

## **A Model of Housing Quality Determinants (HQD) for Affordable Housing**

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**Abstract:** This research identifies the design quality determinants and parameters for affordable housing in a developing metropolis, Karachi, Pakistan. The absence of quality housing in Karachi has resulted in a variety of factors including policy failure, violation of bylaws, housing scarcity and more low quality housing. The combination of these factors has resulted in poor housing design and construction and has lowered the overall quality of housing. Homeowners (end-users) experience unplanned maintenance and repairs. This study provides a design quality model for use as a survey tool among professionals and end-users. This study resulted in a table of 24 quality determinants marked as Housing Quality Determinants (HQD) grouped into eight sections. This research concludes that the existing design quality of affordable housing in Karachi could be enhanced by resolving problems related to design, construction, services, site development, neighbourhood and sustainability. The HQD model provides a platform for developing quality indicators of housing design and an opportunity for local and international design and construction professionals to rethink design in the context of housing quality. This article provides the development of the HQD framework (model).

**Keywords:** Affordable housing, Housing design quality, Quality indicators, Quality standards in housing

### **INTRODUCTION**

The spatial organisation of dwellings changes rapidly and is highly influenced by design trends, region, culture and society. Society and cultural values establish a spatial order in and around living spaces and reflect the characteristics of such spaces. A relation exists between space and human interactions and differences in social systems influence a variety of housing layouts. Families, or groups of people, restrain a socioeconomic structure. Despite being a small element, the family forms a core that comprises the future of a society. A family needs a certain quality space, a "house," to achieve this function. Planning and design solutions are concentrated on design faults and deficiencies of the built environment. Low design quality results in dissatisfaction, building defects and limited maintenance. Low design quality indicates that the design was created without considering building performance and maintenance, or that the construction phase was unchecked by field experts. A review of building problems revealed that the housing sector falls short of quality requirements. This condition

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must be mitigated because the entire global population is living in some form of shelter or enclosure called a "house."

Hussain (2007) outlined the existing housing deficit in Pakistan and mentioned that basic housing remained out of reach for most Pakistanis. The study further added that the housing deficit remains a critical issue, with Pakistan suffering from a housing deficit of close to seven million. This problem is compounded by the additional shortfall of 400,000 urban units experienced annually. The statistics mentioned by Hussain revealed that housing is experiencing a major setback in Pakistan. This finding raises awareness of the dire need for a proper housing policy that would develop and maintain the supply chain of quality housing in both the public and private sectors. Hussain suggested that housing conditions in crowded cities in Pakistan are at risk and the absence of proper housing policies has further diminished the perception of quality housing in city centres.

The effects of housing design and its influence on residents is further highlighted by the report from the Human Rights Commission of Pakistan (2005). The report stated that over 60,000 people slept out in the open sky throughout the year in Lahore (the second largest city in Pakistan), with a similar number observed in Karachi. This number increased during the summer months, with congested and low comfort housing conditions leading many people to sleep outside.

In a study of affordable housing in Karachi, Lari stated that, "Karachi has become a sprawling soulless concrete jungle where services are scarce and sporadic", (Lari, 1996). He also reported that "the quality of architecture is bleak and alienating" (Lari, 1996).

Cowasjee (2004) provided evidence of how bylaws are violated by building control authorities in Karachi. He disclosed that bylaws of private and cooperative housing societies were blatantly violated by the Karachi Building Control Authority, which approved the construction of buildings with a ground level and more than six floors. The bylaws only permit a ground level plus one floor. Violations to the bylaws have contributed to the gradual transformation of Karachi into a city jungle of low-quality apartment blocks without any consideration of the negative effects on the environment and on the citizens of the city.

Previous studies have revealed that Pakistan in general and particularly the city of Karachi, are experiencing housing problems related to ineffective housing policy, outdated housing standards and non-compliance to housing standards. These problems have created a gap in the understanding of housing quality. No platform or criteria exist to help professionals and end-users understand the design quality of a house. End-users do not understand the meaning of housing quality and are generally attracted by housing design simulations. Through the formulation of an HQD, this research has provided a point of reference (quality criteria) for end-users to understand the basic criteria of housing design quality.

## **FEASIBILITY OF THE STUDY**

This research considers problems related to housing quality in a developing region such as Karachi, Pakistan. This study focused on the design problems of private housing that have evolved from low design quality. The research objective is to formulate an assessment framework that can be implemented during housing

design development and can be used to assess the conditions of housing at the pre- and post-occupational stages. Aside from building bylaws, no comprehensive paradigm is available for evaluating housing design in Karachi, Pakistan. The current building bylaws in Karachi are regulated by the Karachi Building Control Authority (2007). These bylaws are decades old and are restricted to certain guidelines for peripheral and enclosure designs. A detailed account of end-user satisfaction, welfare and security is not provided in these bylaws. The National Energy Conservation Centre (ENERCON) Pakistan has established criteria for energy conservation and the thermal comfort of end-users. However, the efforts of these two organisations do not address housing design quality in the broader spectrum, as intended by the HQD model.

## **HOUSING DESIGN QUALITY**

A review of building problems revealed that the housing sector suffers the most during the design and construction phases, which remain unchecked by field experts. International organisations, such as the United Nations-Habitat and the World Bank, have raised concerns on the growing population and unavailability of quality housing in the developing world. United Nations-Habitat (2007) reported that if the high rate of urbanisation continues, the urban population of the developing world will reach approximately six billion people by the end of 2050. This population increase will result in a high rate of demand in urban areas and put pressure on the existing housing supply.

A World Bank report (1993) highlighted the low quality of houses in developing nations and reported that a large fraction of the population living in the developing world has limited access to quality housing. The report also highlighted concerns over the growing population and inadequate housing in the developing region and stated that developing regions have undeveloped land and economic potential but are handicapped by inadequate housing and infrastructure, including water and sanitation. A later report from the World Bank (2000) suggested that underdeveloped countries should do more to ensure better service provision in housing through innovative arrangement and design. The report suggests that to achieve this objective, changes should involve private developers, voluntary agencies and community organisations.

The above discussion suggests that the governmental sector in developing nations has failed to meet the housing needs of their citizens. Therefore, the private sector should step forward to solve the housing issue at the micro level. The present housing scenario is one of the major reasons for low-quality housing design in developing countries.

Housing quality is also a major issue in developed countries. Jansen, Siahpush and Simpson (2008) described the state of housing quality in Australia and mentioned that one aspect of social disadvantage is housing inadequacy; the study considers low-quality housing as a social disadvantage and states that low-quality housing design does not fulfil the basic needs of the end-user.

Ely (2004) mentioned that houses are such awkward properties that people are often imprisoned rather than housed in them. Perhaps the author is referring to low-quality housing design and compares the overall environment of available housing with a prison environment. Prisons have spatial limitations; for

instance, beds and toilets are grouped together without any partition, such that people have limited access. These factors indicate that low-quality housing design can make a dwelling place resemble a prison.

To understand housing quality and its effects on residents, the Commission for Architecture and Built Environment (CABE, 2006) conducted a study to evaluate the design quality of new homes in England and established an active link between housing quality and community development. The study asserts that housing quality and space determine the success or failure of a community. The study also implied that the success or failure of a neighbourhood is exclusively dependent on housing quality and open space, regardless of income group.

The chairman of the CABE (Sorell, 2006) further highlighted the importance of design quality when he stated that design quality cannot be considered as an optional and additional factor but is rather a requirement. This statement suggests that design quality should not be limited to certain types of buildings and housing. This phrase may be directing professionals to consider quality as an integral part of their creative work and that good design quality should not be confined to prestigious edifices.

The importance of design quality was articulated in the report published by CABE (2006). The report highlighted the importance of design quality in buildings and warned of the possible repercussions of poor design. The report stated that the absence of design quality may have significant adverse environmental, social and economic effects. The report further added that low design quality could lower the quality of life. The report also defined what comprised good design quality and stated that a design ought to be fit for the purpose, be sustainable, efficient, coherent, flexible and good looking with a clear expression of requirements. This definition confirms that good design pertains not only to the appearance of a built environment but also to the development of the people within its periphery. The report further added that good design quality could enhance life.

The Housing Corporation England (2007) defines good quality housing design as the delivery of desirable, affordable and high-quality homes and environments that utilise innovative approaches to satisfy needs and help address the aspirations of the occupants and the wider community.

Simmons (2005) considers character, legibility and principles of design to be the basics of design quality and the extent of their existence in any design determines high design quality.

Housing design quality was established by William (2007) through a study commissioned by the Housing Corporation England. The study defined the design of affordable housing and formulated quality standards of housing. The report asserted that good design should contribute positively to making places better for people. The study revealed that the quality of a space is correlated to the users and that the presence of quality in space design is necessary for user satisfaction.

Watt (2007) highlighted the image of a good building and explained that a building should act as a container or envelope that buffers or filters external conditions for internal needs. Watts further added that this image is the simplest definition for the function of a building. The study used an analogy of a building envelope that serves as the skin surrounding the occupants and modifying the environmental conditions.

According to Baird et al. (1996), a well-designed building performs well and enhances our lives, communities and culture. A low-quality design building could affect our health, work, leisure, thoughts and emotions. Watt (2007) and Baird et al. (1996) both supported the idea that a well-designed building not only enhances the lives of users but also helps to nurture their leisure and supports their emotional needs. The above paragraphs can be summarised as follows:

1. The quality of housing design influences the individual and community. Design professionals should understand their responsibilities and adopt high design quality in housing projects.
2. The well-being and satisfaction of the resident population should be considered a priority. The buildings, particularly housing, should be designed in a way that helps build a positive image of the community and urban environment.

Previous studies have revealed that a house, or its multiple forms, has remained the subject of research and discussion in a number of reputable platforms, such as CABE, the United Nations and the World Bank. Despite the availability of modern resources and technology, optimisation of design quality has rarely been applied to modern buildings and housing. This limitation has continued to cause numerous imbalances and deficiencies in the subsequent design of buildings.

This scenario validates the need for a framework for assessing design quality in the design and construction industry. The HQD framework system would check the design and construction processes at various stages, from 2D drawings to the application of an outer fabric and skin to the façade. Such quality measures will improve building performance and life span, prevent highly taxed defects and reduce the requirement for maintenance.

## **DEFINITION OF AFFORDABLE HOUSING**

Affordable housing is a term introduced to cater to a large group of people living in a diversified condition with low to modest incomes. Affordable housing varies among people and among regions. The term refers to the housing type for low to medium income groups. An explanation of the terminology used in this study is important as it relates to potential housing types and potential users.

The United States Department of Housing and Urban Development (2004) defines the term affordable housing as, "the housing that costs no more than 30% of a household's monthly income." The definition indicates that to be affordable, the rental and utilities in an apartment or monthly mortgage payment and housing expenses for a homeowner should be less than 30% of a household's monthly income.

The City Council of Calgary (2002) approved and defined affordable housing as housing that adequately suits the needs of low- and moderate-income households at costs below those generally found in the market. Affordable housing may take on a number of forms that exist along a continuum, from emergency shelters, to transitional housing, to non-market rental (also known as social or

subsidised housing), to formal and informal rentals and ending with affordable home ownership.

The Canada Mortgage and Housing Corporation (2002) determined that for housing to be affordable, a household should not spend more than 30% of its gross income on a rented shelter. This view is reflected in the Department of Housing and Urban Development (2004) definition, which states that, for a house to be affordable, its repayment should not exceed 30% of a homeowners' salary.

Queenstown Lakes District Council is a government organisation working for the betterment of the built environment in New Zealand. Queenstown Lakes District Council (2007) defined affordable housing as a residential activity, the cost of which to rent or own generally does not exceed 30% of the income of low- to moderate-income households.

Communities and Local Government of the United Kingdom (2006) published the guidelines for "affordable housing" as follows:

1. Affordable housing includes social rented and intermediate housing, provided to specific eligible households whose needs are not met by the market;
2. Affordable housing meets the needs of eligible households. These needs include availability at a cost low enough for them to afford, determined with respect to local incomes and local house prices;
3. Affordable housing includes provisions for the home to be retained for future eligible households; and
4. If these restrictions are lifted, any subsidy should be recycled for alternative affordable housing provision.

The above guidelines reveal that different government groups and organisations recognise the importance of outlining the housing typology in the modern world. Only recently, housing used to be categorised as low, medium and high cost. However, the basic understanding of these terms has changed because of the influence of a complex set of economic conditions such as high land value, growing inflation and higher housing demands. These housing categories have failed to match the contemporary world. World forums and housing experts have coined the relatively new term of "affordable housing" to replace the old terms of low- and medium-cost housing. Analysis of the term affordable housing reveals that this new concept is not only capable of defining the range of housing but also contributes to the development and refinement of the demands of housing ranging from low- to medium-cost housing. The term enables designers and developers to understand the basic needs of housing and to adopt the benchmarks of quality set for the range of housing.

The term "affordable housing" is useful and easy to understand:

It complies with the range of housing entities for various income groups, i.e., from low cost to medium cost. A threshold of 30% of monthly income sets a standard for affordable housing.

## **METHODOLOGY**

Determining the problems with housing quality is a key step toward establishing the HQD framework for affordable housing in Karachi. Housing quality was determined by a literature review and verified using various techniques, such as occupational condition survey, site visits, questionnaire surveys and interviews (structured/unstructured).

The study circumscribed the existing matrices of design quality of affordable housing. Contemporary models of housing quality, including the CABE, Building Research Establishment, Housing Corporations models from the United Kingdom, Department of Housing and Urban Development model from United States and the Scottish model (Section Matrices of Design Quality), were used as references to provide an extensive and viable platform for this study. The schemata of these models were studied, analysed and discussed with professionals, including architects, engineers and construction managers (A/E/C). The synthesised quality determinants (Table 2) were validated through unstructured interviews to ascertain the HQD model. The interviews were conducted with two types of respondents: users and A/E/C professionals.

In these models, the strength of each design quality determinant was measured for possible inclusion in the HQD framework (Table 1). The researchers conducted site visits, condition surveys of housing blocks and unstructured interviews to evaluate the housing quality at various sites in Karachi and to validate the secondary data. These surveys were conducted at 16 sites in Gulshan-e-Iqbal, Saddar, North Nazimabad, Gulistan-e-Johar, Federal Blue Area, Buffer Zone, North Karachi and Nazimabad. These sites are located in four towns of Karachi: Saddar, Gulshan, Liaquat and North Nazimabad. These towns are densely populated residential areas that provide a vast range of affordable housing. These towns provided sufficient information on affordable housing requirements for this research.

The research methodology in this study is largely based on both primary and secondary methods of data collection. Primary data were collected through framework validation, as discussed in this article. Validated secondary data were used as primary data for this research. The research phases show in Figure 1.

The final model of HQD was drawn through the triangulation of literature review, synthesis of quality matrices and site survey and validation of the framework through unstructured interviews. The methodology of this research is based on the following research precedents:

Burt (1978) suggested that all factors of building responsible for user satisfaction should be evaluated to determine the design quality.

Powell (1987) determined that the collective judgment regarding a range of varied buildings is important for their quality assessment. This process is an important step in determining the quality aspects.

Baird et al. (1996) stated that building evaluation involves the systematic assessment of building performance-related objectives and requirements. The assessment process is a tool for constructing the appropriate building for the people who own, manage and occupy it.

Liu (1999) stated that post occupational evaluation of a building provides mechanisms for feedback for both users and professionals. This research also

implies that a reliable set of design quality indicators can be developed through building evaluation by users and professionals.

Other prominent individual researchers, such as Seeley (1987), Zavadskas, Bejder and Kaklauskas (1998) and Wood (2003) and organisations, such as Chattered Institute of Builders (1982), Building Research Establishment (1983), Housing Corporation England, (2007) and CABE (2006) have addressed design quality, building maintenance, building decay and faulty design. Most of these individuals and organisations followed a systematic approach to conduct research, by identifying problems through surveys and judging their gravity through literature appraisal, data analysis and suggestions.

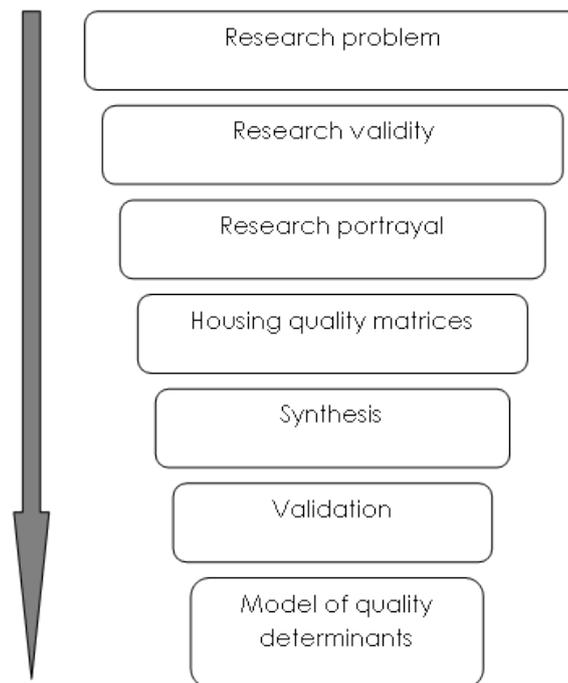


Figure 1. Research Path

## FRAMEWORK DEVELOPMENT

The framework was developed from preferential studies of housing quality variables. The quality variable was evaluated and extracted from earlier studies by scholars and organisations. A framework was established from available references. The design quality matrices were developed through the work of field experts to establish the framework for this study. The corresponding quality variables were evaluated from precedent studies and then synthesised accordingly. The synthesised design quality variables are listed in Table 2. These

variables were further grouped by their respective placement in the building design phase. The schematic is shown in Figure 2.

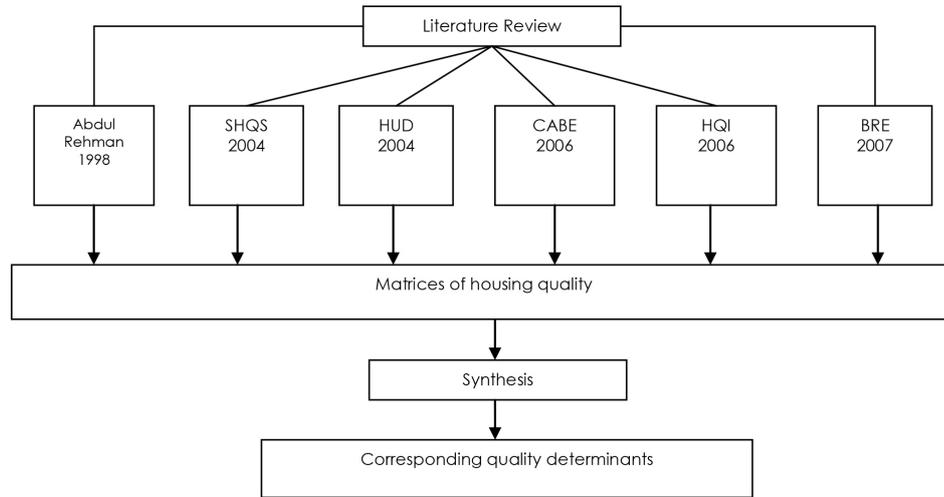


Figure 2. Framework of Housing Quality Matrices

### Matrices of Design Quality

*Matrix 1* incorporates the findings of Abdul-Rahman, Kwan and Woods (1998), who identified the design elements influencing the quality of low-cost housing. The following quality features are important in determining housing quality:

1. Layout of the flat (e.g., living area, kitchen, bathroom, bedrooms, balcony, etc.)
2. Workmanship (installation of ceiling, door, window, tiling, painting, plastering, plumbing work and electric wiring)
3. Garbage collection system
4. Environmental conditions (e.g., air quality, noise, traffic congestion)
5. Appearance/design
6. Internal conditions (lighting, ventilation and temperature)
7. Accessibility (shops, school, market, parking lots, playground/park)

*Matrix 2* was developed from the Scotland Housing Quality Standards (2007). These key quality standards were developed and implemented by Scotland in 2004 to maintain housing quality in the country.

Scotland determined these housing standards through a government initiative. The Scotland Housing Quality Standards is intended to ensure that Scotland's social housing provides decent homes for people to live in. The Scotland Housing Quality Standards were introduced by the Ministry of Communities in Scotland in 2004, but a more recent progress report was also included. The standards provide criteria composed of five items that a property must meet. These items include the following:

1. Above the tolerable standard
2. Free from serious disrepair
3. Energy efficient
4. Modern facilities
5. Healthy, safe and secure

*Matrix 3* illustrates the HQS developed by the United States of America and highlights the minimum quality standards for housing in the US. These standards were planned by the United States Department of Housing and Urban Development for the provision of healthy homes (Department of Housing and Urban Development 2004). According to Department of Housing and Urban Development, housing quality can be evaluated in terms of performance and acceptability criteria from the following 13 key aspects of housing quality:

1. Sanitary facilities
2. Food preparation and refuse disposal
3. Space and security
4. Thermal environment
5. Illumination and electricity
6. Structure and materials
7. Interior air quality
8. Water supply
9. Lead-based paint
10. Access
11. Site and neighbourhood
12. Sanitary conditions
13. Smoke detectors

*Matrix 4* was prepared from the study by the CBE (2006), which is the United Kingdom's champion of design quality. Several key facets of design quality are identified:

1. Function
2. Appearance
3. Context
4. Buildability
5. Maintenance
6. Sustainable characteristics in town and landscape
7. Quality of urban realm
8. Accessibility and local permeability
9. Legibility
10. Adaptability
11. Diversity and choice

*Matrix 5* shows the set of Housing Quality Indicators developed by the Housing Corporation England (2007). These indicators identify and develop performance measures set for the core performance of a house. The specified Housing Quality Indicators provides guidelines to ensure better housing quality.

The Housing Corporation mentions that housing providers should produce well-designed, good-quality housing to meet identified needs in places where people want to live. The Housing Corporation assesses achievement against the following core aspects of performance standards:

1. Internal environment
  - a. Size
  - b. Layout
  - c. Service provision
2. Sustainability
  - a. Code for sustainable homes
3. External Environment
  - a. Building for life

*Matrix 6* was developed from a study by the Building Research Establishment (2007). Building Research Establishment outlined the design quality standards and called them Design Quality Indicators. Design Quality Indicators is distinctive because it charts the quality standards for housing and for the type of building, such as a hospital office or an institutional building. The following are considered the quality indicators for various built forms according to Design Quality Indicators:

1. Exterior architecture
2. Internal fabric and finishes
3. Electrical design system
4. Summer time overheating
5. Sustainability
6. Site planning
7. External material
8. Sourcing of repairable items
9. Visual environment
10. Maintainability
11. Interior design
12. External and internal details
13. Air quality
14. Space planning
15. Junction detail
16. Heating comfort

### **Synthesis of Matrices**

Table 1 shows the synthesis of the matrices. During the synthesis process, design quality determinants were evaluated from the available matrices defined by experts in the field. The design quality determinants are also listed in the table, with each matrix marked. The process of synthesis sorted the determinants that belong to more than one matrix, with the resultant matrix shown in Table 2. Colour coding was developed to explain the synthesis of quality determinants and to highlight the severity of each determinant. For example, the highest to modestly attended

determinants are shaded in grey and the least attended determinants are shown in white.

The corresponding determinants in Table 1 are the appraised design quality determinants and are re-assembled in their respective categories, as shown in Table 2. The resulting matrix was prepared by dividing the corresponding design quality determinants into various categories depending on their location in the design phase and the interrelation of respective determinants.

Table 1. Synthesis of Matrices

Design Quality Determinants	Matrix 1	Matrix 2	Matrix 3	Matrix 4	Matrix 5	Matrix 6	Corresponding Determinants of Design Quality
Site planning and layout	√	-	√	-	√	√	Site planning and layout
Quality of site and neighborhood	√	-	√	-	-	-	Quality of site and neighborhood
Accesses to public transport	-	-	√	√	√	-	Accesses to public transport
Accesses to parks, school, shops, hospital	√	-	√	√	√	-	Accesses to parks, school, shops, hospital
Availability of common open and parking spaces	-	-	-	-	√	-	-
Distinctive character in urban context	-	-	-	√	√	-	Distinctive character in urban context
Quality of landscaping and topography	-	-	-	-	√	-	-
Appearance of house /apartment	√	-	-	√	√	√	Appearance of house/apartment
Space planning e.g. rooms, kitchen, bath, lounge, etc.	√	-	-	√	-	-	Space planning e.g. Rooms, kitchen, bath, lounge, etc.
Interior design	-	-	-	-	-	√	-
Quality of facades	-	-	-	√	√	√	Quality of facades
Workmanship in installing ceiling, door, window, tiling, painting, plastering, plumbing work, electric wiring, etc.	√	-	√	-	-	-	Workmanship in installing ceiling, door, window, tiling, painting, plastering, plumbing work, electric wiring, etc.

(continue on next page)

Table 1: (continued)

<b>Design Quality Determinants</b>	<b>Matrix 1</b>	<b>Matrix 2</b>	<b>Matrix 3</b>	<b>Matrix 4</b>	<b>Matrix 5</b>	<b>Matrix 6</b>	<b>Corresponding Determinants of Design Quality</b>
Tolerance and stability of structure	-	√	√	-	-	-	Tolerance and stability of structure
Proper material selection	-	-	√	-	-	√	Proper material selection
Advance construction technology	-	-	-	-	√	-	-
Adoption of building regulation	-	-	-	-	√	-	-
Adoption of conversion /extension	-	-	-	√	√	-	Adoption of conversion /extension
External and internal detail	-	-	-	-	-	√	-
Junction detail	-	-	-	-	-	√	-
Refuse/garbage collection system	√	-	√	-	√	-	Refuse/garbage collection system
Internal condition e.g. natural lighting, ventilation and temperature	√	√	-	-	-	-	Internal condition, e.g. natural lighting, ventilation and temperature
Water supply	-	-	-	-	√	-	-
Electricity installation layout	-	-	√	-	-	√	Electricity installation layout
Proper sanitary appliances e.g. wc, good quality bath or shower wash basin	-	√	√	-	√	-	Proper sanitary appliances e.g. wc, good quality bath or shower wash basin
Range of kitchen facilities and fittings	-	√	√	-	√	-	Range of kitchen facilities and fittings
Smoke detectors	-	√	√	-	-	-	Smoke detectors
Sourcing /availability of repairable items and materials	-	-	-	-	-	√	-

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Table 1: (continued)

Design Quality Determinants	Matrix 1	Matrix 2	Matrix 3	Matrix 4	Matrix 5	Matrix 6	Corresponding Determinants of Design Quality
Environmental conditions e.g. air quality, noise, traffic congestion	√	–	√	–	–	–	Environmental conditions, e.g. air quality, noise, traffic congestion
Internal condition, e.g. dampness, humidity, etc.	–	–	√	–	–	√	Internal condition e.g. dampness, humidity, etc.
Secure entry systems and safe common entrance areas	–	√	–	–	–	–	–
Lead-free pipes and lead-free paint	–	√	√	–	√	√	Lead-free pipes and lead-free paint
Adequate insulation from noise	–	√	–	–	√	–	Adequate insulation from noise
Proper ventilation bathrooms and kitchens	√	√	–	–	–	–	Proper ventilation bathrooms and kitchens
Function	–	–	–	√	–	–	–
Adaptability	–	–	–	√	–	–	–
Diversity and choice	–	–	–	√	–	–	–
Summertime over heating	–	–	–	–	–	√	–
Visual environment	–	–	–	–	–	√	–
Heating comfort	–	–	√	–	–	√	Heating comfort
Environmental friendly	–	–	–	–	√	–	–
Code for sustainable homes	–	–	–	–	√	–	–
Maintenance measures	–	–	√	√	–	–	Maintenance measures
Sustainable	–	–	–	√	√	√	Sustainable
Buildability	–	–	–	√	–	√	Buildability

Notes:

-  Highest attended determinant
-  Moderately attended determinant
-  Least attended determinant

Table 2. Resultant Matrix

<b>Resultant Design Quality Determinants</b>				
<b>1. Architecture and Site Planning</b>	<b>2. Structure and 3. Construction</b>	<b>4. Building Services 5. Health Safety and Security</b>	<b>6. Users Comfort</b>	<b>7. Maintenance and 8. Sustainability</b>
Site planning and layout	Workmanship in installing ceiling, door, window, tiling, painting, plastering, plumbing work, electric wiring, etc.	Refuse/garbage collection system	Environmental conditions, e.g. air quality, noise, traffic congestion	Maintenance measures
Quality of site and neighborhood	Tolerance and stability of structure	Internal condition, e.g. natural lighting, ventilation and temperature	Internal condition, e.g. dampness, humidity, etc.	Sustainable
Accesses to public transport	Proper material selection	Electricity installation layout	Adequate insulation from noise	Lead-free pipes and lead-free paint
Accesses to parks, school, shops, hospital	Adoption of conversion /extension	Proper sanitary appliances, e.g. water closet (wc), good quality bath or shower wash basin	Proper ventilation bathrooms and kitchens	
Distinctive character in urban context			Heating comfort	
Appearance of house/apartment				
Space planning, e.g. rooms, kitchen, bath, lounge, etc.				
Quality of facades				

### Resultant Design Quality Matrix

The resultant matrix of design quality determinants is shown in Table 2. This matrix was obtained through the process of synthesis. Synthesis was used to evaluate each design quality determinant derived from the available matrices of design quality indicators.

All six available matrices of design quality, as shown in Figure 1, were plotted with constituting quality determinants (Table 2). Each listed design quality

indicator was checked for its presence in available matrices. The hierarchy of attendance was marked and highlighted by shaded coding.

The resulting matrix was developed according to the criteria of higher attendance of each quality determinant. The resulting matrix comprised only those quality determinants that had higher attendance in the available matrices of design quality indicators (refer to Section Analysis). The resultant matrix was divided into five sections, representing the eight stages of housing design (Table 2). Areas in the resulting design quality matrix are as follows:

1. Architecture and Site Planning
2. Structure
3. Construction
4. Building Services
5. Health Safety & Security
6. Users Comfort
7. Maintenance
8. Sustainability

The final resultant matrix contains the eight major areas of building design listed above grouped into five sections (refer Table 2).

## **ANALYSIS**

This section demonstrates the ranking of the determinants in a table to set their priority. The set priority indicates the importance of each determinant in housing design quality. The appropriate determinant requires knowledge of the presence of each determinant in various matrices of design quality. This analysis will remove the most and least common determinants in various matrices of design quality discussed previously. The most common determinants were considered important or very important aspects of housing design quality. The least common determinants were considered the least important aspects of housing design quality. This comparative analysis accurately shows the globally acknowledged quality determinants of housing design. A detailed and preliminary HQD model was generated from the matrix analysis and synthesis shown in Table 1. There are 44 design quality determinants in seven sections, 17 quality determinants were of high priority and nine quality determinants were set at a medium priority. The remaining 18 quality determinants were identified as low priority (Table 1). The trend demonstrated that 40% of quality determinants are of low priority, 20% are of moderate priority and 38% are of high priority. This research considers the determinants that earned high to moderate ranking in the synthesis process to obtain a comprehensive and reliable HQD model. The selected housing quality determinant framework is shown in Figure 3. The figure shows the schemata of the HQD framework with the contents drawn from all seven sections.

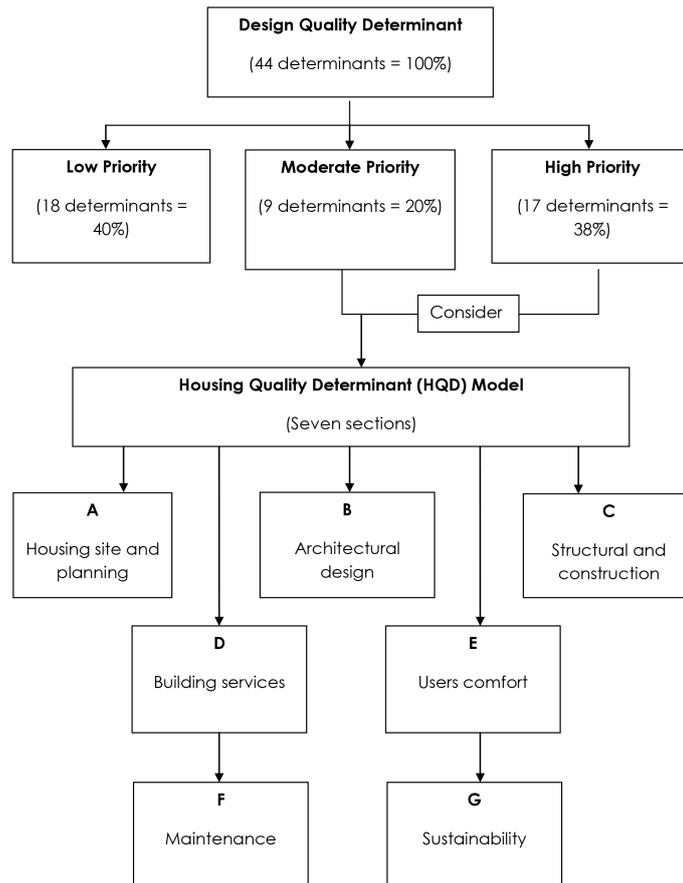


Figure 3. Housing Quality Determinant (HQP) Model

### VALIDATION OF THE RESULTANT HQD MATRIX

This stage validated the resultant matrix of HQD resulting from the synthesis of various matrices and its interpretation through unstructured interviews with people who served as the respondents of this research. This research considered secondary data alone to be insufficient for consolidation of the HQD matrix and therefore planned a validation stage to ascertain the understanding of the respondents about the HQD matrix. Unstructured interviews were conducted at various housing sites (refer to Section Methodology) to verify and validate the contents of the HDQ matrix. This practice provided the opportunity to develop a direct interface with users and to check the reliability of the HQD. This activity also aided in testing the HQD matrix at various study sites (refer to Section Methodology) to evaluate the design quality of current housing. A/E/C professionals were consulted to obtain professional validation of the HQD matrix.

The unstructured interviews were conducted by two principles:

1. Do the respondents identify the contents of the HQD matrix as design deficiencies?
2. Do the respondents agree with the contents of the HQD matrix?

Both users and professional respondents have acknowledged that housing blocks are experiencing problems that have resulted from low-quality design, planning and lack of maintenance. This study revealed that most housing stocks at different sites have common quality problems, such as poor service design and construction, different types of dampness, facade deterioration and improper elements for weather protection. The research also discovered that in the Gulshan Iqbal site, with the exception of the luxury of more space, users faced similar problems associated with the housing stock of the Federal Blue Area. The most significant quality problems highlighted by users included thermal comfort, poor construction and material and absence of a sustainable source of energy. The users were unsatisfied with the housing design and experienced problems attributed to substandard work.

Discussion during the interviews with users revealed that the HQD matrix presented the true picture of the housing quality in Karachi. Therefore, its contents are viable for use as design quality indicators. A/E/C professionals have advised that this matrix should be validated every five years to maintain its viability as a matrix for housing quality evaluation. Residents of affordable housing in which case studies (refer to Section Methodology) were conducted have shown their agreement with the contents of the HQD matrix and also found it to be a useful design quality assurance tool for prospective home buyers in Karachi.

## CONCLUSION

The basic aim of this research was to develop quality determinants for housing design (HQD) in Karachi, Pakistan that would help develop awareness among design professionals and end-users and would enable them to identify measures to ensure quality in housing design.

The HQD model established in this research is an integration of significant findings during research development (Figure 2). These findings include the development of a research framework, resultant matrix for affordable housing in Karachi, a list of quality characteristics for affordable housing and design, ranking of quality indicators, models of quality indicators and a validated HQD model.

The fully developed HQD model could provide the appropriate platform as a basis for understanding and addressing the problem of affordable housing quality. The HQD model was developed with the intention of introducing and bringing quality characteristics to the affordable housing market of Karachi.

The HQD model has a tendency to adopt or reject any change in the future. It is formulated such that it allows for both horizontal and vertical growth, both in the quality characteristics and in the sub-indicators of affordable housing quality. For example, horizontal development is possible in the context of quality characteristics and vertical development could be recorded in the quality indicators. The flexibility of the HQD model has enabled

it to comply with the future needs of affordable housing in Karachi. The flexibility of the HQD has also added another salient feature that could enable its use for the assessment of housing quality in other parts of Pakistan. The HQD could also be used in regions of the world with similar housing problems including China, Bangladesh, Sri Lanka, Indonesia, India, South America, Central Asia and certain Arab-speaking countries.

HQD has multi-dimensional benefits for users and professionals. This model can facilitate the understanding of the quality of housing and provide options for investment in housing for the common man. The HQD model can work as a check list tool for the use of young professionals (A/C/E) in creating new housing designs. This model is a tool for valuers and quality assessors to ascertain the condition of a building for various purposes, including mortgage and dilapidation surveys.

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