responsibility for the success of developments when they help to develop them.
- Producing more successful developments than professionals could produce alone since the involvement of community multiplies the efforts of development professionals.
- Identifying resources needed to conduct effective developments and to legitimize these needs.
- Helping people develop their confidence and leadership. People will have an opportunity to satisfy their basic needs to participate.

## **2- GOODNESS OF THE OLD TOOL FOR COMMUNITY PARTICIPATION: PLANNING FOR REAL**

Planning for Real is a tool-kit that was introduced to allow people to explore possibilities, sort out options, rank priorities, share out responsibilities, and set out a Plan of Action [4]. Planning-for-Real is a strategy designed to establish common ground to create a working neighborhood within an unobtrusive process. It lets people in as active participants, without exposing them if they choose to stay anonymous. That is particularly important for those in the community who get brushed aside because they are too young or too old, or the wrong color, or the wrong gender. It allows people with different backgrounds and attitudes to size each other up, and discover common concerns without having to make a meal of the process, and leave everyone with the indigestion that comes of interminable talk.

People use common knowledge to make a 3D model of the neighborhood which shows it for what it is, here and now; reminds the old hands of what it used to be; and begins to tickle people's fancy about what it could become. The model is made in sections each about one square meter, so that it can be taken around to attract attention. It is put together by a handful of people who have not yet given up hope for their neighborhood. They are the moving spirits not necessarily the committee-mongers or the orators, just people who have put down their roots long ago or quite recently, and do not intend to be uprooted. They are the natural good neighbors, to whom others sometimes turn - when there is a miscarriage, or the spouse flits with the housekeeping money, or you can not understand a government form. They make quite a thing of making the model, using a kit of parts that the Neighborhood. The model is rough and ready, transportable to wherever people gather - outside the bus stop; in the school playground or the foyer when parents come to collect the infants; on trestles in the street market. It is there to be interfered with. This tool kit is an eye-catcher because of its size as anything up to one square meter. Part of the tool kit is a range of suggestion cut-outs, visual representations, roughly to scale, of what could be done sooner or later to turn this anonymous dwelling area into a working neighborhood. Scores of possibilities for improvement include pedestrian crossings, play areas, workshops, trees, bus routes, and improved housing. If what a person has in mind is not there in the kit, there is blank card, a pair of scissors and a pen for him/her to put in the new idea along with others. Anyone can put any item anywhere, so long as they move no one else's suggestion.

The professionals kindle to the situation, feeling almost for the first time that they are wanted and valued. Two things are happening. Residents' proposals are being checked against official knowledge. How much would it cost? How long would it take? Who might provide money and materials? What are the legal or the technical constraints? The process of consultation is being turned upside down. Instead of the professionals graciously presenting their own plans for residents' comment, the residents are consulting the professionals, to establish the range of options, the limitations, the possibilities so that they can reach their own informed conclusions. The experts are on tap, not on top [4].

### **3- COMMUNITY PARTICIPATION IN DESIGN AND PLANNING USING INFORMATION TECHNOLOGY**

Abelson et. al. [9] have conducted a thorough review of public participation and consultation methods including both deliberative and non-deliberative methods. Most of conventional methods of community participation in design and planning are concerned with practical strategies for employing manual tools, like drawing, physical modeling or interactive displays, to be used in face-to-face situations such as design workshops and public exhibitions. It has been suggested that involvement of the public to stimulate good ideas and build a consensus amongst a diverse community requires three modes of communication: presentation of information to the public; receipt of information from the public; and exchange of ideas and opinions that build upon shared information as the ideas evolve. The traditional method of public participation involves the use of public meetings. These are regarded by most as an inefficient, unfair and unproductive method of involving the public in the planning process. Members of the public who attend these meetings often experience difficulty understanding the spatial relationships portrayed on 2-D maps and plans, their frustration often leading to miscommunication and mistrust of planners. The importance of the public's participation in the process is tantamount in avoiding further conflict and objection once a development has been undertaken [10].

Applications of digital media have been recently explored in community and participatory design. Interactive websites and geographic information systems (GIS) are being used to support urban design and planning initiatives [11] and [12]. The application of virtual reality and games computing to participatory design is an interesting and very recent development. Virtual models based upon computer game technology can be used to help non-professionals visualize potentially confusing paper-based plans and drawings, literally allowing them to 'walk through' and interact with designs in three dimensions and in real time. For instance, Arup Associates have developed their own city modeling software based on game technology to allow planners, developers and local people to evaluate proposals for the redevelopment of Ancoats urban village in Manchester. It is expected that this kind of city modeling will be used more widely in the future to speed up the planning approvals process [13]. Other studies experimented with virtual reality systems in environmental design, exploring different hardware and software solutions to support collaboration between professionals

and city inhabitants concerned with the revitalization of a retail district in Japan, and between academic researchers and environmental designers involved in the redevelopment of parkland sports facilities in Taiwan [14] and [15]. In the latter a software was developed that allows users to compare multiple design options and address how real-time environments can be constructed and configured to engage nonprofessionals more directly in design decisions.

Design and planning is a complex, creative practice with many different dimensions, aesthetic, environmental, social and economic, and many different stages, from brief formulation and concept development to detailed design and construction. Consequently, successful strategies for user participation in building projects are also necessarily complex and dynamic. There is rarely a single “quick fix” tool or technique that can address all dimensions of the design process or meet everyone’s needs. Considerable care must be given to the planning of participation strategies in every situation, with different tools being combined, sequenced and adapted to meet the varied interests and abilities of users and to build momentum in user involvement throughout the life of the project [3]. Looking at the full range of digital media used to promote public participation in architecture, planning and urban design, it is apparent that investigations have not been sufficiently grounded in participatory design practice to determine how such tools should work in combination with more conventional participatory techniques. For the most part, studies have been carried out by IT professionals or by designers whose primary interests lie in the application of IT within their own disciplines, rather than in the practice of participatory design. The result is that digital tools have not been tested in the context of realistic, structured processes of user participation. They are usually examined in isolation from other manual tools and techniques or simple comparisons are drawn between one digital tool and a supposed manual counterpart [11]. For this to be appropriately investigated there is a need for a critical inquiry to address the following issues [16].

- At what stages and in what aspects of the design process are digital tools best employed to enhance user awareness and understanding of design problems and user involvement in decision-making?
- How effectively can digital tools enhance user participation when employed in different settings, such as public exhibitions, dedicated public-access computer terminals, and the World Wide Web?
- To what extent is participant control over the production and use of a tool a factor in its success and how does the technical complexity of a digital tool impact upon user participation?
- How are different social groups empowered or disempowered through the use of digital media in the context of participatory design?

#### **4- USING VIRTUAL REALITY SYSTEMS IN FOSTERING COMMUNITY PARTICIPATION IN HOUSING DEVELOPMENT**

##### **4-1 Virtual Reality Systems in a Nutshell**

Virtual Reality has been defined as the use of computer technology to create the effect of an interactive three-dimensional world in which the objects have a sense of spatial presence. Another definition indicates that Virtual Reality is a way for humans to visualize, manipulate and interact with computers an extremely complex data. The visualization part refers to generating visual, auditory or other sensual outputs to the user of a world within the computer. The user can interact with the world and directly manipulate objects within the world. Virtual reality is more than just a further three-dimensional representation. Virtual reality differs from animation in that the user is actively involved; the user can move, walk in or fly through the virtual model in which the movement is unconstrained with predefined paths. Virtual reality feeds the senses of vision, hearing and touch with a simulated experience of exploring space; possibly this is why most people consider virtual reality to be an intuitive medium [17].

Virtual Reality systems can be split into two groups, desktop VR as non-immersive represented by ordinary computer monitors and immersive VR. Complete immersion of user’s personal viewpoint inside the virtual world is the goal of VR systems. This could be achieved through HMD or a Cave Automatic Virtual Environment (CAVE), where the CAVE provides the illusion of immersion by projection of stereo images onto the sides of a room-sized cube. The VR system with one or several projectors projecting stereo

or mono images onto a screen, with or without stereo sound, in front of an audience is more widely used as a semi immersive VR. Although non-immersive VR systems do not provide the same level of spatial awareness as the immersive approach, they provide users with a low cost solution and do not require the use of the HMD. This solution seems to be an attractive compromise for many users who are uncomfortable about spending a long time in a helmet. The virtual model is produced using 3D packages, 3D modeling toolkits and libraries or VRML (Virtual Reality Modeling Language). Although there is research and development in progress for using VR packages as modeling tools as well as visualizing tools, current procedure today is to produce the 3D model in a 3D modeling software and convert it into VR. Within VR systems users can add different features and functions to the virtual model such as environmental features, time or event depending movements and special effects, and add materials and textures to the virtual model although in most cases this is performed in 3D modeling software [18].

Virtual Reality has received an enormous amount of publicity over the past few years. Potentials of VR applications have been realized in many disciplines. Virtual Reality Systems, with their increasing dynamic, interactive and experiential characteristics are able to simulate real environments with various degrees of realism. VR now embraces a variety of systems from the totally immersive, centralized, single user tools with which it began, to the entirely decentralized, remote and anonymous technologies spawned by the net. Into the milieu has come the 'city' metaphor which likens a virtual world or virtual reality to an urban complex, often represented in 2-D or 3-D form as maps and scenes in which users explore and interact with the objects of their interest VR models, allowing the user to explore every part of a model and thus minimizes the dangers and misconceptions of bird's eye view perspectives that scale models and computer generated images very often suffer from [19]. Virtual Reality models that can be interactively explored will undoubtedly make the visual presentation of ideas and proposals at planning meetings or over the internet far more interesting and understandable for the public. For the process of forward visualization VR models of urban areas are and will over time revolutionize the public participation process. Since its introduction, VR systems have been viewed as the ultimate solution to a whole range of problems from all walks of life. Advantages of virtual reality tools for urban planning, when used correctly can facilitate research and practice [10].

#### **4-2 Cases of Using Virtual Reality Systems in Fostering Community Participation in Housing Development**

##### **4-2-1 The Albany Street home zone project, Hull, UK.**

In 2002 the Lincoln School of Architecture (LSA) was commissioned to design the Albany Street Home Zone, as an urban landscaping and traffic-calming scheme in a residential area of Hull in the UK. Home Zones are residential streets where pedestrians and cyclists take priority over motor vehicles and physical obstructions like planting and seating are used to slow traffic to walking pace. They are quite common in other European countries, but are relatively new to the UK. The government identified public participation as a high priority in this initiative, and required local authorities to demonstrate active involvement of community members at all stages of the project, from the compilation of the original bid for funding, through to the design and evaluation of the project. Albany Street was selected for inclusion in the home zone program primarily because it had a highly active residents' association and a low level of car ownership. The LSA proposed a three-phased approach to participation in the project.

The first phase was concerned with raising awareness, familiarizing residents with the home zone concept, design problems they must deal with and relevant design precedents. The aim was to provide people with as many choices as possible and build a consensus around a limited number of options for different elements of the Home Zone before work began on a unifying design. The techniques employed during this phase of the project included a public exhibition, door-to-door interviews with residents, a children's photography workshop and community trips to view similar projects elsewhere in the country. An interactive website was also created. This was an important digital tool; it not only provided general information about the project, but also included a discussion forum and an online 'digital catalogue' where residents could 'vote' for different design features. Local people who did not have access to the internet could use a dedicated public access computer terminal that was set up in a temporary office on the street. The office also served as drop-in facility for residents and a base for project meetings and

events. The second phase of the project saw the creation of a preliminary design for the scheme as whole. Most of the creative activity took place in design workshops. However, some additional supporting events were organized around the workshops. In particular, visiting experts were invited to deliver seminars on key themes previously identified as priorities by residents during the house-to-house interviews. The second phase of the project culminated in a street party and interactive exhibition where residents responded to the preliminary design in greater numbers. During the last phase of the project final modifications were made to the design using information gathered during the exhibition and the results of further consultations with the emergency services and other public service providers.

Computer game software was employed during phase two of the project. The virtual model of the street was well received by participants attending the last design workshop. Initially it was treated as an occasion for 'play', as residents took turns to 'walk through' the virtual environment using the mouse. A partial view of the real-time visualization of the design proposal for the Albany street home zone is shown in Figure 1. In the workshop setting, the virtual environment was viewed by no more than ten participants at any one time. These were all adults in their thirties or older and all of them had some experience with computers, in their work environment if not at home. When the model was displayed during the exhibition it attracted a much larger and more diverse audience, children, teenagers and adults, some with considerable experience of computers and some with little or no experience. Once more, the residents were clearly impressed by the virtual environment.

Large groups of residents, sometimes up to twenty people at a time, stood in the darkened room in total silence, apparently transfixed by the projected image. Individual residents had to be encouraged to speak and to manipulate the virtual model using the mouse. While the assembled audience was happy to view and ultimately comment on the visualization, none of the adults present was willing to control the software. It is clear that the real-time visualization of Albany Street made a useful contribution to the participatory process, enhancing participants' understanding of design problems in all three settings where it was tested. The benefits derived from the software could not easily have been replicated by manual participatory tools. Static perspective drawings cannot communicate space as a sequence of events in time [16].



**Figure 1 A partial view of the real-time visualization of the design proposal for the Albany Street Home Zone [16]**

#### **4-2-2 Virtual Model of Los Angeles Basin**

A virtual model of the entire Los Angeles Basin, which comprises roughly 4,000 square miles, has been created in order to help solve a multitude of urban design and planning related problems in the city. The system is an extremely effective tool for interactive design and consensus building in the intricate process of city planning due to the simulation's interactivity, intuitiveness, flexibility, photo-realism and adaptability. In projects such as the Los Angeles Basin virtual model simple 3-D models are combined with aerial photographs and street level video to create a realistic urban neighborhood. The LA model can be interactively explored by the public by either flying or walking through the virtual world, enabling the user the closest inspection of any proposed new development [10]. Different views of the virtual model of Los Angeles Basin are shown in Figure2.

#### **4-2-3 The FutureHome: Production of Affordable Homes for all**

FutureHome is a 5 million Euro funded project that brings together 15 partners in six European countries and forms part of a global project under the Intelligent Manufacturing Systems (IMS) program. Its aim is to research housing for Europe in the new millennium, to enable the production of affordable, high quality homes for all. FutureHome aims to develop adaptable and sustainable building system concepts that can take advantage of advanced manufacturing systems and methods. This is to promote the use of prefabricated parts and assemblies, and develop tools for design, configuration, production, and assembly. Such tools will facilitate off and on site production and assembly processes

to be developed, that will be heavily dependent on the use of intelligent automation and an IT infrastructure involving agent technology. Overall, the FutureHome project intends to produce leaner design and construction processes that will focus on value for money, improved productivity, maintainability and sustainability. The projections of benefits from the project are estimated at 30% in the cost of construction, 35% in construction time and a reduction of 60% in the number of defects.

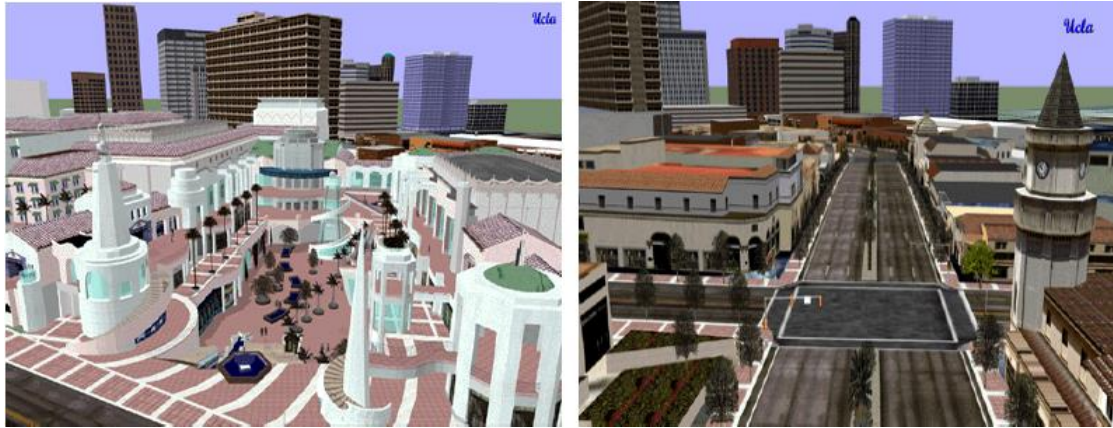


Figure 2 Different views of the virtual model of Los Angeles Basin [10].

A prototype virtual environment has been implemented that allows a model of a house to be constructed from a library of prefabricated components defined within the FutureHome project. Minimal user interaction is required during house modeling since the environment supports automatic constraint recognition between house components, so that as the user is constructing the model the system automatically detects whether the components the user is manipulating can be linked. A database has been established to hold the types of modules that are used in the building. As the user designs and constructs the building model, the construction information is also stored in the database along with the order of construction and any dependencies between tasks as shown in Figure 3. The construction order of 3D model can be replayed to provide an animated 4D model of the construction process. However, there are benefits beyond those during the production phase, including those relating to the operation and maintenance of buildings. One important byproduct of the use of VR techniques is that an object-oriented database can be subsequently interrogated by building owners and occupiers when there is need to perform some maintenance function or carry out a repair or replacement. Instead of handing over as-built drawings, the products of FutureHome will be complete with 3D object-oriented models for use and adaptation by both owners and occupiers. This aspect leads to a greater chance later of being able to build in some form of intelligent function [20] and [21].

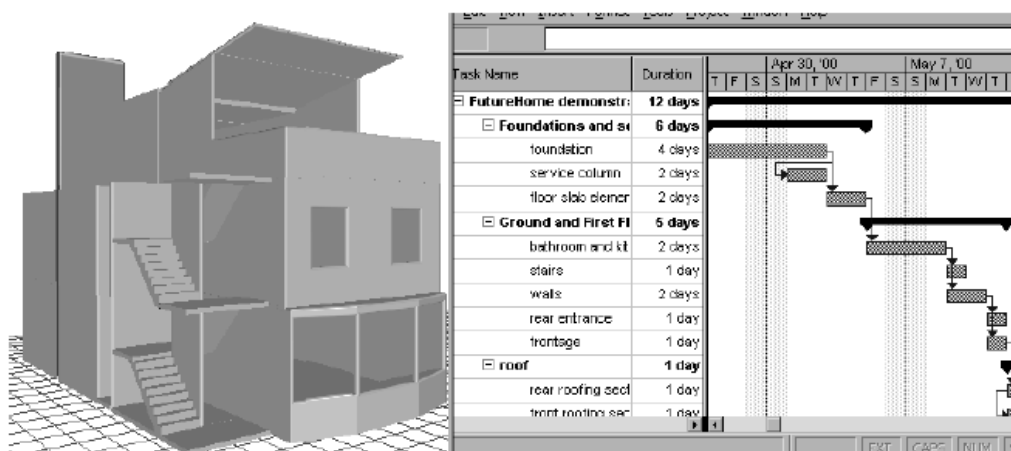


Figure 3 FutureHome Project: An example of a building designed and constructed in a virtual environment and its construction schedule is automatically generated [20].

## 5- CONSTRAINTS OF COMPUTER-BASED COMMUNITY PARTICIPATION

Computers and information technology is increasingly being integrated into the everyday functioning of society. There are many opportunities and many problems associated with this integration. Unequal access to the technology due to economic, knowledge or other barriers has the potential to create an "information underclass". There is a need for tools that have the potential to provide equal access to the information revolution, thus allowing individuals and communities to become more involved in the decision making processes that affect their lives. Over the past few years information and communications technology has accelerated in both its development and application. The power of computer processors has increased dramatically allowing the development of powerful, user-friendly software, thus expanding the appeal of computers and their application. Accompanied by this increase in power has been a decrease in price. Relatively powerful desktop personal computers are within the price range of most people these days. This increase in affordability has resulted in higher proportions of households owning or having easy access to a personal computer than ever before. Furthermore, the ability to network computers has also been increased. This has resulted in massive increases in interest and usage of world wide networks such as the Internet. However, the perceived high level of skills required to operate the software would prevent most people from attempting to take part. Thus it is evident that the opportunities for such people to take part in the "Information Revolution" are severely limited. When viewed in this light the "Information Revolution" and access to it is not very socially just. It excludes large parts of society and creates a further division between the "haves" and the "have-nots". Several local authorities around the world have considered this lack of social justice. A method adopted by many communities in Canada and North America to deal with such changes is the Networked Community, where by the community has cheap and easy access to such technology and provision of information of use to them [22]. The concept of networked community is based on some fundamental assumptions as follows [23]:

- New communications technologies will be increasingly important to the economy and society of modern information societies.
- There are inherent biases in the newer electronic media that reinforce more democratic and decentralized modes of communications.
- New media provides the capability for telecommunications to reinforce face-to-face patterns of communication.
- Telecommunications infrastructures are a public utility rather than a private commodity.

A networked community consists of a network of computers with dial-up or DSL services that allow users to connect to a central computer which provides community information and a means for the community to communicate electronically. Menu-driven software allows the user to access information or services that they would like from the range available. Information can be provided by anybody; the local authority, local community groups, political parties, environmental associations, and other users. Users can participate in electronic discussions. Unlike "virtual communities" networked community is based in a physical place. Virtual communities are groups of people with common interests that communicate electronically. People in virtual communities can be dispersed all over the globe in which they are drawn together by their interests. The common element of users of networked community is their physical proximity and interest in local issues that affect them all [22].

## 6- CONCLUSION

The importance of digital technologies for the improvement of public involvement, computer assisted communication technologies are tools like hoes or shovels, which are only of value when they are in service to the garden. If our communities are to benefit from new technology tools for civic engagement, we must be sure that our technology does not drive or overwhelm the participation process. We can use a range of words and metaphors to explain the use of new technology to aid visualization but the fact is simple: computer aided visualization leads to better understanding by the laymen which leads to better communication and collaboration between the designer and planner and the public. Participation is the key and the technology we use should be focused upon encouraging participation and not the technology itself. The use of urban simulations as a way of presenting ideas to the laymen that can be explored, changed and questioned can only be of maximum use when



accessible by most members of society. Therefore the importance of the internet as a distributive tool for these models is great. The internet opens up the world of design and planning to the public, an area that has always been in the shade, especially during initial stages of the planning process. This provides community with the ability to be involved throughout a development's progression from the plans to construction, thus avoiding conflict at a later stage [10]. Interactive models of housing developments using virtual reality systems allow community users to manipulate and explore design and planning alternatives in an exciting way and foster their participation in the design and planning development processes.

This paper has exemplified the importance of virtual reality systems as a method of engaging a wider range of people into the design and planning processes of housing development. The public's involvement in design and planning is tantamount to better planning and the use of virtual reality systems is an extremely effective method of increase the public's participation in design and planning. However, municipalities and real-estate developers should play an important role in utilizing and supporting the application of virtual reality in fostering community participation in housing development from briefing to construction, operation and maintenance.

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## **2-5 PLANNING, URBAN DESIGN AND ARCHITECTURAL DESIGN EXPERIENCE OF PRINCE SALMAN'S PROJECT FOR CHARITABLE HOUSING IN MOZAHAMEIAH MOHAFAZAH AS A DEVELOPMENT MODEL**

**Saad Khaled Saad Al Fawzan, Engineer**

Manager of Programs Project Administration  
Ministry of Work and Social Affairs  
Riyadh, Saudi Arabia

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\* This paper was presented in the symposium as a working paper; written text is not available. To get a copy of the presentation, contact the Symposium secretary.

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### **Abstract:**

*The paper aims at presenting the planning, urban Design and Architectural Design experience of Prince Salman's Project for Charitable Housing in Mozahimeiah Mohafazah as a development model that could be followed in the development of similar housing projects. The presentation attempts to explain how other charitable societies and institutions in the Kingdom of Saudi Arabia can make use of the Mozahimeiah experience.*

*The paper covers several aspects of the experience, namely:*

- *A general background on the problem of housing the needy people in Saudi Arabia, the targeted residents in charitable housing projects, some examples of similar projects, and statement of the mission of the project in hand;*
- *Planning studies specifically, social and planning standards applied to the selection of suitable site for the an affordable housing project;*
- *Design studies including the design and social criteria of residential units and community centers, and presentation of some detailed information about the project; and*
- *Presenting a documentary film on the project.*

### **Keywords:**

*Project Development, Affordable Housing, Site Selection Criteria, Design and Planning Criteria.*

## 2-6 REUSE OF SPACES AND THE TRANSFORMATION OF THE TRADITIONAL BUILDINGS TO ACCOMMODATE LOW-INCOME RESIDENCE: A CASE FOR TWO MUSLIM CITIES DHAKA AND HOFUF

**Shihabuddin Mahmud\*, Ph. D. and Mashary Al-Naim\*\*, Ph. D.**

\* Assistant Professor  
Department of Architecture  
College of Architecture and Planning, King Faisal University, Dammam  
shihabmahmud@yahoo.com

\*\* Associate Professor  
Department of Interior Design  
nmashary@yahoo.com

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\* This paper was presented in the symposium, then refereed and accepted for publication in the Proceedings Book in its final form as follows:

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### **Abstract:**

*A major cause for transformation in traditional dwellings is due to globalization and agglomeration of a large number of skilled and unskilled labors in the urban centers and an ever increasing demand in housing. Although there is a difference in cultural and religious beliefs the physical transformation in housing is universal and this transformation is more pronounced when it is the case for Third World cities. Dhaka and Hofuf are two Muslim cities with their own unique characteristics and have experienced a substantial amount of transformation in their traditional buildings in the last few decades. The landlords of the traditional buildings of Dhaka for example, have realized the potentiality of these dwellings to be subdivided into rental units and to generate income. Similarly in Hofuf, the landlords also found these houses potential for transforming into dormitories or commercial enterprises for the low-income expatriates. Although there exists a major difference in socio-economic structure and culture between two societies, this paper claims that there are similarities in the spatial arrangement of the domestic spaces and also in their transformation process.*

*This study attempts to compare the traditional buildings of Dhaka and Hofuf occupied by people with same socio-economic and cultural background in order to analyze the degree and the reasons for transformation during usage. This study will also reveal whether transformation of the traditional buildings is one way of building slums into our urban centers. In addition, it will focus the positive and the negative aspects of the transformations that would help taking the future measurements where the landlords are not solely responsible.*

### **Keywords:**

*Transformation in Building Usages, Traditional Housing, Domestic spaces, Dhaka, Hofuf.*

## **1. INTRODUCTION**

The physical transformation of the old and traditional dwellings is an important phenomenon in any Third World cities despite the difference in cultural and religious beliefs [11]. In the last few decades, a major cause for such transformation in housing sector is due to global market that encouraged migration of the rural people to the urban centers [23]. In one hand, rural and poor people are migrating to the big cities in search job and economic security, on the other hand, the expansion and the new development in the periphery with modern facilities encouraged the affluent to move out

from the traditional buildings in the city centers. Thus, a major transformation is shaping up our cities and simultaneously changing our lifestyle as well. There are several factors such as: the social structure of the family is changing; the idea of extending family living are diminishing; the diversity of the jobs and the mobility of the people keeping family members apart; the maintenance of the old traditional dwelling become difficult; the emergence of developers and buying modern apartments with all facilities in the restricted and preplanned secured neighborhoods; and the potentiality of the existing traditional houses for rental purposes for income generations [9] & [14].

The new trend of globalization resulted in agglomeration of a large number of skilled and unskilled labors in the urban centers and an ever-increasing demand in housing and its alternative solutions. Dhaka, the capital city of Bangladesh, has long been regarded as one of the fastest growing cities and at present the city accommodates nearly 10 million inhabitants and 50 percent of this population is migrants. The destitute condition of the migrant's couples with the severe shortage in the supply of residential land accelerated the transformation of the traditional housing especially in the old part of Dhaka [15].

Today in the old part Dhaka, the residential buildings that are 2/3 storied usually around 100 years old are under the occupation of middle class families who either occupied these buildings by force or bought with a very nominal price from the Hindu Jamindars. In 1971 during the liberation war there was another break through, a good number of Hindu families finally decided to move to India and sold their property and therefore, a major transformation took place in such areas of old Dhaka [20]. For another 30 years the middle class Muslim families (who had business in the old center of Dhaka) were residing in such houses. For last two decades due to a number of reasons these houses have been divided and subdivided into many small residential or commercial units.

Housing industry in Saudi Arabia and Hofuf in particular has experienced major changes during the last four decades. Al-Hatloul (1981) pointed out that in the mid 1950s the Saudis experienced the introduction of the gridiron street pattern and detached villa-type dwellings and these changes were first inspired by the housing introduced by the Arabian-Oil Company (ARAMCO) in the Eastern province at the beginning of the oil exploration [2]. The Transformation from the traditional to the modern way of living for the Saudis was a compromise between accepting modernity and keeping the religious and cultural values. After the oil discovery, government declaration of providing land for its local people through an agreement made housing development in a mass scale possible. In addition, the increase in the crude oil revenue beginning in the 1970s created a boom in the national economy bringing a sharp rise in national and household income. This increase encouraged the government's program for providing free plots and the REDF loans, have made it possible for many Saudi households in Hofuf to build new, "better quality" bigger dwellings. That is perhaps one reason why the traditional Saudi property owners have moved out from the old city center to the new development areas and gradually transformed the old dwellings for rental units. Today, the most prominent and the only housing for the expatriate labors in Hofuf are these traditional buildings in the old part of the city center. Beside serving as rental units and income generating spaces for the Saudi owners, these houses also solve the major housing scarcity for the vast number of low-income expatriate which the government and in particular municipality could not handle alone [19].

### **1.1. The Domestic Spaces in a Muslim House**

As far as the domestic space organization is concerned the traditional dwelling units in a Muslim house illustrates different structures and forms that may not fit the conventional understanding of modern urban housing today. The philosophy of domestic spaces within the context of housing in the Islamic world contents three Arab terms "iskan", "harim", and "dar" [7]. Although the family clan is marked by a dominant male ancestry and by the patriarchal character the domestic space of the house like other culture is dominated by female and the main power belongs to the mother or grand mother as the leading personality. Chowdhury (1998) denotes that the urban houses are nothing but the replica of the traditional houses where male and female domain and privacy of women create a number of semi-private and semi-public spaces in a Muslim house. A number of scholars also pointed out that in a Muslim society, the family and especially the women are strictly separated from the public life on the street and the strict segregation of the women and the separation of the public and the private life resulted in two distinct areas within a house; the private family area; and the semi-private guest areas for the men [18], [10], [25], [1] & [3].

A traditional Muslim house is ever growing because there exists an incremental growth. In a traditional Muslim house as the grown-up sons got married, the “*dar*” often had to undergo a division in order to accommodate a new individual unit. Thus, one room or a group of rooms is arranged that becomes a house within a house [6]. Also an additional storey can be added, new units were attached to the main house, or existing neighboring house were connected to the main house. Such architectural transformation process that linked to the social evolution of families can be common characteristics in many Muslim cities [5]. Although the development of Dhaka in its initial phase was mainly dominated by Hindu rulers, it reasonably resembles the Muslim characteristics of the incremental development as well as the nature of its transformations.

The courtyard house was indeed the favored typology of most Arab-Islamic cities; they are enclosed and introverted domestic space responded ideally to the requirements of the Islamic social order. In addition, it offered valuable environmental and climatic advantages: the walled precinct provide protection against desert storm and allowed special climatic conditions to develop at the center of the house and also modifying the microclimate of dwellings and to act as a buffer against the noise are important characteristics [24] [21]. The hollow container of the courtyard, sunken into the building volumes, produced shade and could act as a temperature regulator. In some cases, wind-catchers were added on the roof to collect cool breezes and drain them into the lower rooms. The courtyards also provide a safe play area for small children where mothers while continuing with normal household chores can directly supervise their activities. Therefore, courtyard is the hub of the family that epitomizes the entire dwelling and its life [13].

Veranda is another important domestic space and often regarded as semi-open space in a dwelling. Although this particular space is present in the modern urban apartment buildings the use of such space especially in Arab societies have less impact in using while in other Muslim societies this space is an essential one. A common observation in the most apartment buildings is, they convert this space into bedroom or storage if necessary just by covering with temporary partitions or other materials (see Figure 5). *Iwan* is another common space in the Muslim society especially in dry climatic region that resembles veranda but the major difference is they are placed in the interior and have no visual connection with the exteriors. Both veranda and *Iwan* protects the household from unfavorable climatic conditions.

Like courtyard, rooftop is also an important workable domestic space in some societies. In some indigenous housing, rooftop becomes spaces of architectural significance as they complement the space of courtyard in use and social function. In the countries with hot climate, rooftop can function as a sun deck for drying and in the evening for social activities to escape the heat inside the house. Rooftops are also favorite places for the children to play different games and it may link to other roofs into a complex network accommodating another level of neighborly interaction [16] & [8]. Roof top space in Yemen for example is in contrast to other Muslim houses, as the male reception could also be located at the top of the house. The relatively recent habit of building a *mafraj* on the roof, with windows offering generous views of the city skyline, has in effect marked the townscape of Sana’a [7].

To decrease the conflict between traditional and modern life style some sort of compromise has been done to satisfy the users that is to say to live a fairly modern life and also not disregarding the religious obligations and cultural values and habits. To summarize a traditional Muslim house, one can understand the interior disposition of the dwelling that is based on a number of major cellular units that were grouped around a central distribution space. The space organization of such dwelling reflects the users need and space requirements and the incremental developments with mutual understanding of the neighbors. In most cases, there exist no defined boundaries or territory of the outdoor spaces as they are used commonly with neighbors. Thus, the domestic space of the households can extend well beyond the actual dwelling [25].

## 1.2. Degree of Transformation in the Traditional Houses

Transformation of a traditional house is inevitable as they are dynamic and ever changing, however, such transformation varies according to the family requirements; their comfort; duration of living; and above all the tenure security. Tipple and Ameen (1999) proposes two categories of transformations

namely add-In type and add-On type, where the former one is the changes done within the exiting building and add-On type means the additional construction done on the building or within the premises that increase the floor area [26]. Beside these two types, for our case studies the transformation of the traditional buildings of Dhaka and Hofuf would be evaluated in four main categories namely slight adjustment; addition and division; total conversion; and the reconstruction [4].

**Table 3: Four different categories of transformation as a tool for evaluation.**

<b>a. Transformation by Slight Adjustment</b>	<b>b. Transformation by Addition and Division</b>	<b>c. Transformation by Total Conversion</b>	<b>d. Transformation by Reconstruction</b>
<p>Slight adjustments are usually done by functional change rather than the physical change of the spaces especially in their interiors. Most of the traditional houses were adjusted to be used similar to the new housing types and this changes is due to electricity and availability of modern household equipment such as refrigerator and automatic air cooler. It is a common practice in both cities that there is a need for bed rooms that are produced by transforming the function of drawing rooms or <i>mejlis</i>, <i>Iwan</i> or storage areas. For Dhaka case the introduction of multi entrances is also done by slight adjustments (see Table 3).</p>	<p>Transformation by addition and division are commonly used in the traditional houses. This kind of transformation enables to increase the numbers of the rooms in the houses to satisfy the needs of the dwellers as well as the owner who sublet their houses. Moreover, most additions are done to provide the services that are compatible with the modern lifestyle. Addition of bathrooms and kitchens within the premises are important as rental units are created. Similarly, addition of rooms in the rooftop is common in Dhaka but in Hofuf these addition of rooms are with temporary materials. Division also encouraged for the protection of the maximum privacy while the space is shared by more than one family (see Figure 2 and 3).</p>	<p>The transformation by which the places were completely converted physically into another use may call total conversion. As the life style is changing, the need for animal area has also diminished and therefore, majority animal areas have usually converted into some kind of new space use. Total conversion mostly observed for economic production of the space such as rooms converting into shops or grocery, clinic or a barbershop (see Figure 2). While the courtyard is difficult to convert, it is possible if there were two courtyards for one of them to be converted to another function.</p>	<p>The demolition and reconstruction of the traditional house illustrates how much the people are influenced by the new housing type, materials, and technology in their decisions on their houses. At the same time, the effect of conversion of many areas into commercial uses increased the land values. The new streets and urban clearance in the traditional fabric were the main factor that encouraged these methods of transformation. However, the location of the house played an important role with regards to its ability to undergo reconstruction. The more the houses were closer to the main street, the more likely the transformation by reconstruction would occur. Other important factor is closer the house to the commercial area, the more likely to be reconstructed as a commercial facility. However, total reconstruction is controversial as it is questioned whether this fall in the category of transformation or not.</p>

Source: Al-Naim, M. A., (1998) Potentiality of the Traditional house: A case of Hofuf, Al-hasa, Doha: GCC Folklore Center.

## 2. RESEARCH METHODOLOGY

The potentiality of the traditional houses were examined in terms of a number of criteria such as, physical form to accommodate new functions; flexibility; location and accessibility; the age and the quality of present situation; layout and size; function and relationship; and the open and covered spaces in terms of their changing function in the two cities. How the process of transformation in such traditional houses can achieve a unique architectural form, expression and spatial organization, which may be compatible with modern requirements, has also been considered. In attempting to understand the spatial organization of the traditional houses and its transformation through time, an analysis of its basic spatial formation, components and elements has been accomplished and examined by means of questionnaires, in depth interviews and personal observations by the authors. For Dhaka three neighborhoods (DalPatti, Sutrapur and Bangla Bazaar) near Shadargaht Area (center for old Dhaka) has been chosen to find the traditional houses that has gone through some sort of transformation in its physical layout. First five houses from each neighborhood were chosen randomly and secondly for the sake of this paper one house form three distinctive neighborhoods have been chosen as the case study. For Hofuf case the traditional houses were also in the heart of the old town. There were in fact, three neighborhoods namely Anna'athil, Al-kut and Ar-Rif'a Al-Janubiyya. For the simplicity of this paper three houses from each city has been chosen that represents their neighborhoods. For both cities one major criterion to choose all six houses were to find the past users to collect reliable information regarding the changes done during their tenure and another important criteria that the houses in both cities were built in similar period i.e. before 1940s. The questionnaires aim to evaluate the daily interaction of the users with domestic spaces and the degree and the extent of transformation that is done by the owner as well as by the current tenants.

One important drawback of such research is to collect genuine data and reliability as this solely depends on the past and current user's explanation and description as the way they used and transformed their domestic spaces. Although it is visible that there exist many differences between the traditional dwellings of these two cities, a number of similarities in the formation of domestic spaces show identical characteristics. Thus, one valid argument may be whether this similarity occurs due to the users with same economic background. However, this may give us the chance to analyze the factors, which may account for these differences.

### **3. TRANSFORMATION MODES**

The modes of transformation by the traditional houses in Dhaka and Hofuf can be explained hand in hand in two levels. In Dhaka in the first level of transformation was by the Hindu landlords who were the original owners and in the second level transformation is by the Muslim families who are the current occupiers. Similarly, in Hofuf the first level was by the Saudi landlords who themselves were owner of the house in the most cases, and secondly by the expatriate labors who pays rent and have tenant status. In both levels there was a substantial amount of transformation in both cities. The basic need of such transformation is due to the current pressure of finding more habitable space, the influence of modern technology and varieties of choices [17]. Although there are distinctive features and differences in both traditional houses of Dhaka and Hofuf, the process of transformation shows more or less a similar pattern.

#### **3.1. Dhaka Case**

##### **3.1.1. Transformation by the Hindu Owners**

The houses that belonged to the Hindu owners in the old part of Dhaka today were the most gorgeous and aristocratic residential areas of a higher income group. Majority of these houses were constructed during British time and that is why some replication of Gothic architecture and Neo-classical features are visible (Greek and Roman columns and arches in the front façade) (Figure 1 & Figure 6). These houses had three portions; the front portion namely 'bahirmahal' belonged to the male guest. Much later these rooms had been slightly adjusted and changed to offices or other business enterprises for the same owner without changing any physical setting. The major changes occurred during the marriage of their son who needed a more private space and a separate toilet or bathroom and therefore some addition were done. In the initial phase, these houses had animal area and servant quarter that ultimately had to changed to bed rooms due to lack of spaces and for subletting purposes. One important feature of these houses is having boundaries with empty spaces as backyards that in need can be developed incrementally as the family size are getting bigger [15].

##### **3.1.2. Transformation by the Muslim Occupiers**

A major transfer of the ownership of these traditional houses to the Muslim middle class families happened in 1947 at the time of the separation of Indian sub-continent. Much later in 1971 a second phase of such transfer of the title were experienced when some Hindu families finally decided to migrate to Calcutta. While the Muslim families started to live in those houses certain changes were done gradually. In the initial phase, changes are done by converting *Puja Ghar* into bed rooms; altering the orientation of the toilets; and the position of the kitchens. A major transformation took place just in last two decades which were inevitable due to the increase in the family members and married sons who needed individual living units. Another important reason in changing occupation as the members is having diversified job prospects rather than family business. For the sake of better jobs and better living conditions these owners in their second generation in particular preferred to move to the new development areas of the city and to rent out their old house. Thus the vacant units were suitable for subletting and were occupied by the middle class or lower middle class tenants working within the proximity. The heavy demand of the rental units encouraged the owners to subdivide the house into individual family units. As a result some basic requirements of these single units such as toilets, kitchen and washing areas were created by converting or transforming other spaces and also had to provide separate entrances for the tenants.

There are also evidences that the owners may reside in the house and sublet some portion of the same house for extra rental income and minimized maintenance cost.

### 3.2. Hofuf Case

#### 3.2.1. Transformation by Saudis

Saudi landlords started to transform their houses from the beginning of the modernization of the Hofuf city. The first transformations in the houses were to add modern bathrooms and kitchens. These utilities were added to the house after the introduction of the new housing types in the area. Moreover, the addition of the bathrooms occurred in the guest area and also in the *majlis* lobby at the main entrance to guarantee privacy for the family members and to separate private and semi private spaces. The new electrical appliances encouraged many Saudi inhabitants to transform the animal area or *Iwan* to a new kitchen. The family area had no essential transformation in terms of use. However, new needs arose for rooms for every special function in the house such as the women *majlis* and dining room. Also, the need for special room for every person in the house forced the inhabitants to increase the number of rooms by adding rooms on the roof level.

#### 3.2.2. Transformation by Expatriate Labors

The evacuation of many Saudi families from the traditional areas created vacancies, which ultimately were filled by the expatriate labors the one who have moved into these areas. Most of the transformations done by the expatriate labors were adjustment of the function of some domestic spaces to use them as bedrooms or sewing workshop. Some important functions in the traditional house were superceded by other functions, such as the reuse of the *majlis* into bedrooms or workshops. Also, some *murrabba'ahs* were changed into sewing workshops. The other features of this transformation were the addition of more than one kitchen and bathroom in the house and dividing the *majlis* into several bedrooms to serve the large number of users. New markets also appear adjacent to these areas that sell goods suitable for the expatriate labors.

The difference between the transformation by Saudis and expatriate labors are different in nature. Saudi's transformation can be characterized as permanent while the labor's transformation was mostly adjusting the function of one the rooms to satisfy their needs and their additions were mostly temporary in nature. The right of ownership of Saudi inhabitants over their houses allowed them to make permanent changes in the house, often extensive and without limits with the exception of those spaces, which could not be changed completely, such as the courtyard and the entrance. On the other hand, the expatriate labors could change little and only in the use of the *majlis* as a bed room or sewing workshop because they had no control over the house due to their status as users only.

**Table 3: Transformation by Bangladeshi Households by adjustment and addition and Conversion.**

#### a. Transformation by Hindu Jamindars

Dhaka	Adjustment	Addition	Conversion	Reconstruction
Dhaka Case:1, Gupta Bari (Dalpotti )	-bed room into study room -bedroom into family sitting -bedroom into Puja ghar  -partition for sitting in the open courtyard in the 1st floor.	-toilet and bathroom in the courtyard - tubewell and chowbachcha in the bathroom 1st floor - new apartment in the second floor -store room, kitchen and servant's room at the back of the house	-animal area into toilet -kitchen into study room for children	
Dhaka Case:2, Sen Bari (Sutrapur)	-bed room into puja ghar -garden in the roof top space in the 1st floor	-kitchen and servant room at the back of the house -extension of kitchen into dining space	-kitchen into bed room -servant room into kitchen in the 1st floor	
Dhaka Case :3, Lahiri Bari (Banglabazar)	-bedroom into puja ghar -partition for bathroom -	-separate unit for rental purpose to relatives -varanda at the entrance	-bedroom into kitchen -bedroom into family sitting	



**Table 3: Continued**  
**b. Transformation by Muslim Occupiers**

Dhaka	Adjustment	Addition	Conversion	Reconstruction
Dhaka Case:1, Gupta Bari (Dalpotti )	-five individual unit for rental unit -study room into printing press office -varanda for binding books -	-tube well in the courtyard - new stairs --kitchen and wc in the 2nd floor	-drawing room and bed room into printing press -puja ghar into kitchen -wc in to dining in the 2nd floor	-Demolishing the back part and reconstruction of the two-storied dwelling unit.
Dhaka Case:2, Sen Bari, (Sutrapur)	-two separate units for rental purpose -puja ghar into drawing room -varanda for patient sitting and waiting	-two bed room in the 1st floor	-guestroom into clinic and doctor's chamber -bedroom into kitchen and storeroom by partition	
Dhaka Case :3, Lahiri Bari, (Banglabazar)	-removal of the animal area -rental carparking unit at the entrance -new entrance from the side	-one separate apartment in the 1st floor -one storied bachelor house at the back unused space -tubewell in the courtyard	-bedrooms into departmental or grocery shops -varanda into storage and living	

**Table 3: Transformation by Saudi Households by adjustment and addition and Conversion.**  
**a. Transformation by the Saudis**

Hofuf	Adjustment	Addition	Conversion	Reconstruction
Hofuf Case:1 (Ar-Rifa'a A-Janubiyya)	-Murabba to women sitting	-Bathrooms and storage in the animal area	-liwan to two rooms - Masbah to bedroom	
Hofuf Case:2 (Anna'athil)	-Majlis as bedroom -Liwan as majlis	-Bed room in the roof	- Animal area to kitchen and bed room	
Hofuf Case :3 (Al-kut)	-dar to guest bed room -Majlis to bedroom	-bathroom in the majlis lobby - bathroom near the summer majlis	-liwan to kitchen and bathrooms -animal area to shop	

**b. Transformation by Expatriate Laborers**

Case Hofuf	Adjustment	Addition	Conversion	Reconstruction
Hofuf Case:1 (Ar-Rifa'a A-Janubiyya)	-Bakhar used as bedroom -Majlis as common area	-Bathroom in the wijaq area -bathroom in the majlis lobby		
Hofuf Case:2 (Anna'athil)	-riwaq as kitchen -Majlis as bedroom	-partition in bedroom		
Hofuf Case :3 (Al-kut)	-majlis t bedroom -murabba as bedroom -bedroom for sewing workshop			

#### 4. THE FINDINGS OF THE SPATIAL FORMATION AND ITS TRANSFORMATION AT DIFFERENT STAGES

Despite significant differences in socio-economic, cultural, political and in climatic condition between Dhaka and Hofuf, a number of similarities are present in their physical layout as well as in the process of transformation of their domestic spaces. The findings also show that though the traditional houses in Dhaka were constructed by the Hindu zamindars, there are tremendous levels of similarities even before the transformation done by the Muslim families (Figure 3 & Figure 8). Therefore, one may argue that the cultural factor is more influential than the other factors because the religious differences could not play significant role in the formation of domestic spaces. It has been observed widely that in the traditional houses courtyard are essential for daily activities and also the place for income generation and perhaps this similarity of having a central courtyard made the physical layout similar. Nevertheless the influence of the Mugol and British architecture in the traditional buildings of Dhaka is very much prominent and also reflecting in the building façade if not in the interiors (Figure 1 & Figure 6). As compared to the Hindu families the way of living of the Muslim families have no significant differences in Dhaka. Like Muslims the Hindus are also concerned about keeping privacy and particularly the position of women in their domestic spaces (Table 3). In fact, like Muslims they also maintain specific spaces for male visitors at the *Bahir mahal* and family and friends at the *Andar Mahal*, and likewise distinct domains of opposite sexes. Privacy

also maintained by the second story around the courtyard that makes visual obstacles. Difference usually made especially in the orientation of the kitchen which based on Bastu Shastru and every family had a special *Puja Ghar* (prayer room) adjacent to the courtyard that had a Tulshi tree in the center. In Dhaka almost all these Hindu houses constructed by the jamindars that had a paved courtyard with water facilities and almost all the rooms were directed to the courtyard as that was the main center for all activities of the house. However, in the course of time while the Muslims occupied them the *Puja Ghar* was immediately converted to other functions according to the suitability of the owner (Table 3). For the Hindu families it was a common practice both by man and women to take bath in the courtyard space near the Kumatola (well for water) which is a place for many activities such as washing cloths and cleaning all dirty dishes after meals. However, Muslim families introduced the concept of bathrooms with *Chowbachcha* which is a more private space. The eating habits of the Hindus were also on the floor either in the kitchen or in the semi open space (usually an elevated veranda) adjacent to the kitchen but there were no dining space as such. In those houses the toilet (pit latrine) is usually isolated and at the back of the house which has been changed or altered much later by the Muslim families as they were in need of spaces especially for rental units.



Gupta Bari, Dalpatti, Dhaka



Ar-Rifa'a A-Janubiyya, Hofuf

**Figure 1: The building façade shows the ornamentation and the architectural expression and influences of the Hindu and Muslim builders**



Gupta Bari, Dalpatti, Dhaka.



Anna'athil, Hofuf

**Figure 2: Courtyard in the old traditional houses still the center for all domestic activities and the only spaces for further addition and subdivision.**



Lahiri Bari, Bangla Bazaar



Al-kut, Hofuf

**Figure 3: The stair with a railing to the roof top is a common fashion in both cities where this space is used for many household activities specially drying food staff and clothing.**



Sen Bari, Sutrapur, Dhaka.



Anna'athil, Hofuf

**Figure 4: The conversion of doctor's chamber and the adjacent varanda is a rare transformation in sen bari, Dhaka by the owners shows the interior space; the conversion of the kitchen into bedroom shows the internal arrangement of the bachelor expatriate.**



Gupta Bari, Dalpatti, Dhaka



Al-kut, Hofuf

**Figure 5: The hanging balcony emphasis the courtyard and an element for casting shadow was a symbol for aristocracy among Hindu families while “agasi” meant for the same purpose among the Muslim families in Hofuf.**



Lahiri Bari, Bangla Bazaar, Dhaka.

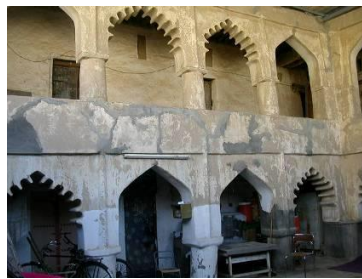


Ar-Rifa'a A-Janubiyya, Hofuf

**Figure 6: The conversion of balcony into storage or additional bed room became necessary due to the lack of spaces in both cities.**



Gupta Bari, Dalpatti, Dhaka.



Ar-Rifa'a A-Janubiyya,, Hofuf

**Figure 7: Division of bedroom into bathroom and the addition of basin and mirror in the varanda is an attempt of transformation with new materials while the riwaq in the traditional houses in Hofuf is a suitable space for tailoring and cooking or working spaces.**



Sen Bari, Sutrapur, Dhaka



Anna'athil, Hofuf

**Figure 8: The ceiling plan of the both houses have similar features and the uses of fan unlike Hofuf is still popular in Dhaka.**

In some houses there is probation for the servant quarters at the back portion of the house and there is one separate entrance usually form the back side of the building for servants and family members. If there exist a 1<sup>st</sup> floor then all activities other than sleeping is done in the ground floor and also an addition of the kitchen is also possible if there is a need. Though the married brothers have their individual families the cooking is done for everyone from the same kitchen and that shows an extended family life. Roof top space is also an important space for other activities such as drying food and clothing's and extensively used for relaxing and recreation in the evening. A common observation is, there exists a single room within the domain of a young unmarried son who need some privacy and also need a space for his friends without interfering the *Andar mahal* and this has similar function as Mafraj like the one in Sana, Yemen.

The concept of a traditional house in the Eastern Province was based on the introverted layout, where very small openings faced the outside with a central courtyard as the main space for all activities. The dwellings are with thick wall where the over all plan and the openings were oriented

toward the rectangular courtyard that compacted in various cluster sizes, forming huge masses accessible by sekkas and cul-de-sac (Figure 2). Moreover, the high parapets on the roof, the arrangement of the doors and entries, and few windows to the outside are all the physical expression of the traditional house in Hofuf. The privacy especially for female is the prime factor in the orientation of the domestic spaces and the intention is to provide the maximum privacy desired. The Islamic value of separation of male and female domain within the domestic space also played an important role in the organization and orientation of the houses.

The organizational principle of the traditional house in Hofuf is primitive in its formation and typically divided into three portions, the front portion majlis hall surrounded by rooms, the middle portion courtyard is also surrounded by rooms and the back portion the animal area is again surrounded by rooms. Moreover the middle is accessible from the front and the back is accessible from middle. Most traditional houses in Hofuf are two storeys with a prominent organic form [27]. As compared to the traditional houses of Dhaka the houses in Hofuf have similar features but with a more dilapidated condition. However, the sizes are little smaller but neither the open space nor the circulation pattern is pre-determined. The house prototype also is a two-storied courtyard house and the female section is located in the deepest part of the house. Two unique features of the traditional houses here are *rushan* (ornamented ventilation) and *agasi* (Figure 5). Unlike Dhaka, in Hofuf, the openings in the neighborhood and the later expansion of the road for motor vehicle are prominent. The AC outlet and the dishes for satellite television channels are also visible (Figure 1). In Hofuf the physical form shows a diversity of plans in all neighborhoods. Thus the quality also varies according to the vernacular materials used in different architectural elements in the house. As all the traditional houses are occupied by the expatriate labors with similar economic background, the over all environment and activities shows similar pictures (Table 3).

As far as the transformation is concerned, the amount of transformation is done more during the owner's occupation than the expatriates' and there is no reconstruction done in any of these dwellings unlike Dhaka. The major issue in Hofuf was to find maximum habitable spaces and therefore, the main concern was to create bedrooms than other facilities. In fact, the number of rooms increased is not proportionate with neither kitchen nor bathrooms and in many cases kitchen, animal areas were also converted into bedrooms. Additional rooms were added in the roof when there was no space in the ground floor (Table 3).

From the above discussion and the pictures, it is quite visible that there exist a huge number of similarities in the formation of domestic spaces between Dhaka and Hofuf. Firstly, in both houses privacy seems to be the prime factor although to some extent religious difference between Hindu and Muslims were experienced. In both places the houses were constructed around a central courtyard which is the center of all household activities. The construction material were mainly from the local market, however for Dhaka case imported materials were also used. A major difference can also be noticed within the workmanship of the mansion as Dhaka's traditional buildings were on brick foundation whereas in Hofuf it is in organic form (Figure 1, 3 and 5). The building façade shows a clear difference in image as one based on purely Islamic architecture that is decorated with Islamic arches while the other imitated the neo-classical style (Figure 1). While in Hofuf the intention was to protect dwellers from the heat and the sunlight, in Dhaka it was to provide the maximum ventilation and to get the direct sunlight. In Dhaka, the courtyard in the center of the house is sunken and provide open veranda all side and used for sitting as it is shaded, similarly in Hofuf, *riwaq* serves the same purpose. Eating habits on the floor are also similar and that has been reflected in the layout but later on the modern furniture changed certain habits in both places. While in Dhaka these houses are of different stories, in Hofuf majority of such houses are two storied. Some differences such as taking bath in the courtyard space in Dhaka and *riwaq* in the Hofuf for taking rest in the afternoon are unique characteristics. The rooftop space in Dhaka is also used for many activities including family sitting in the afternoon. A major difference in Dhaka is the men and women at times share the same space for a gathering for recreational purposes with the guest from outside, whereas in Hofuf man and women never mixed up and have separate *mejlis*. As far as the degree of transformation is concern (i.e. adjustment, addition, division or conversion), in Dhaka it is nothing but building slums as subdivision of spaces can accommodate more families that brings extra income. In Hofuf, it is just the expatriate labor who is sharing the space and also bed rooms with other male bachelors. Therefore, the major difference

now although in both traditional house occupied by similar income level people, in Dhaka it is a family living who spend most of their time in the domestic spaces, in Hofuf, the expatriate labor who spend most of their time outside and use their dwellings only for sleeping purposes.

#### 4. CONCLUSION

The potentiality of the space transformation has shown the compatibility and adaptability for new functions according to the current need of the dwellers both in Dhaka and Hofuf. Moreover, this study helped to illustrate the mechanism of transformation that lead to the revelation of the latent potentiality of the traditional houses. It also shows that the housing demand of the middle class in Dhaka and the low income expatriate in Hofuf is accommodated by the help of such transformation that solve the scarcity of housing to some extent.

The traditional houses in both cities have been transformed at different levels where no single factor is responsible rather the demand and economic pressure played a prime role [17]. However, despite all differences in cultural and socio-economic background the paper claim that there exists a number of similarities in the context of transformation as well as in the physical layout of the domestic spaces.

The characteristics of the traditional houses once formed with its socio-cultural and religious values have been drastically diminished as the context have changed to accommodate the maximum number of family in Dhaka and expatriate labor in Hofuf. However, in both places it is obvious that the socio-cultural factors were more influential than its climatic factors as pointed out by Rapoport (1969) though Kaizer (1984) who showed the importance of climate in domestic spaces exclusively for the Eastern Province, Saudi Arabia has not been disregarded but not considered in this study [22] & [16].

The separation of male and female domain in a domestic space within the Islamic context can also be challenged as for Dhaka's case as there exists some overlaps where both sexes share the same space that may contradicts with the Islamic customs. This further opens a debate whether the ever-changing social relationship in modern time and the transformation of the dwelling space are unable to provide the desired privacy once played the prime role.

This study concludes that the traditional house of Dhaka and Hofuf indeed has great potentiality to accommodate changes through time. Physical transformation made by users has its limits beyond which the essential character of the traditional house ceases to exist. A controversy is certain that, as it is possible to impose unlimited physical changes, will it still have the characteristics of a traditional house [26]. Such excessive transformation is not considered within the meaning of potentiality in this study. For example it can not be said that reconstruction of the traditional house is potential. Perhaps it is the potentiality of the location of the house.

The comparison in both cities shows remarkable similarities in traditional buildings of Dhaka and Hofuf although there were socio-economic, religious and cultural differences. In both traditional dwellings the house could be divided into three different portions (though mentioned in different terminologies) however, the major theme for developing such dwelling is similar as the houses were designed with a central courtyard and introverted plan. For the case of Dhaka, all the traditional houses were incrementally developed according to the need of the family and the major transformation took place when the demand for rental units reached to its peak. On the other hand, in Hofuf the construction of the whole unit had been done in the same time, however, major transformation took place during the accommodation of the expatriate labor. One major difference between these dwellings is, in Dhaka the landlord is also sharing some portion of the house with their tenants, where as in Hofuf, this question does not arise, as it is quite impossible for the Saudi families to share with other bachelors for privacy reasons.

The positive side of the old part of both cities has realized that the importance and the land value did not fall. Nearness to the city center also encouraged the middle-income dwellers and the expatriate to occupy those traditional houses and could involve themselves in economic activities by using domestic spaces. The degree of adaptation and adjustment by the expatriate and there transformation

and conversion of the spaces into new function shows the potentiality of the traditional houses. It became also possible for the landlords (the Bangladeshi as well as Saudi) who already have move out to the new development areas in order to transform the house into commercial enterprises or for rental purposes that brings additional income for the families [27].

El-Shakhs, S. and Shoshkes, E. (1998) pointed out that the process of transforming traditional houses in the city core into commercial enterprises and the concentration of economic power in our Islamic cities which are accessible, is an impact of globalization [12] & [23]. Perhaps this is applicable for the cities of Eastern Province as we observed a major transformation in Hofuf due to its large economic demand, near proximity and accessible to the Gulf States. This study also revealed that people will adapt with the current space formation if there is no freedom of choice to transform but he will also satisfy him by practicing his cultural, ritual and habitual attitudes within the limitations. Although the tenants of Dhaka and Hofuf represent the same people with similar socio-economic background, it is difficult to compare, as in Dhaka we observed rental units with family residence whereas in Hofuf it is a dormitory or mess type of living with all male bachelors. However, ownership perhaps plays the key role for major transformation in the domestic spaces. The results of the research also show that the percentages of all types of transformation experienced at the time of landlords both in Dhaka and Hofuf rather than their tenants.

The impact of globalization and economy are two interrelated terms that important for transformation of the traditional buildings. Because globalization plays important role for employment and job opportunities that encouraged migrants to the urban centers and an enormous pressure for accommodating maximum people possible [23]. This demand of housing also have created and transformed a substantial amount of traditional houses into urban slums and made economically feasible for the low income people to use domestic spaces for income generation. Thus economic factors are important in the process of transformation and have experienced in many Third World cities.

It is also a pity that traditional buildings that once housed generations of thriving families have been either destroyed or left to decay. Social problems further arises that include the undermining the Islamic values like privacy; the encouragement of land speculation; transformation of living lifestyle- particularly enhancing aspirations towards large scale consumption of commercial goods; dominance of the motor vehicle, air and visual pollution; loosing identity; and unfortunately the deterioration of the traditional house remain, indeed unresolved in both cities.

A number of drawbacks are also a disadvantage for such qualitative research as nothing is so accurate and genuine. In the case studies, the numbers of sample are too low to evaluate any conclusion and also the families have different requirements and demands, their sizes are also different and above all their physical setting and formation are not identical. Collecting information about previous dwellers and tracing them was difficult. As some data are solely depends on the current occupiers the reliability can be questioned. The percentages of the transformed spaces calculated is an approximate measure that has been quantified in order to compare different phases of transformation and to understand the spaces that are vulnerable for transformation than other spaces in a domestic environment. Although it is visible that there exist many differences between the traditional dwellings of the two cities, a number of similarities in the formation of domestic spaces show identical characteristics.

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## **2-7 TOWARDS MORE EFFECTIVE STEPS TO PROVIDE CHARITABLE HOUSING IN SQUATTERED AREAS: KING ABDULLAH BEN ABDULAZIZ FOR HIS PARENTS INSTITUTION- HOUSING DEVELOPMENT IN MEDINA**

**Saeed Mostafa Kamel, Ph. D.**

Dr. Ahmed Fareed Mostafa Consulting Office, Medina, Saudi Arabia  
afmoffice@maktoob.com

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\* This paper was presented in the symposium as a working paper; written text is not available. To get a copy of the presentation, contact the Symposium secretary.

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### **Abstract:**

*The engineering consultancy work is considered to be one of the important aspects of the Charitable & Affordable Housing projects, since it will formulate the charitable intentions, efforts & objectives into a new urban housing level for the households that need help. However the engineering consultancy work differs between developing a housing project in slum area and another in vacant land due to the existing social and urban reality which directs the consulting work. El-Nakheel District Housing Project is one of the projects that achieve different objectives at a time such as: providing financial support, participation in area development, raising the level of urban & living conditions. The project now is at tender stage. To make use of this project experience this paper will try to analyze the stages of the project development & come up with conclusive results to improve the engineering consultancy work of the Charitable & Affordable Housing of Slum Areas for similar projects.*

*The paper methodology is based on the observation & analysis of the different work stages by studying the stage of the existing conditions, the stage of studying the municipal development plan for the district( up-grading project for the district),the stage of the survey & classification of the existing housing & this is followed by the preliminary site planning and housing model design , and finally the working drawings and bidding stage . The paper then analyzed all work stages procedures related to the project , in order to explain ways & means of overcoming & completing the work and the paper makes use of all studies and site survey, and it developed the design process in connection with reality in order to raise the level of effectiveness of Charitable & Affordable Housing projects & the existing urban environment. The paper end up with a set of recommendations related to the main elements and components of development process such as improving the level development partners participation, providing more flexible housing designs, improving construction methods, providing means for active citizen and (NGOs) participation in districts urban environment development process.*

### **Keywords:**

*Affordable Housing, Development Projects, Consulting Design and Planning Work, Al Nakheel District.*



# **SECTION 3: FINANCE AND CONSTRUCTION OF AFFORDABLE HOUSING PROJECTS**

## 3-1 ASSESSING BUILDING PERFORMANCE TO IMPROVE SUSTAINABILITY FOR LOW-INCOME HOUSING PROJECTS: THE CASE OF RESIDENTIAL BUILDINGS IN MUSAFFAH COMMERCIAL CITY IN ABU DHABI

**Mahmoud A. Abdellatif\*, Ph. D. and Ayman A. Ezzat Othman\*\*, Ph. D.**

\*Professor of Urban and Regional Planning,  
College of Architecture and Planning,  
King Faisal University,  
Dammam, Saudi Arabia.  
ma\_latif@yahoo.com

\*\*Architect,  
Commercial Buildings Directorate,  
Department of Finance, Abu Dhabi,  
United Arab Emirates.  
aothman@emirates.net.ae

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### **Abstract:**

*The focus on improving sustainability for low-income building projects is increasing and its contribution towards adding more values is becoming visible. Government authorities responsible for the construction process need to deliver sustainable buildings in terms of being: on time, cost effective, high quality, good indoor environment, durable, cheaper maintenance, and user friendly. On the long run continuous improvement to achieve year-on-year reduction in project cost and time is expected to be accomplished. In order to improve sustainability for low-income building projects, it is necessary to assess the performance of these buildings to identify their deficiencies and faults to take corrective actions and enable government authorities improve the performance or new projects.*

*Towards this aim, this paper attempts to accomplish three main objectives: First, to propose a set of Key Performance Indicators to Assess Building Performance (KPI\_ABP). This objective is achieved through the review of literature related to assessing building performance and sustainable development in construction. Second, to test the proposed KPI\_ABP set in assessing the performance of actual buildings. To achieve this objective, a field study is carried out on a sample of 36 low-income buildings projects constructed by the Government of the United Arab Emirates (UAE) in the city of Musaffah, Abu Dhabi. Finally, to outline learned lessons and recommendations useful to government authorities and construction professionals as to how to enhance the performance of new low-income projects.*

### **Keywords:**

*Assessing Building Performance, Sustainability, Low-income Building Projects, Construction Management.*

### **1- INTRODUCTION**

Often, clients and end-users of low-income building projects complain that their accommodations or workplaces are not designed to suit their requirements and meet their expectations. Controversially, building designers assert that their designs have carefully considered the client needs and accommodated all of the specified requirements. Unfortunately, the problem is often one of misunderstanding on both sides. It is true that the designers have comprehensive knowledge of building design but usually receive little or no feedback after the building is completed. Today building technologies are progressing rapidly, buildings became more complex and sophisticated, and hence their impacts on environment, society and economy are greater. New constraints such as efficient resource usage and low environmental impact require innovative sustainable solutions.

The increasing attention to improve sustainability for low-income building projects and its contribution towards adding more values is becoming visible. The government authorities responsible for the construction process need to deliver sustainable buildings in terms of being: on time, cost effective, high quality, good indoor environment, durable, cheaper maintenance, and user friendly. On the long run continuous annual improvement in reducing project cost and time is expected to be achieved. Without the opportunity to assess the performance of low-income building projects and learn from past projects, designers and government authorities may repeat solutions on new projects that have proven unsatisfactory in practice.

To achieve this aim, this paper attempts to accomplish three main objectives: First, proposing a set of Key Performance Indicators to Assess the Performance of Buildings (KPI\_APB). This objective is achieved through the review of literature related to assessing building performance and sustainable development in construction. Second, testing the proposed KPI\_APB set in assessing the performance of actual buildings. To achieve this objective, a field study is carried out on a sample of 36 low-income buildings projects constructed by the Government of the United Arab Emirates in the city of Musaffah, Abu Dhabi. Finally, outlining learned lessons and recommendations useful to government authorities and construction professionals as to how to enhance the performance of new low-income projects.

The aim and objectives outlined above called for a research strategy, which could gather data sufficiently rich to enable clients and construction professionals assessing building performance as an approach to improve the sustainability for low-income building projects. Two research methods were employed, namely literature review and case studies. The literature review was used to (1) review the assessment of building projects and sustainable development in construction, (2) proposing Key Performance Indicators (KPI) to be used in assessing building performance. The literature review depended on textbooks, professional journal and magazines, conference and seminar proceedings, dissertations and theses, organisations and government publications as well as Internet and related websites. The second method was a field study carried out on 36 construction projects to assess their performance according to the proposed indicators. Analysis of case studies was presented as learned lessons and recommendations for enhancing the performance of new low-income projects. Each case study comprised a detailed inspection of project files to collect information about building history, design and construction defects, users' modifications, as well as clients and users complaints database. A survey questionnaire, site visits and unstructured interviews were held with a sample of clients, end users, building designers and maintenance contractors in order to assess building performance and investigate the operation and occupation problems. Using more than one source of evidence (project documentation, complaints database, questionnaire and interviews), it was possible to improve the validity of the collected data and increase background knowledge. In an effort to ensure the reliability of the data, data collection and questioning concentrated on facts and events, rather than highly subjective interpretations [1, 2].

The objective of case study sampling was to select a representative and non-biased sample of construction projects from which to assess the performance of low-income buildings and as such to test the KPI\_APB. The survey was undertaken in the city of Musaffah, Abu Dhabi, United Arab Emirates. Information about distribution of the surveyed projects was collected from the Department of Social Services and Commercial Buildings, UAE. The city was divided into 3 sectors: Musaffah East-10 (ME-10), Musaffah East-11 (ME-11), and Musaffah East-12 (ME-12). The total number of buildings in these sectors was 673 buildings [3]. A systematic sample of 36 buildings (1:19) was used to select the case study sample. This sampling methodology effectively covered the surveyed city, so the assessment of low-income building projects were extracted from different projects constructed in different sectors, with different client structures, cost, time and quality, as well as used by different users, all of which enhanced the reliability and validity of the collected data and lessons learned.

## **2- A BRIEF DESCRIPTION OF THE UNITED ARAB EMIRATES AND STUDY LOCATION**

The United Arab Emirates is a federation of seven emirates, namely Abu Dhabi, Dubai, Sharjah, Ajman, Umm Al Quwain, Fujairah and Ras Al Khaimah. All these areas were under the British Protection since 1820 and were known the Trucial States. They joined to form the United Arab Emirates, which came into existence in 1971 and is a member in the Gulf Co-operation Council. The

rulers of the seven emirates established the Supreme Council and Federal Government. Abu Dhabi is the federal capital being the largest, most populous and richest in oil. Dubai although rich in oil is more known as a business and commercial centre. The languages spoken in the UAE are Arabic, English and others. The official currency is Dirham (DHS), where DHS 3.68 estimated to = \$1. The religions in the UAE are Islam and others. The time in the UAE is four hours ahead of GMT. The total area of the UAE is 83.600 square kilometres. The Emirate of Abu Dhabi is 67.000 square kilometres of the total. The UAE is situated in the southeast of the Arabian Peninsula, north of the equator, between latitudes 22 degrees and 26.30 degrees to the North, and longitudes 51 degrees and 56.30 degrees East of Greenwich mean time (GMT). It extends from the Sultanate of Oman in the East to Qatar in the West and Saudi Arabia in the South. It lies along the southern coast of the Arab Gulf stretching for 700 kilometres. Its eastern coastline stretches for 90 kilometres along the Gulf of Oman, see figures (1) and (2).



Source: <sup>[4]</sup> Al-Tunaiji, 1996

**Figure 1 The Geographic Location of the United Arab Emirates**



Source: <sup>[4]</sup> Al-Tunaiji, 1996

**Figure 2 The Map of the United Arab Emirates**

The UAE is one of the best world winter resorts. Between November and March, it experiences warm sunny days with an average temperature of 26°C and cool nights with an average temperature of 15°C. High temperatures (up to 49°C) and high level of humidity are the normal between June and August. The population of the UAE was estimated to be 2,563,000 million in 2005. . 85% of the UAE populations are urban. The population of the United Arab Emirates is concentrated primarily in cities along both coasts, although the interior oasis settlement of Al-Ain has grown into a major population centre as well. Less than one-fifth of the emirates' residents are citizens. The remainder are mostly male foreign workers and their dependents, with South Asians, mainly Indians and Pakistanis, constituting nearly half of the population. Arabs from countries other than the United Arab Emirates, notably Egypt, account for more than one-tenth and Iranians nearly one-fifth of the population. Southeast Asians, including many Filipinos, have immigrated in increasing numbers to work in various capacities [5].

## 2-1 The Construction Industry

Since the establishment of the UAE, the federal government used the country's oil wealth for the country development and upgrading the life of citizens, thus making huge achievements in a very short time. Successive plans for sustainable development have been implemented for the establishment of hundreds of projects for modernisation, development, services provision, setting up of residential towns, modern metropolis, building hospitals, clinics and health centres, schools and universities. Huge projects have also been carried out for the construction of necessary infrastructure, roads and bridges and tunnels, provision of electricity and water, communications and telecommunications and other basic services, thus making the UAE in par with developed nations. The most important source of funding for construction projects in the United Arab Emirates is the budget allocation by the federal government to finance development projects. This tends to be the case in all other members states of the GCC. These projects include road building, bridges, drainage and sewerage, public building, and

low income housing projects. In the Emirate of Abu Dhabi, there is another source of finance available for commercial and low-income building projects. The Department of Social Services and Commercial Buildings (DSSCB) [6] runs this. Since the case studies used to test the assessment of low-income building projects were projects executed by the DSSCB, the following section will give a brief description of the department, its objectives, the execution steps of the commercial and low-income building project and the department achievements.

## **2-2 The Department of Social Service and Commercial Buildings (DSSCB)**

The Department of Social Services and Commercial Buildings is the authority responsible for the construction of commercial buildings in the Emirate of Abu Dhabi. It is playing a pivotal role in the booming and progress of the United Arab Emirates. Its beginning was marked by the setting up of the Building Credit Corporation in 1971, followed by the Committee of Commercial Buildings Supervision in 1976 and integrated with the Department of Social Services and Commercial Buildings in 1981. The department is coordinating and co-operating with other authorities and parties to achieve the highest standards and specification in the construction process [4].

### **2-2-1 The Objectives of the Department of Social Services and Commercial Buildings**

The establishment of the DSSCB aimed to achieve the following objectives:

- Providing social insurance to citizens and escalating their life standards.
- Providing citizens with stable income to enable them to meet the challenge of life.
- Saving citizens from the high interest rates and debts of commercial banks.
- Offering solutions to housing problem in Abu Dhabi and achieving balance between offer and demand.
- Supporting the infrastructure projects such as roads, water and electricity to fulfil the requirements of its projects.
- Developing and enhancing the construction industry and other economical sectors in Abu Dhabi.
- Contributing in establishing national design firms, contracting and maintenance organisations to construct and maintain the department projects.
- Establishing the architectural development principles and boosting the tourism industry [7].

### **2-2-2 The Execution Steps of the Commercial Building Project.**

The execution of any commercial building project will normally follow specific steps, namely:

- Getting a preliminary approval from the Crown Prince's court and nominating a qualified consultant by the department to prepare the required design.
- The department reviews the designs and selects those compatible with the rules and regulations issued by government bodies.
- The building project is announced in a general tender through the newspapers giving the chance for contractors enlisted in the department to take part in the tender.
- After the opening of envelopes and the settling of the tender on one of the contractors, the Projects Directorate follows up the execution of the project and prepares weekly and monthly reports on work progress.
- After the completion of the building the department follows up the one-year obligatory maintenance then goes to the Maintenance Directorate, which pursues the building's maintenance through the announcement of a tender giving the operation to the best bidder.
- Rentals are made through the Lease Directorate, which manages the building's financial and administrative affairs through renting shops, showrooms, and flats and providing them with the required services.
- The building revenues are being distributed accordingly to the percentage ratio by the project as follows:
  - The building client will receive 30 % of the building's revenue and 40% of the villa revenue.
  - 60% of the building's revenues and 50% of the villa's revenue are allocated for reimbursing the surety until the mortgage is lifted. The sureties do not bear any interest.
  - The department keeps the remaining 10% for the maintenance work [4, 8].

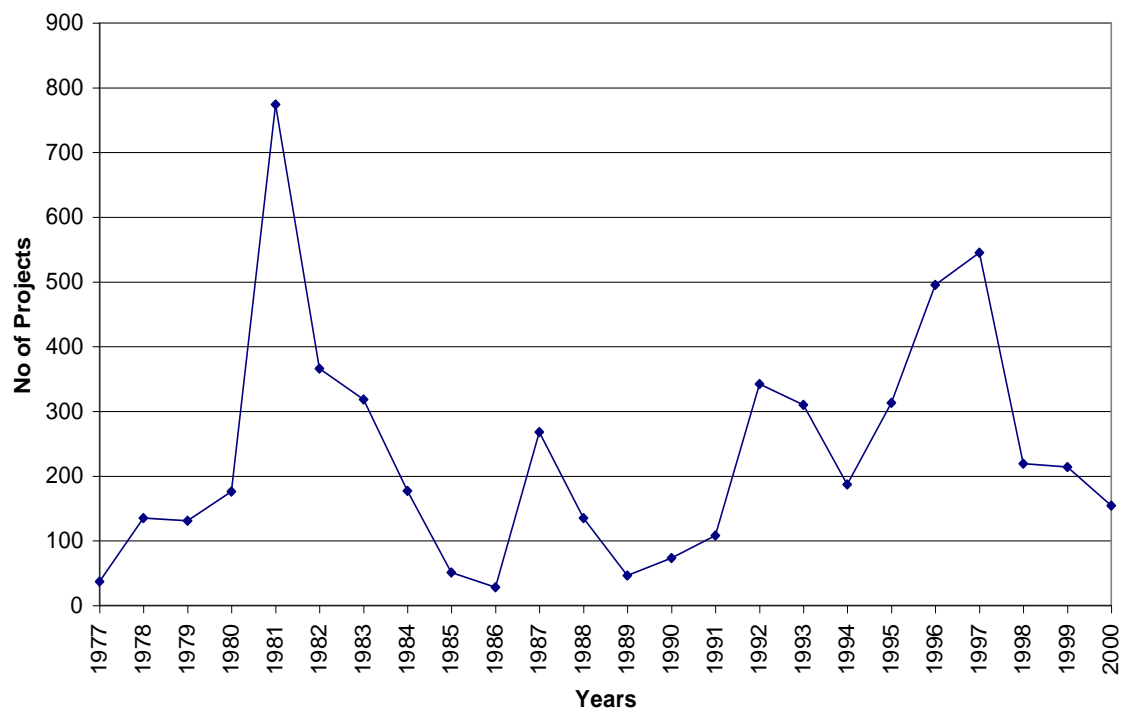
### 2-2-3 Achievements in Figures

Table (1) indicates that the value of the projects has increased since the establishment of the DSSCB. The department has completed about 6000 projects at a cost of 30 billion Dirhams. They included about 94000 housing units. Figures (3), (4) and (5) show the numbers of the projects, flats, and costs respectively over years [8], [9].

**Table 1 The Development of Projects Executed by the DSSCB**

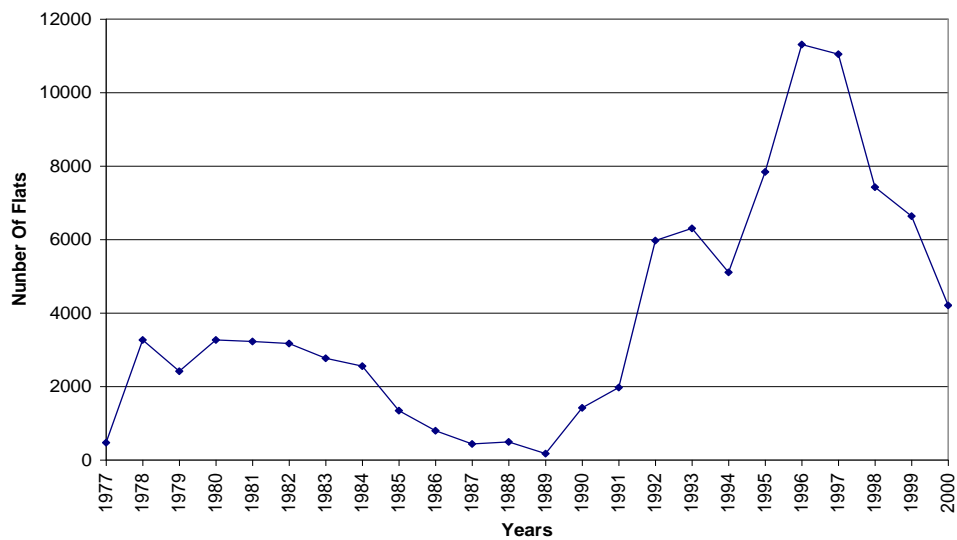
Year	No. of Bldgs.	No. of Flats	Projects cost (Dirhams)	Year	No. of Bldgs.	No. of Flats	Projects cost (Dirhams)
1977	37	472	79,400,000	1989	46	172	51,900,000
1978	135	3268	461,300,000	1990	73	1417	280,800,000
1979	131	2417	513,300,000	1991	108	1969	659,800,000
1980	176	3265	682,200,000	1992	342	5974	1,466,600,000
1981	774	3224	720,700,000	1993	310	6306	2,049,200,000
1982	366	3172	814,200,000	1994	187	5108	1,928,900,000
1983	318	2766	1,109,800,000	1995	313	7838	3,270,500,000
1984	177	2555	845,800,000	1996	495	11306	3,748,200,000
1985	51	1343	494,100,000	1997	545	11047	4,197,000,000
1986	28	797	576,800,000	1998	219	7426	2,769,300,000
1987	268	436	208,500,000	1999	214	6637	2,421,400,000
1988	135	489	148,100,000	2000	154	4210	1,435,900,000
Sub Total	2596	24204	6,654,200,000	Sub Total	3006	69410	24,279,500,000
				Grand Total	6002	93614	30,933,700,000

Source: [4] Al-Tunaiji, 1996



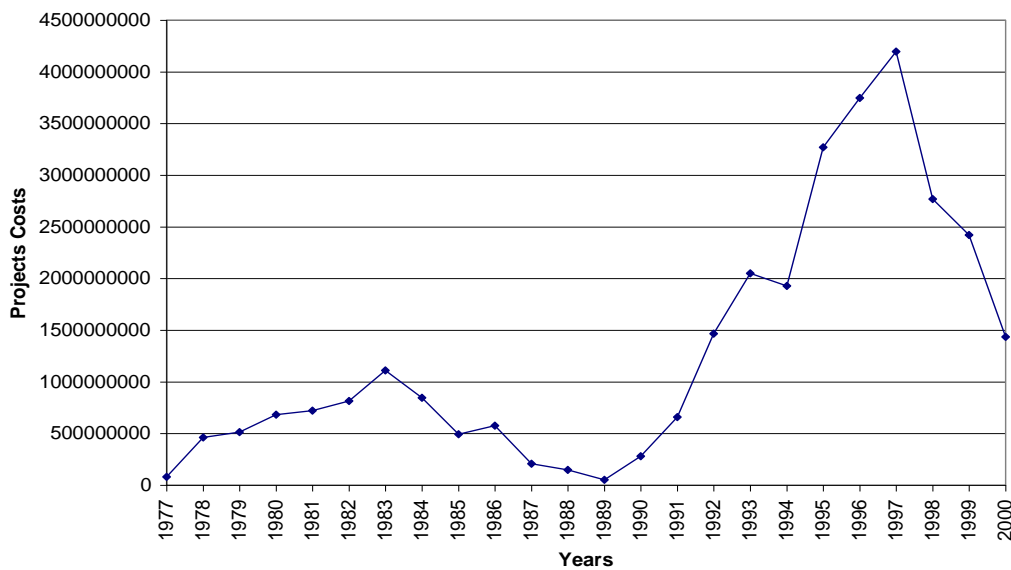
Source: [4] Al-Tunaiji, 1996

**Figure 3 The Number of Projects Executed over Years**



Source: [4] Al-Tunaiji, 1996

**Figure 4 The Number of Flats Executed over the Years 1977-2000**



Source: [4] Al-Tunaiji, 1996

**Figure 5 The Costs of the Projects Executed over the Years 1977-2000**

## 2-2-4 The City of Musaffah

The city of Musaffah is located 40 km. from Abu Dhabi. It is divided into two main sections: Musaffah Industrial City and Musaffah Commercial City. The first city is designed to be an industrial base to Abu Dhabi. It contains a number of factories, workshops, establishments and Musaffah Port. The commercial city is constructed by the Government of the UAE to accommodate the low-income worker of the industrial city. The case studies used to assess building performance are selected from the buildings in Musaffah commercial city. These projects consisted of ground floor (entrance, shop, watchman room, and service rooms), three typical floors (4 two bed room flats), and roof (service rooms). Two types of Air conditioning (A/C) systems are used: Window type and Central A.C type. The average cost of each building was around 3.000.000 Dirhams Figure 6.

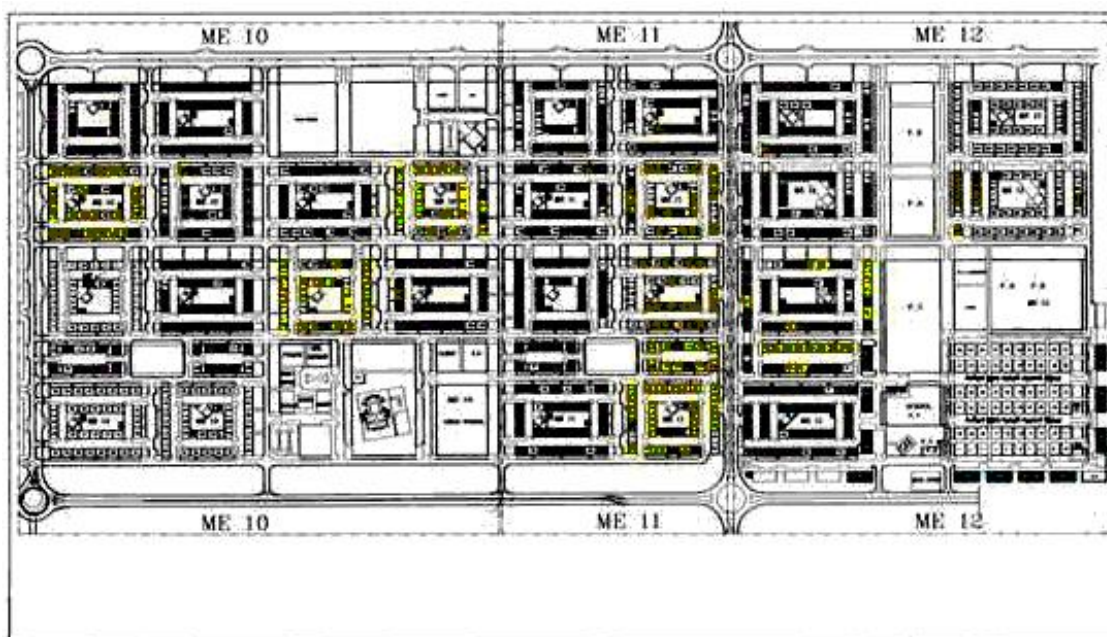


Figure 6 Musaffah Commercial City Map

### 3- ASSESSING BUILDING PERFORMANCE

Generally, assessing and measuring performance are the processes of checking, monitoring, reviewing and evaluating the short, medium and long-term progress and direction of organisations, departments, divisions, projects, functions, groups and individuals. It is an ongoing process which aims to identify what is going well and why and what is going wrong or could be improved, and why. In addition, corrective actions have to be taken in order to overcome shortcomings and enhance performance. Performance measurement can only be effective if it is carried out against specific aim and objectives [10]. Performance measurement has spread to many industries, including the construction industry. The construction industry is a project-oriented industry where each project is unique and could be considered as a prototype, although a similar set of process stages is involved in every project [11]. In the past, construction projects were typically evaluated informally and in terms of cost, time, and quality [12,13]. This type of evaluation was perhaps sufficient at that time because building projects were relatively less complex and the level of technology in design was low. But things have changed dramatically and the three categories of project evaluation of time, cost and quality have been described as insufficient [12]. Building performance evaluation has to be improved to cope with the ever-increasing proliferation and specialisation in the construction industry in terms of matters such as building types, services, technology, code and regulatory requirements, energy conservation, fire safety, environmental health, and safety constraints. Construction is a highly sophisticated industry that has evolved from simple residential homes to complex projects incorporating high technology services and communications. The research and development of new technologies and its introduction into buildings is progressing quickly. Monitoring of these new technologies is necessary in order to compare actual performance with intended criteria, and through this process improvements can be found and incorporated in future building design [14].

#### 3-1 The Role and Purpose of Assessing Building Performance

Assessing building performance is an effective tool to record and compare actual performance with explicitly stated criteria. It is an ideal tool and a systematic way to tackle significant problems experienced in building performance with particular emphasis on the perspective of the building users. It could be used for different purposes. For example, it provides an opportunity for clients and facility management team to consult building users. This will improve the relationship for any future cooperative activity and enable building users deliver their problems or dissatisfaction to higher levels. In addition, assessing building performance can be used to assist upgrading of existing facilities. It is



often very useful to conduct an assessment before planning for any refurbishment or renovation because users' expectation, requirements and needs are addressed and the design team is properly informed. Similarly, it responds well to users' complaints, dissatisfaction and understanding expectations. However, it is crucial to find out the underlying sources of dissatisfaction before spending money imposing solutions that in the end turn out to have addressed the wrong problem [14].

### 3-2 Benefits of Assessing Building Performance

Despite its obvious usefulness in understanding current building performance and occupants' requirements, Assessing building performance is an important tool for the management and planning of new facilities. Potential benefits range from short term to long term [15].

- The short-term benefit of assessing building performance is to allow clients and facility management team have a better understanding of the functionality and performance of their buildings compared with the stated criteria during design. Before improvement can be made, the problem needs to be identified and studied in detail. Active user participation in the evaluation process plays an important role in this respect. As a result user values are confirmed and reflected in the design of new building.
- The medium-term benefits comprise the use of data collected during the assessment of building performance to be a source of knowledge for planning new buildings of similar type. Designers equipped with user feedback are helped to design future buildings that more closely meet the needs of the users.
- In the long term assessing building performance helps establish databases, generates planning and design criteria for specific building types and enables designers to consider documented past experience. This is important to avoid repeating past errors and recognize past success. The accumulated information plays a pivotal role in improving the quality of future buildings and services to the client and users. Assessment results may also improve design practice by making designers aware that their buildings may be subject of scrutiny. Thus, design of future buildings may lead to better value for money to clients and society. This concern not only issues of functionality, but overall sustainability, energy efficiency and environmental impact.

## 4- SUSTAINABLE DEVELOPMENT IN CONSTRUCTION

Sustainable development is defined as development that meets the needs of the present without comprising the ability of future generations to meet their own needs (cited in [16]). It is not a new idea. Many cultures over the course of human history have recognized the need for harmony between the environment, society and economy. What is new is an articulation of these ideas in the context of global industries and information society. Sustainable development aims to deliver built assets that enhances quality of life and offers customer satisfaction; offers flexibility and the potential to cater for user changes in the future; provides and supports desirable natural and social environments; and maximise the efficient use of resources [17].

Sustainable construction is a part of sustainable development. Chen and Chambers [18] defined sustainable construction as creating a healthy built environment using resource-efficient, ecologically based principles. Sustainable construction is concerned with three issues: environmental, social and economic. Environmental protection is important because construction represents major contribution to climate change, resource depletion and pollution at both local and global levels [19], [20]. Construction needs to consider its effect on society because everything that has or will be built affects the local community. Construction should promote healthy living and socially cohesive communities and respond to any changes in societal expectation. The economic dimension of sustainable construction can be seen from two perspectives. In the one hand, sustainable construction will stimulate growth in the industry, which will increase the percentage of gross domestic product and provide more job opportunities [19]. In the other hand, it will increase client's profit and increase investment return [21].

If sustainable construction is successfully accepted and absorbed in developing a construction project, the participants will gain its benefits in terms of cost savings, project schedule compliance, reducing environmental risk and uncertainty, ensuring legislative compliance, improving relations

with regulators, improving public image, enhancing employee productivity and improving market opportunity. Good construction practice offers both environmental and economic benefits such as reducing health and safety impacts on staff and local community, reducing liability costs in connection with disposal, reducing remedial work and construction delays. There are also many potential advantages for contractors for demonstrating environmental responsibility: improved opportunity to tender, less money wasted on fines, less money restoring environmental damage, less money lost through wasted resources and the improved environmental profile [22].

To achieve sustainable construction, there should be changes in thinking, behaving, producing and consuming [23]. Miyatake [24] Suggests that in order to achieve sustainability, the industry must change the process of creating the built environment from linear to cyclic processes which will bring increased use of recycled, renewed and reused resources, and decrease in the use of energy and other natural resources. To attain environmentally responsible construction, all practitioners must make a commitment, change their behaviour, adopt new products, ideas and practices, integrated environment system with normal work processes, involve close co-operation of all project participants, starts as early as possible, and be visible throughout the building's life cycle [20].

The focus on improving sustainability for low-income building projects is increasing and its contribution towards adding more values is becoming visible. Sustainability promotes a balanced approach by taking account of the need to continue in business, but does not seek profitability at the expense of the environment or society's needs [25]. Sustainability concerns protecting environmental quality, enhancing social prosperity and improving economic performance [19].

#### **4-1 Sustainability Principles in Construction**

The principles of sustainability within the construction industry are:

- Showing concern for people by ensuring they live in healthy, safe, productive and nature-harmonious conditions.
- Safeguarding the interests of future generations while at the same time meeting today's needs.
- Evaluating the cost and benefits of the project to both society and environment.
- Improving relationships and supply chains to create healthy business environment, promote effective productivity and efficiency.
- Improving the quality of buildings and services, creating job opportunities, and promoting social cohesiveness.
- Minimizing damage to the environment and its resources.
- Assessing risk and uncertainties of any action taken.
- Using technology and expert knowledge to seek information and improving efficiency and effectiveness.
- Providing for easy access of information, working within ethics, encouraging participation, respecting and treating stakeholders equitably [26].

### **5- USING KEY INDICATORS TO ASSESS BUILDING PERFORMANCE OF CASE STUDIES**

Government authorities responsible for the construction process need to deliver sustainable buildings in terms of being: on time, cost effective, high quality, good indoor environment, durable, cheaper maintenance, and user friendly. On the long run continuous improvement to achieve annually reduction in project cost and time is expected to be achieved. Once an authority has analyzed its mission, identified all its stakeholders, and defined its goals, it needs a way to measure progress toward those goals. Key Performance Indicators (KPIs) are those measurements. The KPIs are quantifiable measurements, agreed to beforehand, that reflect the critical success factors of an organization or a project. They will differ depending on the type of the organization and the project. Whatever KPIs are selected, they must reflect the organization's goals, they must be key to its success, and they must be quantifiable. The Key performance indicators purpose is to enable measurement of project and organizational performance throughout the construction industry. This information can then be used for benchmarking purposes, and will be a key component of any organisations' move

towards achieving best practice. There are many frameworks for KPIs. For instance, the Department of the Environment, Transport and Regions, the Construction Industry Board, and the Movement for Innovation through the Construction Best Practice Programs in the United Kingdom, identified a KPI framework consists of the following indicators: (1) Time, (2) Cost, (3) Quality, (4) Client satisfaction, (5) Change orders, (6) Business performance, and (7) Health and safety [27]. In addition, The Centre for Advanced Engineering (CAE), New Zealand undertaken some research into how best to measure construction industry performance – so that to establish some objective data on how well the industry is doing, and how to allow companies involved in the construction industry to benchmark their performance against the overall industry results. The Centre has produced a set of Key Performance Indicators. They are: (1) client satisfaction-product, (2) client satisfaction-service, (3) predictability cost-design, (4) predictability cost-construction, (5) predictability cost-project, (6) defects, (7) predictability time-design, (8) predictability time-construction, (9) predictability time-project, (10) safety lost time, and (11) profitability [28].

Since the case studies selected to assess building performance are constructed buildings and already in use, the Key Indicators to Assess Building Performance KIABP proposed by the authors will focus on assessing building performance in terms of quality and clients satisfaction. User satisfaction was added to client satisfaction, as many of the building users are not clients. In addition, Maintenance works indicator was added as it expresses and measures the ongoing situation of the interaction between the users and the rented facilities. Details of both indicators are as shown in Table1.

Quality is defined as conformance to an owner or customer product requirements. It is the totality of features and characteristics of a product or service that bear on its ability to satisfy stated or implied needs [29]. A quality issue is defined as an issue that affects the project so that work needs to be redone, modified or compromised to a lower standard than originally agreed. Since measuring design and construction defects represent a key issue to assess building quality, a number of measures was identified by the authors to assess the quality of low-income building projects. Clients and users will be satisfied when the finished product meets or exceeds their expectations. In addition, the satisfaction will diminish when the after completion services do not cover the client and user requirements [30], Assessing client and user satisfaction aims to measure how they are satisfied with the final product and followed service. Using maintenance works to assess building performance represents an important KPI. It aims to explore the main problems that face the building and its users throughout the project life cycle. This will enable government authorities and construction professionals avoid such problems in new projects. A Likert scale of 1 to 5 was employed to measure the building performance against the stated criteria. Although there are many forms of scaling, the Likert scale was adopted because it is commonly used [31], simple to construct, permits the use of latent attitudes and is likely to produce a highly reliable scale [32].

## 6- DATA COLLECTION

Different methods were used for data collection, namely:

- A detailed inspection of project files was carried out to collect information about building history, design and construction defects, users' modifications, as well as clients and users complaints database.
- A survey questionnaire was designed to test the KIABP suggested by the authors. The questionnaire was divided into three sections to cover the assessment criteria. Section one was intended to be answered by the building architects. The questions of this section were open ended question to get as much information about assessing the quality of the surveyed buildings. Section two was intended to be answered by both, the client and the end users. Section three is intended to be answered by maintenance contractors. The questions of the last two sections were close ended questions and the respondent were asked to rank their answers on a scale from 1-5: where 5= excellent, 4= very good, 3=Good, 2= average, and 1=low, see table2.
- Site visits were carried out to check up the building maintenance, record current problems and take photograph of the building under study.

- Unstructured interviews were held with a sample of clients, end users and maintenance contractors in order to assess building performance and investigate the operation and occupation problems. The number of categories to respond to the questionnaire and to be interviewed was as follows: 36 building clients, 72 end users (at a rate of 2 families/building), 15 architects, and the top ranked 3 out of 13 maintenance contractors working in the Musaffah site.
- A plenty of room was left blank so that respondents of the questionnaire can add information, comment and advice.

**Table 1 A proposed checklist of key indicators to assess building performance KIABP**

Major Performance Area	Indicator	Sub-indicator
Quality	Design & Construction Defects	Imitating Project brief
		End user involvement in the briefing and design process
		Understanding the users' culture and traditions
		Considering whole project life
		Functional, aesthetic, safety requirements and constructability
		Material Selection
Client and User Satisfaction	Client satisfaction – product	Client satisfaction – service
		User Satisfaction
Maintenance Works	Maintaining Sanitary ware	Maintaining aluminium, glass and carpentry works
		Maintaining block work, plastering and painting.
		Maintaining Flooring and external finishing
		Maintaining electro-mechanical services

**Table 2 Survey Questionnaire Using the Proposed KIABP to assess Building Performance**

Area	Indicator	Sub-indicator
Quality	Design & Construction Defects	Who imitated the project brief?
		Have the building user been involved in the briefing and design process?
		To what extent do you understand the users' culture and traditions?
		Have you considered the whole project life cycle during design?
		How do you consider the functional, aesthetic, safety and constructability requirements of the building?
		How were the building materials selected? And what are the implications of the selected materials?
Client and User Satisfaction	Scale:	1
		2
		3
		4
		5
Maintenance Works	Remarks:	As a client, how are you satisfied with the finished building?
		As a client, how are you satisfied with the service submitted by the DSSCB, architect, and maintenance contractor?
		As a building user, how are you satisfied with the service submitted by maintenance contractor?
		How is it easy to maintain sanitary ware?
		How is it easy to maintain aluminum, glass and carpentry works?
Remarks:	Remarks:	How is it easy to maintain block work, plastering and painting?
		How is it easy to maintain Flooring and external finishing?
		How is it easy to Maintain electro-mechanical services?

## 7- DATA ANALYSIS

Out of 126 questionnaires were distributed, 71 questionnaires were completed and returned. This included 21 clients, 40 end users, 7 architects, and 3 top-ranked maintenance contractors, which represents % 56.34 of the overall number of clients participating in the project. All the respondents of the survey questionnaire were interviewed. The results of analyzing the collected data of the case studies showed that:

## 7-1 Quality: Design and Construction Defects

- All the architects responded to the questionnaire pointed out that the general project brief was initiated by the government authorities, which are responsible for the construction process. This included the number of floors, parking area, number of shops, open to sky dimensions, etc. Detailed project brief which include the number of flats, its contents and specifications is initiated by the client in collaboration with the designer and then approved by the government authorities. All end users claimed that they were not engaged in the briefing and design process. Hence, their requirements were not captured and their needs were not reflected in the building design. Architects mentioned that this could be attributed to the nature of the government and mass production nature of the projects, where the end user is usually absent or unknown during the briefing and design process.
- Five out of seven architects stated that the users of these facilities came from different background and different cultures. Because of their absence during the briefing and design process, they were not able to explain their requirements and the designer does not have the chance to understand their culture and traditions. Hence, many of the end users have modified the rented facilities to meet their requirements and match their customs, which affected the performance of the whole building and its surroundings.
- About 85% of the respondents mentioned that the whole project life was not well considered during the design process. This was obvious in the cost of operation and maintenance stages. Selection un-durable materials resulted in replacing installed items within few years of completion. For example, upper water tanks, which are exposed to external weather, humidity and sunlight, resulted in creating cracks in these tanks and getting nails and metal connection rusted. The whole life of the project was expected to be 25 years, where these tanks became unusable within 3 years of construction. Many of these water tanks are being replaced with isolated plastic panels which are more durable in hot and humid weather, see figure (7). Furthermore, another discard of the whole project life and represent unnecessary cost is present in fixing and installing facilities and equipment which were not used since these buildings were constructed: such as central gas system and filtration system. This is because tenants preferred to avoid any extra bills that they have to pay, see figure (8).



Figure 7 Damaged Water Tanks

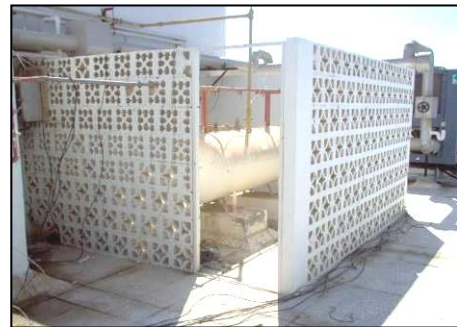


Figure 8 Unused Gas Tank

- Regarding the functional, aesthetic, safety requirements and constructability of the surveyed buildings, all architects referred that these buildings were designed to be commercial buildings to meet the function and the aim of their construction. In addition, the aesthetic appearance of these buildings were designed by the architect according to the client point of view and then approved by the Heritage Committee in Abu Dhabi Municipality. Respondents mentioned that many design firms used luxury materials such as marble tiles and curtain walls, which resulted in increasing the building cost and the area exposed to sunlight. As a result, the Air Conditioning capacity to cool the building has been increased. This increased the amount of the electric bill, which has to be paid by the end user. Adequate safety requirements were provided and checked by the Civil Defense Directorate. Four out of seven architects mentioned that many design firms opted to create complicated façade design to attract their clients and win new ones. It was noticed during the site visits that it was difficult to construct such designs, which are not

commensurate with low income building projects. Furthermore, poor workmanship resulted in improper fixing of external cladding, which led to falling marble tiles causing damages to people, and private properties see figure 9.

- Specifying construction materials was done by the architect with the collaboration with client. Project documents include a list of material selection, where the contractor was allowed to select from three materials (equal in price and performance). All architects pointed out that 75% of the surveyed buildings were constructed about 10 years ago. Many of the materials used were imported from abroad, as they were not manufactured in the UAE at that time. This included glass, kitchen cabinets, sanitary ware, external finishes...etc. The maintenance companies which are responsible for maintaining these buildings referred that any damage happens to an item such as broken glass or damaged sanitary ware resulted in importing materials to fix the damaged items. Recently, these materials were changed locally and new buildings use locally made materials.
- All architects clarified that there were many defects in the construction of low-income buildings in Musaffah city. These defects emerged from design faults or construction deficiencies. For instance, water leakages represent one of the problems that affect buildings, disturb end users and maintenance contractors. This is attributed to many reasons such as: bad workmanship of fixing sanitary ware and sewerage pipes, hiding the pipes in concealed ducts, which make the process of following water leakages a difficult task, see figure 10. Many of the areas that use water such as bathrooms and kitchens were built above electric rooms. So, any broken pipe will leak on electric room, which in some cases resulted in electric short causing danger to tenets. In addition, areas of service rooms are not sufficient to allow the electro-mechanical contractor performs required maintenance work. This delays repairing affected parts or changing damaged sets, see figure 11.



**Figure 9 Falling of External Marble Cladding**



**Figure 10 Concealed Sanitary Pipes**



**Figure 11 Congested Pump Room**

According to the Municipality and town planning department regulations, the dimensions of the service duct is 2.00m X 2.00m. This is to ventilate kitchen, bathrooms and toilets. Site visits showed that these ducts were used to pass Air Conditioning ducts to the flats. The dimensions of A/C Duct are about 0.60m X 0.60 m. The O.T.S, which contain all these installation of sanitary pipes and A/C ducts make its maintenance a big trouble particularly if a sewerage pipe is broken.

Remarkable changes to the building design were done by clients by transferring the parking area to shops and flats to meet the increasing demand in low-income building. Such modification is not considered in the building design in terms of electric load, water tanks capacity and city services. Furthermore, in few buildings, the service rooms were used as accommodation, see figure (12).



**Figure 12 Using Service rooms as accommodation**

## 7-2 Client and User Satisfaction

A number of 15 clients out of 21 have an average satisfaction with their finished buildings with a rate of 2.75 out of 5. Although they have briefed their requirements to the design firm, the architects ignored their roles, particularly naive clients, and behaved unilaterally in taking design decisions such as material selection. In addition, they mentioned that a number of design firms escalated the building specifications in order to increase their design fees, as it is a percentage of the building cost. This resulted in specify luxury materials that does not commensurate with low-income building projects. Furthermore those clients stated the poor workmanship of construction companies resulted in many construction defects that affected the performance of their buildings. Other clients have a good satisfaction rate of 3.5 out of 5.

A number of 14 clients out of 21 refereed that they were not satisfied with the service submitted by maintenance contractors. They rated their satisfaction 1.6 out of 5, where the remaining clients rated their satisfaction with the service submitted by maintenance contractor 2.25 out of 5. Through the interviews conducted with clients, they mentioned that the faults of design and construction cause a number of problems that the maintenance contractor had to solve. This task is being difficult to do because of the poor workmanship of the maintenance contractors and the need to remove and re-construct affected parts. In addition, clients stated that the end users behavior and habits as well as the increasing number of their children helped damaging many of the building facilities.

About 62.5 % of the end users rated their satisfaction with the service submitted by maintenance contractors at 1.8 out of 5. This could be attributed to the increasing demand for maintenance work due to design and construction faults as well as the damage occurred by end users. One important reason is the poor workmanship of maintenance companies working in the commercial city of Musaffah. This is because of the lower requirements for a company to embark maintenance work which, enabled unqualified companies submit and win tenders at lower cost. The remaining end users had an average satisfaction at a rate of 2.5 out of 5.

## 7-3 Maintenance Work

The results of the questions asked to the maintenance contractors are summarized in Table (3).

**Table 3 Summary of Maintenance Contractors Response**

Rate	No. of Maintenance Contractors (out of 3)	Rate (out of 5)
How is it easy to maintain sanitary ware?	3	2.25
How is it easy to maintain aluminum, glass and carpentry works?	3	3.5
How is it easy to maintaining block work, plastering and painting?	3	4.5
How is it easy to maintaining Flooring and external finishing?	3	4.35
How is it easy Maintaining electro-mechanical services?	3	3.75
Remarks:		

## 8- SUMMARY OF FINDINGS AND CONCLUSION

Having reviewed the concept of assessing building performance in order to improve sustainability for low-income building projects and bearing in mind the previous results derived from the case studies, the research may reach the following conclusions:

- Government authorities have to engage clients and end users in the briefing and design process. So, their requirements could be adequately captured and reflected in the building design. This will facilitate the achievement of clients and users satisfaction and eliminate further modifications of facilities.
- Government authorities have to play more effective role to organize the relationship between the client and the designer. In addition, particular attention has to be paid to the development of

a list of specifications, which every design firm have to abide with during the design process. Furthermore, it is highly recommended that government authorities and construction professionals adopt Value Management techniques as an effective technique to achieve the project objectives at the most cost effective manner through generating and evaluating creative solutions.

- Design firms and construction companies should be obliged to use locally made materials to avoid the problem of maintaining imported materials. This will encourage the national industry and hence improve the economy and society.
- Designers have to consider the whole project life cycle and specify durable material that copes with the environmental climate.
- Avoid the use of curtain wall in the design of building façade. Such curtain walls do not suite the climate of the United Arab Emirates and similar other gulf countries that have the same climate, which is hot and humid most of the year. This will help reducing the exposure of the building to sunlight and hence, reduce the air conditioning capacity to cool building.
- Avoid both hiding sewerage pipes and using concealed ducts in order to facilitate rectifying any water leakages. In addition, sanitary pipes have to be exposed or kept in accessible ducts via inspection doors. Furthermore, areas that use water have to be placed away from electric rooms.
- Designers have to pay more attention to delete any items that will not be used in the future. In addition, building regulations have to be revised to modify the dimensions of services rooms and O.T.S to facilitate the maintenance process. Furthermore, furnished plans for service rooms have to be carried out during the design process to make ultimate use of the rooms area.
- Government authorities have to increase the qualifying level of maintenance companies wishing to submit for maintaining low-income residential buildings.

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## 3-2 SUSTAINABLE VALUE IN DESIGNING AND IMPLEMENTING LOW-INCOME HOUSING PROJECTS IN SAUDI ARABIA

**Mohammed Esam Shaawat\*, Ph. D. & Hashem Abdullah Al Saleh\*\*, Ph. D.**

\*Associate Professor  
Dept. of Building Technology,  
College of Architecture and Planning, King Faisal University,  
Dammam, Saudi Arabia.  
abtshaawat\_2005@yahoo.com

\*\*Chairman  
Dept. of Building Technology,  
College of Architecture and Planning, King Faisal University,  
Dammam, Saudi Arabia.  
hsalah\_sa@yahoo.com

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### **Abstract:**

*In general, a house is considered a shelter for man. It fulfills his social, environmental, economic and safety needs. Hence, providing a house becomes, by all means, one of the major challenges facing every youngster and family supporter looking for securing his family life. Eventually, housing becomes main strategic goal for most countries. The Kingdom of Saudi Arabia has defiantly been and will be facing during the coming twenty years a remarkable housing shortage in general, and in low-income housing types in particular.*

*The current practice of providing economic housing in Saudi Arabia needs review and correction from all involved and concerned parties. There is lack of feasibility of governmental housing provision programs. These programs are not capable to meet the growing demands under the continuous cut down of governmental budgets. The increase of construction cost of a house in addition to the improper local culture concept which propagate large spaces and luxurious consumptive fixtures have lead to escalating the housing problem, especially for the most needy and poor citizens.*

*So, the purpose of this study is two-fold: (1) to review the low-cost housing shortage in K.S.A, and (2) to discuss the obligation to achieve sustainable value in urban housing projects- an approach which could be regenerated during project phases. Sustainable value aims to establish housing design practice that is open, cyclic and comprehensive. The main conclusion of the study insured the need to integrate value into sustainability to establish a methodology that can be applied in low-cost housing projects*

### **Key wards:**

*Sustainability, Low-Cost house, Value Engineering, Environmental Equilibrium, Sustainable Value.*

## 3-3 NEW TECHNIQUES IN BEARING WALL SYSTEM IN FORDABLE HOUSE

**Hazem Mohammed Nour Afifi, Ph. D.**

Associate Professor, Department of Architecture  
College of Architecture and Planning, King Faisal University,  
Dammam, Saudi Arabia  
hazemmafify@yahoo.com

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### **Abstract:**

*This paper aims to present the most recent modern applications of bearing wall construction system in the fordable house, and rediscover its spatial and structural abilities. The research begins with discussing the bearing wall system, its advantages and disadvantages. After that it reviews the modern development to overcome the spatial and structural disadvantages of bearing wall system. The research ends with analyzing a housing project in Germany (1994) built with bearing wall construction system.*

*The paper has reached the following conclusions:*

- *The system of bearing wall is an old method for new days. Its modern applications try to treat its disadvantages on both the architectural and structural levels:*
- *On the architectural level, there are several methods to form the walls in plan spatially: perpendicular wall type, parallel wall type, slices wall type, and combines between the last types.*
- *On the structural level, the treatment is done in three directions: increasing the strength (cohesiveness) of the wall, developing the brick bonding and improving the quality of (brick or block).*
- *The ceiling is made from reinforced concrete beams and hollow blocks laid between beams*
- *Analysis of a housing project built in 1994 in Berlin have shown that the architect used bearing wall system and succeeded in creating a good living space, respecting the surrounding context and making economically efficient buildings that provide a healthy, balanced indoor climate.*

### **Key Words:**

*Bearing wall, Economic Efficiency, Perpendicular Wall, Slice Wall, Wall strength-straight Ceiling.*

## 3-4 LOAD-BEARING MASONRY AN ECONOMICAL AND A DURABLE ALTERNATE SYSTEM FOR THE KINGDOM OF SAUDI ARABIA

**Khaled Medallah, Ph. D.**

Assistant Professor, Department of Building Technology,  
College of Architecture and Planning, King Faisal University,  
drmedallah@hotmail.com

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\* This paper was presented in the symposium, then refereed and accepted for publication in the Proceedings Book in its final format as follows:

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### **Abstract:**

*Surveys showed that framed structures with ribbed slabs and shallow beams are the dominating structural system exceeding 95 % in Saudi Arabia. Such a system seems uneconomical and unnecessary, contains so much reinforcement that contributes to durability problems and reduces life cycle. Load-bearing masonry, on the face of it, seems more economical and durable system. An implementation plan based on the ability of the local block industry and the level of awareness of the engineering society is needed. A research project funded by KACST "King Abdulaziz City for Science and Technology" has proven with regards to the concrete block industry otherwise. A survey into engineers' motives toward load-bearing has shown serious awareness problem. A survey questioner showed owners, who have limited knowledge, play an important role in selecting the structural system.*

*The research data is based on several surveys of the block industry, the engineering design offices, test results enhanced with cost analysis and cost comparisons. This paper introduces load-bearing as an alternate system for the building industry with a cost saving approaching 20 %. When introducing the suggested system for basement the savings hit the ceiling reaching 70 %. When introducing load-bearing system in the building industry other by-products play additional effect on the cost and particularly the life cycle, example; the use of fare face clay tiles, split-fluted concrete block or calcium silicate blocks that eliminate the need to plaster and paint for a life long building facade. A special construction techniques emerged in the building industry such as the one introduced by Elmaimani Red Brick Factories that can impact the schedule together with reducing construction material such as shuttering and reinforcement in addition allowing parallel disciplines to start early which can sum to additional significant savings. The disadvantage of load-bearing structure is in its limited ability to accept changes, a framed structure is more flexible but the question arise does all our buildings require total flexibility. If the suggested alternate system is more economical, faster to build, require less maintenance and can sustain longer life with some limited flexibility is it, at least, an option.*

### **Keywords:**

*Load-bearing, Affordable buildings, Cost saving, Structural systems, Masonry.*

### **1- INTRODUCTION**

Suggesting an affordable building system alternate to the common popular system is acceptable if the suggested system add value, namely; it should be durable and less expensive such as Load-bearing. In a visit to a government agency, the author was received by an engineer who was surprised to hear of masonry. The engineer gave an order to remove a room on the roof of a poor family because it had no columns. My simple question to him was "Did you notice any cracks in the room?"

In today's world of competitive market, the need for a more economical and practical system is a desire and an aim we all try to achieve. The author has evaluated several new building systems such as Plastbau, Coffey and other systems some of which were initiated for the poor can only be afforded by the rich. The Load-bearing building system is not a total stranger rather it has been around for ages. A project for the affordable housing was executed by the Ministry of Public Work and Housing MPWH in Riyadh using Load-bearing masonry.

The author noticed the domination of the framed structural system with shallow beams and ribbed slabs, which triggered the need of initiating the investigation of building systems in 1985. The questions which was hard to answer at the time "Why would a system that appear to be uneconomical is so dominant?"; "does the local industry lack the ability to provide suitable and dependable quality blocks?" or "is it to do with the engineering society and design offices?" This research started as a funded project by King Abdulaziz City for Science and Technology KACST to study the suggested alternate building system [1].

The paper is presenting Load-bearing Masonry as an alternate system to the system commonly in use in the Kingdom of Saudi Arabia. The suggested system is durable and less expensive. Durability arises due to the less amount of reinforcement in Load-bearing Masonry. The study did not include slabs in details which are another area of significant saving for affordable systems.

## 2- BUILDING COUNTS

To establish the level of the phenomena several buildings counts were conducted at different times and at different locations for the last two decades by the author. The building counts are aimed to establish the percentage of the common system and to document any merging of new system into the building industry. The repeated counts at different locations and at different times always surprisingly came with the same results "framed structures with ribbed slabs and shallow beams" remains to be the prevailing system with more than 90 % of the total building systems since the seventies when this system entered in the Saudi Building Industry. An alternate building system may be used here or there for a house or for a housing project by a single owner or an organization.

## 3- LOAD-BEARING SYSTEM

When using framed structures walls are only used as removal infill partitions. Masonry walls, with load-bearing masonry, act mostly as permanent supporting walls that carry loads and few walls may be designated as removable partitions within the system to enhance the building flexibility. Walls have both thermal and acoustical properties. Some architectural layouts work better with load bearing such as listed in figure 1: a, b. The hollow nature of the wall allows the use of reinforcement or services. If reinforced properly, walls resist beside axial loads, bending and shear forces due to lateral loads [2].



Figure 2 Suggested Layouts for Load-bearing Masonry [2]: a.

4-9

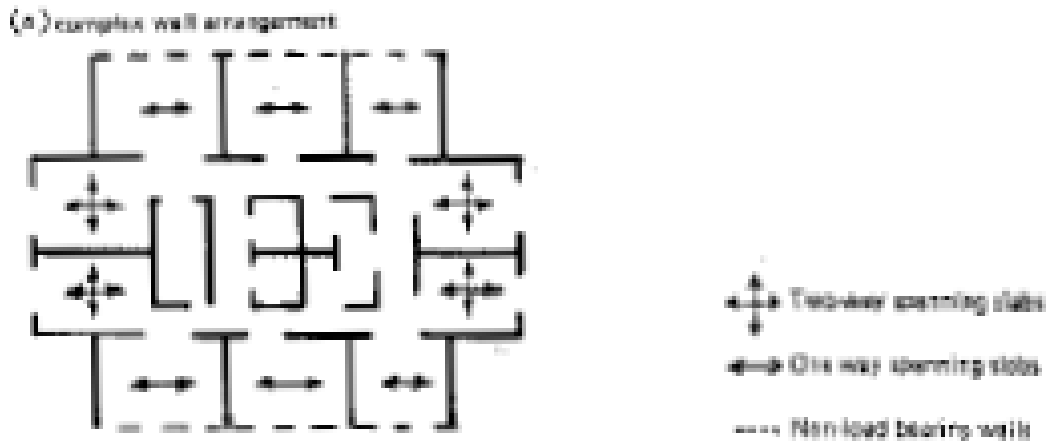


Figure 2 Suggested Layouts for Load-bearing Masonry [2].

Plastering is famous for spalling; change color and deterioration. Some quality blocks are used for exterior walls that eliminate the need for plastering. The use of fare-face clay tiles, split-fluted concrete blocks or calcium silicate blocks eliminate the need to plaster and paint for a life long building façade. There has been selected load bearing cases in the Kingdom presented in the following figures. Figure 2 to figure 4 illustrate some successful load-bearing experiences by the local industry.



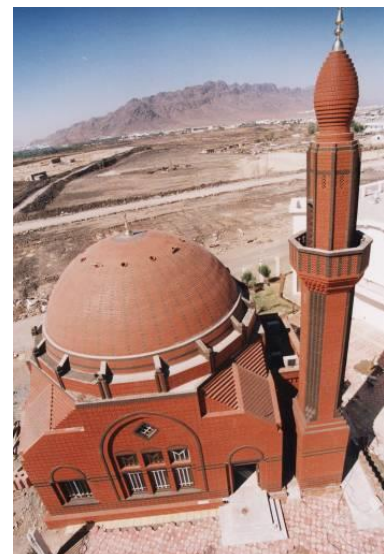
Figure 2 Successful example of better utilization of blocks



Figure 3 Successful example of better utilization of blocks



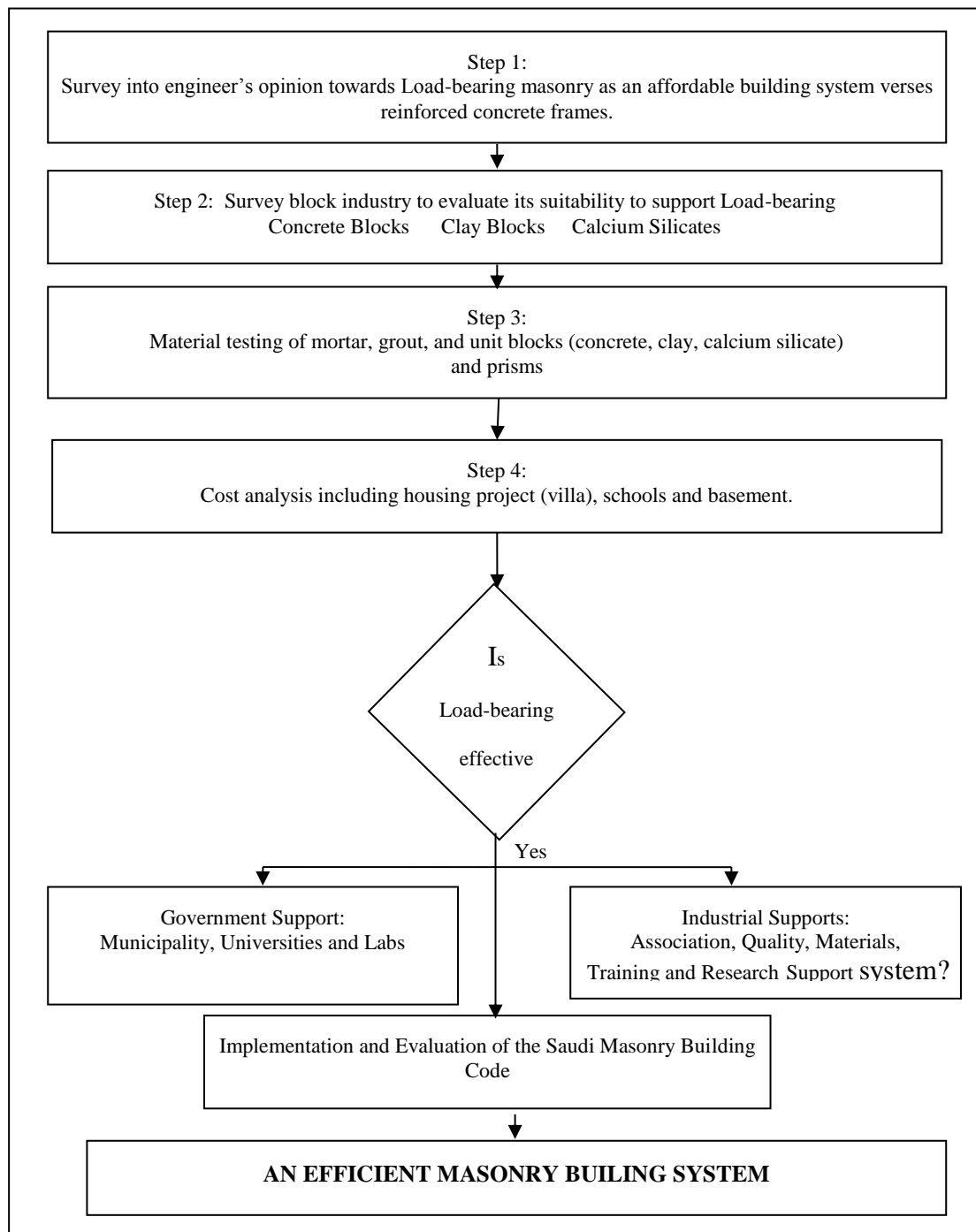
Figure 4 Successful example of better utilization of blocks



#### 4- IMPLEMENTATION OF LOAD-BEARING

The new Saudi masonry code of practice adopted from the International Building Code [3], and the American Concrete Institute Masonry Code [4] modified as necessary to suite the local industry. The author was one of the team worked with the committee addressing the adaptation process. The local industry whether its manufacturers, contractors or designers are obligated to study, implement and take ownership of the code. We are better today than two decades ago as the code is a reality now and is available for use. It was part of the frustration two decades ago when the research started and the research group had to decide to adopt a code of practice [5].

A suggested implementation plan for load bearing in Saudi Arabia is summarized in the



following and is presented in figure 5;

**Figure 5, Implementation Plan**

- (1) Survey into engineer's opinion toward choosing an affordable system for the Saudi average income family from three different systems, Namely; In-situ Reinforced Concrete, Engineered Load-bearing Masonry and Engineered Reinforced Masonry.
- (2) Evaluation of the block industry and examining the suitability of the industry today to support the suggested system. The author evaluated the concrete block industry as part of the KACST project in 1985 [6, 7]. The evaluation is repeated with emphasis on selected issues with regards to the concrete block industry and emphasis on evaluating other types of block such as clay blocks and calcium silicate. This part of the research is still in progress partial results are presented in section 6.
- (3) Testing of the constituent materials and establishing the prism strength for different types of blocks. This is also an ongoing project partially established [8]. This step is essential toward providing design aids and a code of practice.
- (4) Cost comparison of the alternate system with the common system. This stage is considered as the feasibility study toward the implementation of the suggested system. If the system is cost effective then the system is feasible and further implementations are required. The implementation required includes adopting the Saudi code of practice and receiving both government and industrial support.

## **5- ENGINEERS' SURVEY TOWARD AFFORDABLE SYSTEMS**

A Survey is performed into engineer's opinion toward choosing an affordable building system for the Saudi average income family from three different systems. Engineers were asked to select a system suitable as the affordable house for the average Saudi family. The engineer was requested to make a selection from three choices as discussed below.

It is important to briefly give the reader an over view of several useful surveys into engineers motives toward number of issues conducted by the author over the last two decades. Some of these surveys are not yet published. The author has repeatedly conducted questioners into the engineers' motives and/or interviews to study the trend or changes concerning issues related to building systems. In 1985 a study is published in The Masonry Society (TMS) which was a survey into engineers' motives toward selecting reinforced concrete verses load-bearing masonry [9]. An awareness problem is found related to number of issues with respect to building systems. In 1993 we conducted a survey into engineers' motives in selecting a slab system repeated with different objective in 2003. A survey into engineers' motives toward selecting masonry for basements verses reinforced concrete and precast concrete was conducted in 2004.

This survey is concern with the affordable building system for the Saudi family. We simply asked the engineers the following question;

“Which of the following systems would you select as an affordable building system for an average Saudi Family?”

- In-situ reinforced concrete
- Engineered Load-bearing masonry
- Engineered reinforced masonry

A model is designed to receive the response as illustrated in appendix a together with the results of the questioner. Summary of the finding of the survey is in the following;

### **5-1 Office General Information**

We visited 19 offices and met with 12 architects, 4 engineers and 4 designers. The respondents were 2 Ph. D., 2 M. Sc. and 15 B.Sc. Experience was surprisingly 4 for 5, 10, 15 and 25 years of experience and 3 for 20 years experience. Thirteen of the offices were dealing with buildings, 3 mainly civil and 3 mainly structural.



When we asked whether their education included any load-bearing masonry 8 responded with yes. When we asked whether they think it is adequate only 5 said yes. Then we asked the question whether their education included costing, 3 and 5 were positive. 15 answered yes to project management.

### **5-2 The Size of The Building**

We asked what would be the suitable Gross Floor Area of an affordable average Saudi family building. The answers came as one for (50 to 100) sq. m, 8 for (150 to 200) sq. m, 2 for (200 to 250) sq. m. and 7 for (250 to 300) sq. m.

We asked as how many stories an affordable house should be and the answers came 7 for (one story), 11 for (two stories) and 1 for (three stories).

### **5-3 The Engineers Opinion toward Affordable Housing**

Only four respondents accepted load bearing as suitable affordable building system. Most of the respondents said the reason for selecting reinforced concrete with highest score is popularity with client, seconded with ease of supervision, third contractors preference, fourth municipality approval, and fifth allow more flexibility in positioning partitions.

More than one third the respondents gave Load-bearing some value close to average for cost, fast to build, low in maintenance cost, fits well with services, good in sound insulation and good in thermal resistance.

### **5-4 Survey Conclusion**

Our finding repeatedly has proven the following;

- (1) The seriousness of an awareness problem with regards to building systems
- (2) Seriousness of awareness problems with regards to cost comparison and the lack of cost analysis when selecting a system
- (3) Although there are some attempts for larger projects there is a need on the national level to conduct feasibility studies for small project which had little or no real feasibility studies.
- (4) Owners play an important role in building system selection not based on any knowledge of other alternatives
- (5) School education form the future of our engineers that require inclusion of building systems and enhancing cost analysis and value engineering

## **6- THE BLOCK INDUSTRY**

A survey is conducted by the author in 1985 with an attempt to study the local manufacturing capabilities as part of the KACST project [1]. This survey focused on studying the concrete block factories in the form of interviews followed by testing constituent materials used in producing blocks. Then the study included testing the blocks for strength, absorption and tolerance. All tests satisfied ASTM American Society for Testing Materials and SASO Saudi Arabian Standard Organization. Factories then were classified into three categories A, B and C, see Table 1. The two classes namely A and B did satisfy ASTM requirement for load-bearing masonry as the results averaged between 9 to 12 N/mm<sup>2</sup> satisfying ASTM C 90 [10] which specifies 5.5 N/mm<sup>2</sup> (800 psi) as the requirement for Load-bearing blocks, on occasions one of the factories in class C was below the ASTM standards. The results proven the capability of the local industry to support the suggested alternate system results are listed in [6] and [ 7].

In 2004 a survey conducted focusing on selected highlights of the block industry as a follow up. Thirteen factories were visited among them it was found that eleven factories are fully automated and two were semi automatic. Ten factories used steam curing and three used normal water spaying for curing. Seven factories said they have quality control practices in their factory, one use an independent agency and the rest depend on the municipality. Ten of the factories had a resident engineer on site. Except for the quality control the data is encouraging it was also noticed that the types of the blocks introduced are larger than it was earlier in 1985.

**Table 1 Classification and Locations of Interviewed Manufacturers**

Factory Location	Class A	Class B	Class C	Total
Dammam	3	2	4	9
Khober	1	1	2	4
Jubail	2	-	-	2
Hofuf	-	2	-	2
Riyadh	2	-	-	2
Medina	-	-	3	3
Khamis Mushait	1	1	1	3

During the 2004 survey we asked a direct question “Are the blocks used as structural elements or just an infill?”. The responses came with 6 respondents do not know, 3 said rarely and 4 said occasionally.

As indicated earlier we have an ongoing study of the clay block where we are trying to establish the unit strength and the prism strength. Initial data showing very encouraging results and is above specified strength. Three types of clay blocks were tested namely P20 (10x20x40), L20 (15x20x40), RSG20 (20x20x40) the specified strength was 150 kg/cm<sup>2</sup> and the average results 153, 155 and 154 Kg/cm<sup>2</sup> respectively.

The study of the clay blocks is sponsored by Elmaimani Red Bricks Factories-Madinah.

## 7- COST COMPARISON

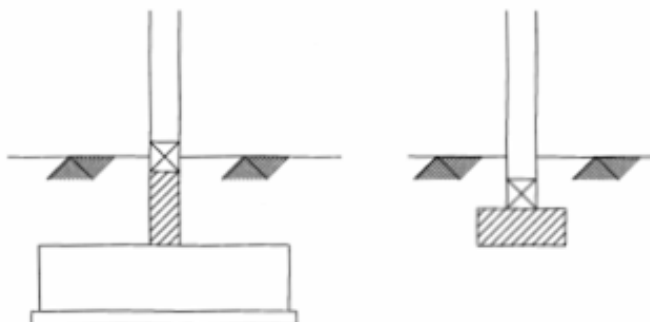
Many attempts to build for the poor ended as nice alternate systems affordable only by the rich. Load bearing is not a total stranger rather it has been around for ages. The system is known in many areas around the world and proves durability and long life. Here in this section the author present cost comparison for the Load-bearing system verses the conventional common framed reinforced concrete system. The discussion will focus on the building structure envelop and focus on areas of savings in the suggested system. Light will be shed briefly on by- products in this discussion. The building structure envelop include foundations, walls and supports (the load carrying elements), slabs systems (slabs and beams).

### 7-1 Foundation and Excavations

Foundations are the most contributors to saving between the two systems. In the framed system, walls are supported by the beams and transferred to the columns to the foundations. In the Load-bearing system walls are load carrying elements and loads are transferred through the walls directly to the footings. The loads from the slabs are transferred into a line loads to the walls to the footing. If walls are reinforced properly, walls resist beside axial loads, bending and shear forces due to lateral loads [2].

With the reduction of the weight of the walls and due to the line load per meter the size of the footing is reduced together with the excavation and back filling which contribute to most of the savings, see figure6.

**Figure 6 Foundation comparison of framed building with Load-bearing**



A villa were designed based on the data collected by the author in a survey of the engineering design offices for the average gross area of the Saudi Family in 1985 [9]. The villa designed by the investigating team [1] as part of the KACST project as a perfect square to eliminate the shape effect. The structural system were designed once with the framed reinforced concrete using the conventional ribbed slabs with shallow beams and the other with Load-bearing masonry using two-way solid slab. The results are listed in table 2. It is obvious that the foundation contributed to the largest saving. It is important to indicate that excavation saving was over seen by the investigating team as it is not included in table 2. The total saving between the two systems exceeded 18.33 % of which the foundation contributed by 9.7 % most of the rest comes from the columns.

**Table 2 Cost Comparison of Load-bearing verses Reinforced Concrete**

Description	Framed Building	Masonry	Variance	Percent
Foundation	50,382	30,940	20,042	40
Column and Edge Beams above zero	18,035	0,00	18,035	100
Walls	47,249	55,411	- 8,162	-17.27
Beams at and Above Zero	0,00	3,656	- 3,656	-100
Floor Including Beams	31,981	26,153	,828	18.22
Main Roof Including Beams	33,782	29,460	4322	12.80
Penthouse( Columns and Edge Beams)	2,286	828	1458	63.78
Penthouse Roof	1,340	1,718	-378	-- 28.2
Copings, Lintels and sills	8,325	8,325	0.00	0.00
Stairs	7,728	7,728	.00	0.00
Total	201,108	164,240	36,868	18.33

A recent study of a school conducted by Afendi [10] at King Faisal University has shown a similar saving totaling 16.8 % and the main contributors are foundation and excavations. Part of the school plan was designed by both the Load-bearing and the reinforced concrete framed system, the results are listed in table 3.

**Table 3 Cost comparison of framed building with masonry**

Description	Framed Building	Masonry	Variance	Percentage
Excavation	17,661	12,850	4811	27
Backfill	5,910	4,620	1290	22
Concrete	63,125	47,700	15,425	24
Block Work	42,090	49,834	-7,744	-18
Reinforcement	64,000	38,000	26,000	41
Labor	105,750	95,400	10,350	10
Total	298,000	248,404	50,132	16.8

## 7-2 Walls and Columns

The second important contributors are in the elimination of columns and the reduction in the total reinforcement needed for the suggested system. Notice that the system suggested and used in the design of two examples, the villa and the school are the engineered reinforced masonry which requires reinforcement. With the added reinforcement required by the new codes of practice to avoid cracking in the reinforced masonry systems there is still a lot of savings in reinforcement. Table 3 illustrates the saving in the school, the second example.

## 7-3 Slabs and Beams

Since we are discussing load-bearing verses framed structure it's fair to say slabs do not play an important role in contributing to the choice of a system. But if the discussion is carried aiming to suggest an affordable building system then the discussion open an era of suggestions and savings that again is not strange to the building industry. Aramco is using composite structures and is very

successful for the one storey buildings allowing large spans. With load bearing, system if composite structures are used additional savings is expected and more flexibility of the system would be allowed. Here we may think of schools, restaurants, sports halls or in general buildings that require larger spans and/or more flexibilities.

Another area of potential savings under study is in the utilization of walls in reducing shuttering or the ease of using semi-precast techniques that are not possible with framed buildings. Walls can be easily utilized verses beams that require shuttering and time to be able to carry loads.

Elmaimani red bricks factory suggested an interesting semi-precast system that is being evaluated as part of an on going study compared with other systems. The one way ribbed slab system that emerged in our society in the early seventy and dominating the building industry using the wide shallow beams with high percentage of reinforcement require further evaluation and discussion. The author is studying alternatives but it is early to elaborate on the subject now.

#### **7-4 Plastering and Finishing**

Another area of savings that is potential with Load-bearing are the use of fare-finished blocks. Due to the use of columns, it is harder to use with framed reinforced concrete buildings. Figure 2 is a good example of this. The industry can provide quality blocks in concrete, clay or calcium silicate that support the finished block. Noticed this is possible both from the inside of the building or the outside. It has been used for public buildings without plastering from the inside and looked very reasonable, see figure 3.

A building of 300 sq. m. gross floor average was studied to estimate the cost of plastering and painting and the result came depending on the type of the paint or the finishing material between 50,000 to 70,000 Saudi Riyals (one dollar is equivalent to 3.75 S.R.). This is another area of concern that is being addressed and evaluated. It is to do with the use of fare-finished block and study the increase cost of labors together with the savings by eliminating finishing and increasing durability and life cycle of the building.

#### **7-5 Basements**

Many places around the world are using load bearing for one and two stories housing projects particularly for basements. In Saudi Arabia the author does not know of one case except for the one designed and supervised by the author in the Alkhobar city. The building now is more than ten years old and did prove success.

A study has been conducted here at King Faisal University by Aldossary (12) as a comparison for a basement in a school. The school basement is designed once with Reinforced concrete and once with load-bearing masonry. The saving exceeded 70 %.

### **8- CONCLUSION**

Load-bearing masonry is presented as an option for the building industry in the Kingdom of Saudi Arabia. The local industry can support it and there are some successful examples of private housing, housing projects or public buildings. Cost comparisons show savings between 16 and 18 % and reached 70 % for a basement. Other areas of potential savings has been highlighted but not fully presented as the study not finished yet including finishing materials and slab systems.

Load bearing is an option with no doubts as an affordable building system it can add value as a durable long life building system at a lower cost. An implementation plan is presented by the author in the paper.

There is an awareness problem that was discussed and need to be addressed by the government agencies, universities and the industry.

#### **ACKNOWLEDGEMENT**

The author is thankful to King Abdulaziz city for Science and Technology for sponsoring the project. Thanks are extended to Elmaimani red bricks for the continuing sponsoring of the research and their support.

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**APPENDIX a****A study of the suitable system for the affordable building of an average Saudi Family in Saudi Arabia**

- In your opinion what GFA (Gross Floor Area) would you consider adequate for a typical house for affordable building for a Saudi family?  
50-100 sq.m (1)    100-150 sq.m ( )    150-200 sq.m (8)    200-250 sq.m (2)  
250-300 sq.m (7)    Don't know ( )
- Would such a typical Saudi house be single storey? Two storeys: Or more?  
1 Storey (7)    2 storey (1)    3 storey (1)    don't know ( )    More ( )
- (a) Which of these building systems would you use for the design of low-rise affordable residential building?  
In-situ reinforced concrete (15)    Engineered load bearing masonry ( )  
Engineered reinforced masonry(4)    Other (specify) \_\_\_\_\_  
(b) Please indicate on the scale 1-5 shown your opinion of the system chosen by you in.
- (a) Did your technical and/or university studies include the theory of design using:  
Engineered load bearing masonry walls    Yes (8)    No (11)  
Engineered reinforced masonry walls    Yes (8)    No (11)  
(b) Would you describe the scope and extent of your studies in engineered load bearing systems as?  
Inadequate (1) Adequate (5) considerable (13)
- Did your studies include any of the following?  
The relative economics of various Building systems    Yes (5)    No (14)  
The Present Worth of money?    Yes (5)    No (14)  
Critical Path Analysis?    Yes (3)    No (16)  
Construction or Project Management    Yes (15)    No (4)
- (a) What is the scope of your own (or your office) design work?  
Mainly Buildings (13)    Mainly Civil engineering (3)    Mainly Structural Engineering (3)  
(b) If a client requested you to design for him Low-rise residence using engineered masonry wall system would you accept (9) or decline (10)?
- What is the size of your office staff?  
1-5 (7)    5-10 (7)    10-15 (3)    15-20 (1)    20-50 ( )    Over (1)
- (a) What is your own position in the office?  
Architect (12)    Engineer (4)    Designer (3)    Other (specify) \_\_\_\_\_  
(b) What is your educational background?  
Diploma ( )    B. Sc (15)    M. Sc. (2)    Ph.D (2)    Other (specify) \_\_\_\_\_  
(d) (i) Number of years experience?    1-5 (4)    5-10 (4)    10-15 (4)    15-20(3)    20-25(4)    Other (specify) \_\_\_\_\_  
(ii) Years of experience in Saudi Arabia (specify) \_\_\_\_\_

Please indicate your opinion on the scale 1-5 shown below about the system chosen by you

	<b>5</b>	<b>4</b>	<b>3</b>	<b>2</b>	<b>1</b>	
	<b>Very</b>	<b>Quite</b>	<b>Neutral Average</b>	<b>Quite</b>	<b>Very</b>	
Economic in cost	4	9	7			Expensive in cost
Fast to build	2	8	7	3		Slow to build
Easy to gain Municipality's Approval	8	8	4			Difficult to gain municipality's approval
Popular with clients	10	4	3	2		Unpopular with clients
Sound structurally		10	8	1		Unsound structurally
Low in maintenance cost	7	5	7			High in maintenance cost
Long in life-span (durable)	7	8	5			Short in life-space (not durable)
Good in appearance	7	11	1			Poor in appearance
Easy to supervise	9	6	4			Difficult to supervise
Preferable to contractors	9	5	3	2		Not preferable to contractors
Fits well with service systems	4	7	7	1		Doesn't allow much flexibility in positioning partitions above it
Good in sound insulation	1	11	7			Poor in sound insulation
Allows more flexibility in positioning partitions above it	7	9	2	1		Doesn't allow much flexibility in positioning partitions above it
Good in thermal performance	2	9	6	1		Poor in thermal performance
Can cover big span	4	9	3	3	1	Cannot cover big span

## **4-5 PRACTICAL AND APPLIED EXPERIENCE TO BUILD VILLAS AND LOW-COST HOUSES IN AL MEDINA ALMONAWARAH REGION**

**Kamal Hussni Rasheed Al Qabli, Engineer**

Maymani Red Bricks Factories  
Medina, Saudi Arabia  
Sales@elmaimani.com

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\* This paper was presented in the symposium as a working paper; written text is not available. To get a copy of the presentation, contact the Symposium secretary.

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### **Abstract:**

*Buildings have been essentials for human kind along all stages of the history up to now. In ancient times construction was simple using in all its elements material which was available in the surrounding environment such as stone, mud, and wood. In spite of being simple, these traditional buildings which existed in Saudi Arabia, have stood and stayed usable until this moment, regardless of continued abandoning and desertion as well as lack of care and maintenance. With the emergence of Reinforced Concrete (RC) construction method, the traditional Wall Bearing (WB) systems were put aside because of unsuitability of material to modern activities and needs. Besides, traditional material were hard to get in comparison with cement, iron, and other components of reinforced concrete, not to mention that preparing a RC building is much more faster than traditional (WB) building .*

*As the industry and technology of producing Burned Clay Red Brick (BCRB) improved, WB construction with BCRB has become as good as building with RC system in terms of endurance, workability and easiness. The introduction of new advanced techniques in the pre-cast RC molding frames has made it possible to return to the traditional WB system supported with RC pre-cast spines. This new WB system improves the process of construction in time, handling, and project completion as well as the considerable reduction in cost. This working paper reviews the experience of red brick factories in Medina in using WB construction method in building houses. It lists the advantages of this new improved system.*

### **Keywords:**

*Wall Bearing Construction, Red Burned Clay Bricks, Pre-cast Reinforced Concrete Spines, Construction Cost Reduction.*

# **SECTION 4: CRITERIA FOR SELECTING ELIGIBLE CITIZENS AND INFORMATION RECORDING AND MANAGEMENT**



## **4-1 BUILDING AFFORDABLE HOUSING FOR ELIGIBLE RESIDENTS: THE EXPERIENCE OF AL-MADENA AL-MONAWARAH**

**Yahia Saif Saeed Saleh, Engineer**

General Manager of Charitable Society for Social Services  
Medina - Saudi Arabia  
yhy@gwab.com

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\* This paper was presented in the symposium as a working paper; written text is not available. To get a copy of the presentation, contact the Symposium secretary.

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### **Abstract:**

*The provision of a house is a basic necessity to achieve social and living stability for a family as it lifts a big burden of the shoulder of a family supporter and liberates him to gain income enough for other living expenses. The field surveys carried out by the Charitable Society for Social Services in Al-Medina (CSSSA) on cases requiring financial support or medical care have shown that the houses owned or rented by poor citizens benefiting from the CSSSA support have been depredated. One of the reasons for that is that owned houses are usually not completed and lacking basic fixtures and parts. While rented houses are normally rented with a sizable part of the family income exceeding its financing capability. Moreover, these houses are situated in over populated high-density slums. These problems escalate the social problem and reduce the opportunity to reach proper solution for this situation. Since 1412, the CSSSA Council has observed that concentrating on individual cases of beneficiaries has been very effective way to elevate the sufferings of such cases. This way contributes well in creating much favorable conditions for the specific cases where the beneficiaries become more motivated to take self initiative role in completing the job by themselves satisfying other demands of their families and reducing their dependence on the society.*

*The paper aims to presents a review of the experience of CSSSA in providing affordable housing for the poor and needy families in the metropolitan Area of Medina and outside it, especially in the remote areas of the province.*

### **Keywords:**

*Voluntary Work, Neighborhood Centers, Affordable Housing Communities*

## **4-2 CRITERIA AND PROCEDURES FOR AFFORDABLE HOUSING ELIGIBILITY FOR PROJECTS OF PRINCE MOHAMMED BIN FAHD BIN ABDULAZIZ FOR AFFORDABLE HOUSING IN THE EASTERN PROVINCE**

**Abdullah Hussain Al Kadi, Ph. D.**

Assistant Professor  
Dept. of Urban and Regional Planning  
College of Architecture and Planning, King Faisal University  
al\_kadi@yahoo.com

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\* This paper was presented in the symposium as a working paper; written text is not available. To get a copy of the presentation, contact the Symposium secretary.

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### **Abstract:**

*The general objective of “Projects of Prince Mohammed bin Fahd bin Abdulaziz for Affordable Housing”(PMFAH) in the eastern province of Saudi Arabia is to insure suitable and affordable housing for the low-income community to the limit where this type of shortage diminishes asymptotically. This is to be done within the available resources, according to social priorities, and fitting the declared procedures. To achieve that main objective within these conditions, this study comes to state and define “eligibility criteria and procedures for affordable housing”.*

*The following elements will be discussed: affordable housing eligibility/poverty line; minimum standards for humane housing; social priorities to be considered, list of routine eligibility conditions; procedures and criteria for assigning houses; proposed “Act of social affordable housing;” and finally, highlights of social and environmental conditions necessary to sustain social profitability out of affordable housing projects. This is to be done through links with other social programs; education, employment, and other high standard of living considerations.*

*All these details will be discussed to present an applicable model for the organization (PMFAH). Similar organizations in the Gulf States can make use of our proposal presented herein.*

### **KEY WORDS:**

*Affordable and Charitable Housing, Social Development Programs, Eligibility Criteria and Procedures, Vocational Training and Development of Poor.*

## **4-3 REVIEW OF CHARITABLE HOUSING EXPERIENCE IN HAEIL REGION**

**Saad Abdul Aziz Aljarwan, Engineer**

Manager of Projects Center of the Development Authority of Haeil Region  
Member of the Charitable Housing Committee of Haeil Region  
gerwansa@hailcom.com

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\* This paper was presented in the symposium as a working paper; written text is not available. To get a copy of the presentation, contact the Symposium secretary.

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### **Abstract:**

*The fast and large urban growth and development that has been occurring in the Saudi cities lately- the city of Haeil is one of which- has been the cause of several profound problems. One of these problems is the provision of suitable and affordable housing for large number of Saudi population. The Real-estate Development Fund "RDF" has played a role in partial overcoming of such a problem. However, the RDF has met only little portion of the up growing demand for housing. It take a very long time to get a housing loan from the RDF. Furthermore, the cost of renting a house has increased in the last decade. Consequently, poor families with no or low income have become unable to secure a house through building or renting.*

*Here comes the role of his Royal Highness the Prince of Haeil who has formulated a committee for charitable houses to serve the poor and needy people of Haeil. The Committee is chaired by him personally. The Committee aims at building well designed modern houses with reasonably low construction and maintenance cost to accommodate the residential need of poor and needy families, including widows and orphans. The Charitable Housing Committee of Haeil opt to achieve both social and economic development of this part of the society which is in desperate need for help and support. Other institutions such as the Supreme Committee for Haeil Development will address other aspects of development. The final aim is to complete the development process and improve the people quality of life in Haeil Region.*

*This research, reviewing the Haeil Experience in charitable Housing, will present the initiation of the Charitable Housing Committee of Haeil, its objectives and its organizational structure. In addition, the research will summarize the various stages of the developing a charitable housing unit and project: the design, finance, construction, supervision, highlighting the hindrances facing the work of the Committee.*

### **Keywords:**

*Charitable Housing, Organizational and Administrative Structures, Social and Economic Development, Project management, Development process.*

## **4-4 PROVISION OF AFFORDABLE HOUSING AND THE ROLE OF REAL ESTATE DEVELOPERS IN SAUDI ARABIA**

**AAied Farhan Al-Gahtani**

President Al Oula for Real Estate Development  
Al-Khobar – Saudi Arabia  
aydh@aloula.com

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\* This paper was presented in the symposium as a working paper; written text is not available. To get a copy of the presentation, contact the Symposium secretary.

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### **Abstract:**

*The Dilemma of providing an affordable house for the Saudi community lies within the lack of definitive understanding of the term “Affordable Housing.” The multifaceted aspects associated with the “affordability” of a community are so wide that it encompasses a broad variety of economical, social and institutional/legislative factors. The cumulative impacts of these factors require a “nation-specific” understanding of the housing affordability dimension. Although this paper does not attempt to define the housing affordability of the Saudi community, yet it will attempt to sum up a number of factors specific to Saudi Arabia in order to identify a role that would be played by Real Estate developers in the provision of affordable housing.*

*In a fast changing social and economic conditions here in Saudi Arabia, the housing sector has not been able to keep pace. Housing- in general- has lagged behind offering only huge houses on large land parcels beyond the reach of the majority of Saudi families. What makes the conditions of owning a decent house at the “free market prices” worse is the absence of suitable financing mechanisms.*

*It is time to tackle the issues of housing affordability in a broader and more integrated approach, and that is where Real Estate Developers- as partners in developing our communities - may have a role.*

### **Keywords:**

*Affordable Housing, Community, Real Estate Developers, Saudi Arabia.*

## **SECTION 5: THE ORGANIZATIONAL ASPECTS OF AFFORDABLE HOUSING**

## 5-1 A PROPOSED ORGANIZATIONAL STRUCTURE FOR EFFECTIVE AND EFFICIENT MANAGEMENT OF CHARITABLE AND AFFORDABLE HOUSING

**Mohammed Nasser Al Beshi, Ph. D.**

Public Administration Institute  
Riyadh, Saudi Arabia

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\* This paper was presented in the symposium as a working paper; written text is not available. To get a copy of the presentation, contact the Symposium secretary.

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### **Abstract:**

*The researcher has been eager to participate in the symposium in the theme: Administrative and organizational structures of Charitable and affordable housing. He held two meetings with officials in Alber Society of the Eastern Province with an aim to delineate the limits of the structure to be proposed according to the following:*

- *Proposing the vision and message of charitable and affordable housing. projects.*
- *Articulating the main objectives of charitable and affordable housing. projects.*
- *Proposing the administrative and organizational structures of charitable and affordable housing. projects.*

*The proposal is comprised from four stages, namely:*

- *Preparation Stage: It includes the recognition of similar cases and experiences concerning the process of house management, and reviewing documentations on the studied subject.*
- *Data Gathering Stage: I has not been completed, yet due to the nature od the housing affordability. Therefore, the researcher has depended in large on his long practice of public Administration.*
- *Data Analysis Stage: It depends on the review of recommendations and ideas raised by participants in the symposium.*

### **Keywords:**

*Administrative and Organizational Structures, Affordable Housing Communities, the Eastern Province.*



# **FINAL RECOMMENDATIONS**





Upon concluding the activities of the 1<sup>st</sup> Affordable and Charitable Housing Symposium which was held during the period from 18-19<sup>th</sup> April, 2006 in Al-Kubar City, Saudi Arabia; the participants have reached their final recommendations.

#### **FIRST- GENERAL RECOMMENDATIONS:**

- The symposium attendances extend their thanks to the Government of the Custodian of the Two Holly Mosques for its support and facilitation of Affordable housing in the Kingdome.
- The symposium attendances extend their gratitude to His Royal Highness Prince Mohammed Ben Fahd Ben Abdulaziz, the Prince of the Eastern Province, for his patronage and opening of the Symposium.
- They recommend that the Affordable and Charitable Housing Symposium is to be held at a regular basis, every two years, and that the next Symposium is to be held during the period from 28-30 April 2008, corresponding to Rabea II, 1429 H.
- The theme of the next symposium is “Innovative Solutions and Ideas to Affordable Housing.”
- The attendances recommend that frequent short workshops should be held (every 3 to 6 months) tackling specific immerging issues of affordable and charitable housing and introducing practical solutions for them.
- They share views of the importance of continuing scientific involvement in the field of affordable and charitable housing using the resources of universities and other Saudi research institutions to study the various aspects of affordable and charitable housing and find practical solutions for them.
- The attendances recommend the establishment of a new committee named “The Supreme Committee for Housing Affordability,” whose main task is to develop, implement and follow up a comprehensive long-range national strategy for housing affordability—a strategy that coordinates all efforts and resources of public and private institutions and individuals involved in the housing sector.
- The attendances recommend the selection of a permanent committee from among themselves to follow up with the recommendations of the symposium.

#### **SECOND- RECOMMENDATIONS OF SCIENTIFIC SESSIONS:**

- Applying sound and just criteria in selecting the beneficiaries of charitable housing and developing a selection digital system that could be shared by all organizations involved in the process at the Kingdome level.
- Initiating a comprehensive interactive database on affordable and charitable housing and making it accessible to all concerned institutions.
- All types of governmental support are required to enforce the role of non-profit organizations in facilitating charitable housing. This support includes free grants of land to build new projects, ease of building permits procedures, financial assistance and technical support.
- High quality assurance measures must be applied along the various stages of the process of developing charitable housing projects. This includes sound site selection for new projects, standard and sufficient basic services within the sites, efficient functional relationships and accessibility, suitable environmental conditions, high esthetic values, sound structural systems, stable and self-supporting economy for the residents, and continuous monitoring and maintenance of the projects.
- Paying careful attentions to the human and psychological dimensions of the less-capable persons eligible for charitable housing and respecting their dignity and feelings along the process of designating a house for them.
- Affecting “citizen participation” in all the stages of affordable and charitable housing development to better express the needs of residents, solve their problems, and achieve their goals using all resources available to them.

- Using proper alternatives of building materials and methods that maintain aesthetic values, sustainable economy, cost efficiency, and suitability with local climatic and environmental conditions.
- Affecting the concept of “integrative social centers” and the central role of “mosque” in enhancing the ethical and moral values, enforcing social interaction, strengthening voluntary work, and making good use of residents’ and youth’ spare time in healthy cultural, recreational, sport, and social activities.
- Applying the principles of sustainability and using innovative solutions to reduce cost while preserving the quality at all stages of the development of affordable and charitable housing projects (planning, design, implementation, and monitoring).
- Applying proper building performance assessment approach in affordable and charitable housing projects in order to insure quality and sustainability of the projects, measuring residents’ satisfaction, quality of maintenance and other criteria.
- Considering the upgrading of existing housing stock in old districts as an approach to housing affordability and a way to lessen the cost of new projects.

### **Recommendations Committee**