ARCHITECTURAL DESIGN CRITERIA AND THEIR APPLICATION IN MULTI-STOREY RESIDENTIAL BUILDINGS IN THE KLANG VALLEY

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ABSTRACT

This research focuses on certain design issues in architectural practice that have been influenced by architects, clients and the market. In practice, the design and production of buildings work in a social context comprising the profession, clients, users, architects, consultants, and contractors. The work dynamics of client-architect interactions in the market influence the conception of architectural design. The resultant design affects the quality of buildings which in turn has life-long effects on people and the environment. This research began with the question of why certain multi-storey residential buildings lack architectural design quality.

The research aims to determine architectural design criteria, apply these criteria to establish the relationships between design quality and market price, and test a hypothesis i.e. architectural design quality decreases as market price decreases. It validates two hypotheses i.e. clients are more dominant than architects in making design decisions, and there is a lack of congruence of the design quality in buildings between the users to whom the architects are ethically responsible and the clients to whom the architects are accountable.

A theoretical framework was developed, which then guided a mixed methods research including case studies and surveys. These methods underline non-equivalent dependable variables design, pattern-matching, replication, descriptive and inferential statistics. The determination of design criteria utilised from literature review and survey. For establishing the bivariate relationships involved case studies of eight developers, case studies of seven architectural firms, and surveys of low, medium and high cost residential buildings.

The survey results analysed with t-test ($p \leq 0.05$) on criteria determination established a majority opinion of agreement (test-results>4"agree") on six design criteria, except for Feng Shui which scored 49.50% agree, 36.80% neutral and 13.7% disagree. These results established the first ever set of architectural design criteria for multi-storey residential buildings in Malaysia. The results of case studies and surveys generally established positive and significant correlation ($p \leq 0.05$), linear and causal regression, case replication, observed and predicted pattern-matching and positive hypothesis testing. The findings confirm the three hypotheses to be true.

The findings of this research contribute to the body of knowledge in architecture, the profession, and practices.

ABSTRAK

Penyelidikan ini tertumpu kepada isu tertentu dalam amalan reka bentuk seni bina yang dipengaruhi oleh arkitek, pelanggan dan pasaran. Dalam amalan, reka bentuk dan hasil bangunan berkait rapat dengan konteks sosial mengandungi profesion, pelanggan, arkitek, perunding dan kontraktor. Kerjasama diantara pelanggan dan arkitek mempergaruhi ke atas konsep reka bentuk seni bina. Reka bentuk bukan saja boleh menjejaskan kualiti bangunan dan bentuk binaan, malah mempunyai kesan yang panjang kepada manusia dan sekitarnya. Kajian ini bermula dengan persoalan ialah mengapa bangunan kediaman bertingkat kekurangan kualiti seni bina.

Penyelidikan ini bertujuan untuk menentukan kriteria reka bentuk seni bina, mengaplikasikan kriteria untuk mewujudkan hubungan antara kualiti reka bentuk dan harga pasaran, dan menuji satu hipotesis ialah kualiti reka bentuk seni bina berkurangan apabila terdapat penurunan harga pasaran. Ia mengesahkan dua hipotesis ialah pelanggan adalah lebih dominan daripada arkitek untuk membuat keputusan reka bentuk, dan terdapat kekurangan kekongruenan kualiti reka bentuk dalam bangunan di antara pengguna bangunan yang arkitek bertanggungjawab beretika dan pelanggan yang arkiteknya bertanggungjawab.

Satu rangka kerja teori telah diperkenalkan, dan rangka kerja ini membawa penyelidikan kaedah-kaedah campuran yang terdiri daripada kajian kes dan selidik. Kaedah-kaedah ini menggariskan ketidaksamaan dalam kepelbagaian reka bentuk, padanan corak, replikasi, statistik deskriptif dan inferensi. Penentuan kriteria reka bentuk dijalankan melalui tinjauan ilmiah dan kaji elidik. Untuk mewujudkan hubungan antara kriteria reka bentuk dan harga pasaran dijalankan melalui kajian kes untuk lapan orang pemaju, kajian kes untuk ujuh firma arkitek, dan kaji selidik secara rawak bangunan kos rendah, sederhana dan tinggi.

Hasil kajian selidik dengan "t-test" ($p \leq 0.05$) dalam penentuan kriteria telah menunjukkan pendapat majoriti (test-results>4"bersetuju") mengenai persetujuan pada enam kriteria reka bentuk, kecuali Feng Shui mempunyai 49,50% bersetuju, 36.80% neutral dan 13.7% tidak bersetuju. Hasil dapatan ini yang pertama di Malaysia yang merupakan satu set kriteria reka bentuk seni bina untuk bangunan kediaman bertingkat. Hasil kajian kes dan kaji selidik telah menubuhkan korelasi ($p \leq 0.05$) positif dan ketara, regresi linear dan sebab-musabab, replokasi kes, padanan corak dicapai dan ujian hipotesis positif, kecuali kriteria kos. Penemuan ini mengesahkan tiga hipotesisnya benar.

Penemuan penyelidikan ini menyumbang pengetahuan dalam seni bina, profesion dan amalan.

ACKNOWLEDGEMENTS

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LAM	Lembaga Arkitek Malaysia (Malaysia Board of Architects)
NEDV	Non Equivalent Design Variable
PAM	Pertubuhan Akitek Malaysia (Malaysia Institute of Architects)
RIBA	Royal Institute of British Architects
SEM	Structural Equation Modeling
SPSS	Statistical Package for the Social Sciences
UM	University of Malaya
UTM	University of Technology Malaysia
USM	University of Science Malaysia
UiTM	Universiti Teknonlogi MARA
UPM	Universiti Putra Malaysia
UIAM	International Islamic University Malaysia
RQ1	Research question 1
RQ2	Research question 2
RO1	Research objective 1
RO2	Research objective 2
RO3	Research objective 3
RO4	Research objective 4
RO5	Research objective 5
RO6	Research objective 6
RH1	Research hypothesis 1
RH2	Research hypothesis 2
RH3	Research hypothesis 3
MSRB	Multi-storey residential building

CHAPTER 1 INTRODUCTION

1.1 Introduction

This thesis is an explanatory and descriptive type of research. The research focuses on certain design issues of architectural practice, and factors that influence architectural design quality of buildings and the environment. The factors include architects, clients, users and the market in a social context. There exists perennial concern of architectural design quality for people and the environment but also difficulty of measurement of the quality both in theory and practice. This thesis starts with the first question that is why certain multi-storey residential buildings (MSRB) lack to some extent architectural design quality, and then the second question that is how architectural practice can contribute to this phenomenon.

The thesis is designed to determine a set of architectural design criteria for MSRB, apply these determined criteria to investigate the relationships between the architectural design quality and market price, and test RH1 research hypothesis that is architectural design quality decreases as market price decreases. It validates RH2 research hypothesis that is clients are more dominant than architects in making design decisions, and RH3 research hypothesis that is there is a lack of congruence in the design quality of buildings between the users to whom the architects are ethically responsible and clients to whom the architects are accountable.

A literature review is given in which it is built round the research problem and questions that underline two main abstract subjects including architectural design and architectural practice. The two subjects contribute to significance of this thesis. They constitute a contemporary phenomenon within its real life context that requires an empirical investigation when the boundaries between phenomenon and context are not so evident.

There exists a social context of architectural practice in which the design and production of buildings take place. This context comprises the profession, clients or/and users, architectural firms, and practicing architects' design ideas on how buildings ought to function and ought to look (Goldberger, 2009; Norberg-Schulz, 2000; Vitruvius & Morgan, 1960). The work dynamics of the client-architect interaction (Mrema, Salaam, & Mhando, 2005; Pressman, 2005; Siva & London, 2011) in the market have an impact on the conception of architectural design. Architectural design affects the quality of buildings and the built forms, which in turn affect people and the environment in the past, present and future (Scully, 1969). Grothe (2002) quotes Sir Churchill (1944) "We shape our buildings; thereafter, they shape us.", and explains that this quotation is a profound architectural truth that applies to buildings. In the beginning, buildings reflect the qualities of the people who design and construct them. Once built, the people who live and work in them take on the qualities of the buildings they inhabit. There exists a psychological realm of the individual architects which affects the conception of architectural design. In a study, MacKinnon (1962) concludes certain personality characteristics of creative architects in response to clients in work dynamics. With the self-descriptions of the respondents, it is found that the creative group of architects favoured autonomy, aggression and restricted change, while the controlled group preferred the importance of satisfying clients in contrast to the creative group. These findings show the tension of the working relationships between the creative individual architects and the collective corporate clients in particular.

In one study, Sommer (1969) analyses mental hospitals, bars and schools. This study investigates on how the organization of physical spaces can encourage people to take greater part in social activities or vice versa. However the reverse can be true on how these spaces can turn them away. This study shows that architecture does have an effect on human

behaviour. Wright (1983) and Hayden (1981) analyse how residential architecture has promoted cultural values for women in society by the spatial design and location of houses and neighbourhoods. These studies show that there is a significant link between the socio-cultural values and architecture. Similar studies that further support such investigations include that from Mumford (1938) in his study of the culture of cities, Gans (1982) account of the buildings and neighbourhoods on urban dwellers, and Jacobs (1961) study of the nature of community in large cities.

Goldberger (2009), Pulitzer Prize winner architecture critic for *New Yorker*, comments in *Why Architecture Matters,* that architecture is a representation of social ideas, political statements and cultural icons as well as a great physical symbol of the idea of community. Goldberger states the purpose of the book "*…is to come to grips with how things feel to us when we stand before them, with how architecture affects us emotionally as well as intellectually….Pg. xvi"*

Architectural historian and educator Scully (1969) explains architecture as a continuing dialogue between generations which creates an environment across time "…the architect should be regarded as a kind of physical historian, because he constructs relationships across time: civilization in fact. Pg. 297" Studies of sustainable design by early researchers (McHarg & History, 1969; Odum, 1971; Olgyay, 1963) have contributed to the body of knowledge and practice for people and the environment. The practice of Pulitzer Prize winner architect Murcutt (Drew & Murcutt, 2001) on sustainable design create buildings that are responsive to the environmental context of the site and region. B. Edwards (2003) describes on how green buildings are designed to reduce the level of earth material extraction and to enhance the health of people who occupy them. Williams (2007) explains how the ecological model of sustainable design contributes to the community, economic and environment.

Studies of practice show that the contemporary practice is subject to certain contradictory features (Blau, 1987; Gutman, 1988; Lucchesi & Architects, 2002) or dialectical dualities (Cuff, 1992). These predicaments affect the intentions of architects and their accomplishments (Blau, 1987), and thus the quality of architectural design of the buildings (Cuff, 1992). Blau (1987) concludes in a survey study that architectural firms in New York City were governed by structures of risk comprising contradiction features. Gutman (1988) concludes in a study that there is a gap in practice between the expectations of the world and the espoused ideas of architects in the U.S. Symes, Eley, and Seidel (1995) conclude in a study that the once highly traditional professional role has responded to the challenge of the economic and social changes in the construction industry. The results show that if the situations were not corrected, the quality of the designed environment will surely suffer. Cuff (1992), Jenkins and Forsyth (2009) conclude in their studies that buildings may be collectively or socially conceived in architectural design process for excellent buildings and architecture towards making better environment for people.

Study of practice in Malaysia has been limited. A historical review shows that the limitation is owing to the historical development of the architectural profession, practice, education and training in the country. The architectural practice and profession in Malaysia is to a large extent a continuation of the practice of British architects under RIBA (1834) during the British Malaya (1924 – 1946). The first Institute of Architects Malaysia was formed in1920, changed in 1948 and 1967. The first architectural school in Malaysia began in 1956 as a Diploma course in Building Design at the Technical College, Kuala Lumpur. The Board of Architects Malaysia was first established in 1973, and has a total registration of 1,775 professional architects in 2011. However this limitation has led to search for study of residential quality and satisfaction of multi-storey residential buildings.

Study of residential quality and satisfaction in Malaysia provides important background inquiry to architectural design quality issues of multi-storey residential buildings. It examines the relationships between residents and dwelling unit design features, dwelling unit support services, public facilities, social environment and neighbourhood facilities. It focuses on the relationships in the cognitive and behavioural characteristics of residents as well as the physical and social characteristics of the environment. Residential satisfaction of the users or occupiers is therefore considered as a criterion of the resident's quality of life that is related to design quality. Studies on residential quality and satisfaction have been exemplified by the works of Marans and Rodgers (1975), Galster and Hesser (1981), Cutter (1982), Gifford (1988), Weidemann and Anderson (1985), Amerigo and Aragones (1997).

Studies of residential quality and satisfaction in Malaysia have begun since 1980. Tan (1980) concludes in a low cost housing study that poor housing design quality had affected the family needs and comfort in the physical, socio-cultural, psychological, and religious realms. Subsequently Sulong (1984) concludes in a similar study that poor housing design quality had not met the family needs and comfort in terms of the physical, socio-cultural, psychological, and religious needs. Sulaiman and Yahaya (1987) conduct the first low-income housing quality study in Kuala Lumpur. This study shows that the residents were not satisfied with the dwelling unit features including the dinning areas, bathroom, toilet, laundry etc. Nurizan and Halimah (1993) concludes in a housing quality study that space deficit in dwelling units had affected the family needs and comfort in the physical, socio-cultural and psychological. Goh (2007) conducts a study on the development and design quality of housing in Klang Valley and concludes that the revised architectural design of dwelling units was not meeting family needs and comfort. Mohit, Ibrahim, and Rashid (2010) conduct a housing quality study in Kuala Lumpur, and conclude that the residents were dissatisfied with the design features of

dwelling units including dining space, bedroom 1 and 3, laundry etc. The results of these housing studies generally show common issues of design quality in dwelling units that have affected the family needs, comfort, socio-cultural lifestyles, and hence quality of life.

Study of criteria for architectural design quality of buildings for people and the environment reveals several types of studies. Some studies focus on specific environmental design criteria including heating, cooling, lighting and ventilation, climate and energy (Al Obaidi, 2004; Gifford, 1988; Zakaria, 2006), energy saving and glazing (McMullan & Seeley, 2007) and building shape, glazing and energy saving. In addition, there are studies focusing on conservation, sustainability, history, society and architecture, and users.

1.2 Research Gap

The literature review and personal experience of architectural practice in the Klang Valley are utilised to identify research gap.

The literature indicates numerous areas of studies that influence architectural design can be classified into several groups. Some of these groups include studies of practice (Cuff, 1992; Gutman, 1988); history and theory of architecture (Arbi, 2008; Jencks, 2005; Jencks & Ridler, 1973; Kim, 2006; Neumeyer, 1991); works or products of prominent architects concerning the styles and the building uses (Galster & Hesser, 1981; Marans & Rodgers, 1975); relationships between architecture and people and the environment (Corbusier, 1986; Scully, 1991); user requirements and building performance measurement (Garcia Ferrari, Glendinning, Jenkins, & Taylor, 2008; Markus, 1969; Maver, 1970; Preiser, 2001); specific environmental design criteria for buildings and people (Capper, 2008); residential quality and satisfaction (Goh, 2007; Salleh, 2008), and seismic and engineering design criteria for multi-

storey buildings (Palermo, Pampanin, Buchanan, & Newcombe, 2005). These studies of the literature provide guidance for the research gap to build round four aspects as follows:

Firstly, the historical review in Malaysia reveals that there have been limited studies of architectural practice on this research topic. Most studies of practice have examined the products of prominent architects on design, styles and uses of buildings. These studies are mainly conducted by the Institute of Architects Malaysia or Pertubuhan Akitek Malaysia (PAM) (http://www.pam.org.my/, 2012). Most studies that have been conducted in Universities are architecture and history, theory, sustainability, conservation, building and environmental sciences.

Secondly, there have been studies of residential quality and satisfaction for multi-storey buildings in Malaysia since 1980. The findings of these studies by planners and social science researchers conclude design quality problems of dwelling units and the built environment. However these studies have not examined quality issues of architectural design.

Thirdly, studies of architectural practice overseas have identified the design quality issues. These issues could be caused by socio-economic and contradictions in the contemporary practices or the position or social role of architects as profession. In addition there exists difficulty or controversy for measurement of architectural design quality.

Lastly, study of criteria identifies that there is a lack of a set of criteria for analysing architectural design quality of multi-storey residential buildings. Much has been written about architectural design of buildings on people and the environment. These studies are in general conducted separately or independently for each of these architectural design concepts or ideas.

In summary, there exists this research gap. Whilst there appears to be a general consensus that architectural design has effects on users and the environment, there does not appear to have a set of architectural design criteria for designing or analyzing quality of MSRBs. Thus this study is aimed to address this gap by developing a set of criteria to study effects of market price on architectural design quality of MSRBs. These criteria can be derived from definition of architectural design itself as a process of creative visualizing of concepts or ideas to actualizing optimal solutions for human needs and goals in a built environment. These concepts or ideas will be considered as a set of criteria for architectural design quality. These concepts or architectural design criteria include site context, aesthetics of art, function, sustainability, cost, socio-culture, and Feng Shui. These architectural design criteria will be developed in Chapter 2 2.4 so that these can be measured, relevant, current, and easy to understand and apply for in research or practice by developers, government housing agencies, built environment students, professionals and the public. Some research methods are utilised to verify these developed criteria in local context and to apply these criteria for analyzing architectural design quality of MSRBs.

1.3 Statement of Research Problem

Architectural practice has been a major force shaping Malaysian cities since independence in 1957. The rapid development during the last three decades has produced many high rise residential buildings, and in particular in the capital city of Kuala Lumpur and the Klang Valley. The city skyline has been transformed by many buildings of different types, sizes and qualities. The urban landscape has changed tremendously for the good, bad or ugly depending on the eyes of the beholder. Certain multi-storey residential buildings are to some extent

lacking architectural design quality as shown in Figure 1.1. These design quality issues include the lack of adequate number and sizes of the rooms, aesthetics, site context, sustainable design features, and socio-cultural facilities such as sport and recreation rooms, common social gathering areas, shops, car parks, indoor and outdoor open play spaces or landscaping.

Built environment is chaos, lacking in socio-cultural spaces and cluttered with cars, bikes and illegal stalls

Façades are 'match box' like appearance, lacking in sun shades and aesthetics concern.

External glass louver windows and corridors are cluttered with 'laundries', furniture and kitchen utensils

Figure 1.1 Certain multi-storey residential buildings lack architectural design quality

As a consequence, some undesirable effects on people and the environment (Sommer, 1969; Goldberger, 2009) can be seen in the Figure 1.1 such as cars being parked haphazardly, stalls illegally erected along road sides, children and mothers were not provided with appropriate playground in the open or indoor areas. A more crucial aspect is the unpleasant visual image of the clutter of hanging clothes in pigeon-hole glass louver windows and corridor railings, and the stacking of kitchen utensils in grille cages projecting outside buildings. This phenomenon has become a common sight among most low cost multi-storey residential buildings in the Klang Valley, representing a sense of design deprivation and blunt façade architecture.

The city of Kuala Lumpur used to be a people and environmental friendly capital in the 1950s and 1960s. There are fine traditional two to four storey shop-houses with fine façade architecture with built in covered walkways; beautiful and spacious institutions; tropically designed cool houses; schools of good visual proportion and style with wide corridors and high ceiling classrooms; large parks with insects and birds to watch; large golf greens with majestic trees surrounding them; numerous football fields with shrubs and spiders to catch, and; clear rivers with occasional splashing of fishes. This lovely gem of the capital seems to have gone and separation of people or communities arises. The capital now has becomes a mega city of many high rise buildings with many environmentally unfriendly road systems and frequent traffic jams despite numerous highways and byways. The city today at first sight appears glamorous but with complexity and contradictions (Venturi, 1977) in the current planning and architecture.

Studies of residential satisfaction and quality in Malaysia since 1980 have concluded this design quality problems of dwelling units and the environment in planning and architecture

for low cost multi-storey residential buildings (Mohit, 2010; Goh, 2007; Nurizan and Halimah, 1993; Sulaiman, 1987; Tan, 1980). These quality problems of architectural design from practices hence, provide a gap for this research.

Architectural design quality has always been a controversial debate, thus its measurement is hard to deal with. Blau (1987) explains there exists polarity of view of quality between the professional standards derived from consensual judgment and the judgments of their successors or the public. Cuff (1992) comments the controversy from the philosophical question of whether design quality can ever be absolutely determined to the phenomenological entity. M. Cook (2007) states architecture and design quality is seldom without controversy, as it is generally viewed as subjective.

However architects in practice do not work alone in a social context which includes the developers, users, consultants, contractors, authorities and specialists. Studies of practice show that contemporary practice is subject to certain contradictions or dialectical dualities (Blau, 1987; Cuff, 1992; Gutman, 1988). These contradictions can occur among differences between the clients' business objectives and the convictions of architects' design ideas on how buildings ought to look and function. Another aspect of the contradictions can be a duality of doing the actual work for any project that exists in the contrast between the individual autonomous artist and the collective professionals. There exists an issue of social importance of architecture for society (Forsyth, 2009; Saint, 1983) among practicing architects who have isolated themselves from wider social engagement in design process. The profession tends to favour one side of each conflict or duality while ignoring the other, and raises problems of an imbalance. However the ignored sides of the problems are equally important parts of the whole of practice for excellent buildings (Cuff, 1992).

These conflicts are not uncommon among local architectural practices in the Klang Valley and have caused several dilemmas as follows:

- The predicament in the intentions of architects in architectural design conception and its accomplishments;

- Certain multi-storey residential buildings lack to some extent of architectural design quality as shown in Figure 1.1;

- There is a lack of congruence in the design quality of the buildings between the users to whom the architects are ethically responsible and clients to whom the architects are accountable;

- There is no user participation in the architectural design process of the MSRBs;

- Clients are more dominant than architects in making design decisions;

- There is a need for a set of criteria for studying architectural design quality of MSRB.

A statement of the research problem can be summarised as there is concern of architectural design quality of multi-storey residential buildings for people and the environment but also difficulty of the measurement of architectural design quality.

1.4 Research Scope

The scope of research for this study covers the geographical area of Kuala Lumpur city and Klang Valley (http://en.wikipedia.org/wiki/Klang_Valley, 2012).

There are four empirical field studies which include architectural and related professionals, developers, architectural firms and multi-storey residential buildings (MSRBs).

The 1980s saw the beginning of the growing trend of design and production of the MSRBs. This study will examine the buildings constructed from the late 1980 to recent times.

The MSRBs include medium and high rise types. The medium rise residential buildings are ranging from six to twelve storeys while the high rise from above twelve storeys.

There are three main categories of market price for the MSRBs in the last few years. Firstly, it is the low market price or low cost per dwelling unit ranging from $35,000.00 to $42,000.00. Secondly, it is the medium market price or medium cost per unit ranging from $80,000.00 to $350,000.00. Thirdly it is the high market price or high cost per unit ranging from $750,000.00 and above. The low cost market price of the MSRBs is determined and controlled by the government (Government, 2002), while the medium cost market price and above are subject to the supply and demand in the market.

1.5 Research Questions (RQ)

From the literature review, research gap and problem, two research questions for the study of design quality issues of multi-storey residential buildings arise as follows:

RQ1. Why do some multi-storey residential buildings lack to some extent architectural design quality?

RQ2. How does the practice of architecture contribute to this phenomenon?

1.6 Research Hypotheses (RH)

With the two RQs, three research hypotheses are proposed and one of them is developed along with a theoretical framework. The "why" and "how" research questions capture what are really essentials in the answers but do not point what should be studied. The hypotheses direct attention to specific areas that should be examined within the scope of study and give the right direction. The hypotheses reflect an important theoretical issue and guide where to seek for the relevant evidences to the research. The three RHs are stated as follows:

RH1. Architectural design quality of MSRBs decreases as market price decreases;

RH2. Clients are more dominant than architects in making design decisions;

RH3. There is a lack of congruence in the architectural design quality of the buildings between the users to whom the architects are ethically responsible and clients to whom the architects are accountable.

1.7 Research Objectives (RO)

There are six research objectives stated as follows:

RO1. To determine a set of architectural design criteria for MSRBs

RO2. To investigate the relationship between the established architectural design criteria and market price (low, medium and high cost) of MSRBs from the perspectives of developers and architectural firms

RO3. To evaluate the application of architectural design criteria on selected low, medium and high cost MSRBs.

RO4. To establish the relationship between architectural design criteria and market price of MSRBs

RO5. To test RH1 research hypothesis

RO6. To validate RH2 and RH3 research hypotheses

1.8 Framework Development

The development of a theoretical framework (Cavana, Delahaye, & Sekaran, 2001; Zeidler, Sadler, Simmons, & Howes, 2005) for architectural design quality started with a conceptual framework which was developed as shown in Chapter 3 Figure 3.2. The theoretical framework has a fourfold importance for this research as shown below:

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                    ┌─────────────────────────┐
                    │  Conceptual Framework   │
                    └─────────────────────────┘
                                 │
                                 ▼
                    ┌─────────────────────────┐
                    │  Theoretical Framework  │
                    └─────────────────────────┘
```

Formulate research hypothesis	Guide mixed methods research	Focus on data collection and analysis	Provide an organised and validated research
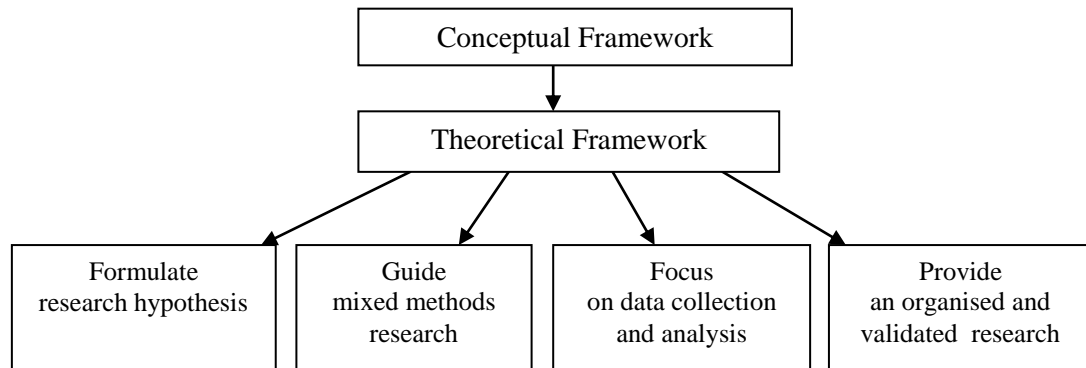
With the aid of the conceptual framework, this theoretical framework constructs a basis to formulate the RH1 research hypothesis which is structured before measuring by structural equation modelling. With conceptual framework, the theoretical framework provides a broader and richer explanation of the relationships among the concepts and or variables, leading to theory development. Theory development has four important aspects for the study: firstly factor isolating to describe phenomena; secondly factor relating to explain phenomena; thirdly situation relating to predict the relationships between or among phenomena; fourthly situation producing to control phenomena. In theory development, there exist two different structural equation models of causal measurement (Bollen & Lennox, 1991; J. R. Edwards & Bagozzi, 2000; Hair, Black, Babin, Anderson, & Tatham, 2006) including reflective and formative constructs. The constructs for this study are reflective as shown in Figure 3.6. The theoretical framework developed for the relationship between the market price and architectural design quality is represented in Figure 3.8.

1.9 Summary of Research Methods Research (MMR)

This thesis is based on a mixed methods research (MMR) to address the research problem, questions and objectives with certain possible significant results reasonably at the end. The research approach to this study is summarised in Table 3.1 on page 75. As a methodology the approach is designed to guide the direction of data collection and analysis, and the mixing of qualitative and quantitative data. As a method, it centers on collecting, analyzing and mixing the qualitative and quantitative data in a single-study or multiple-study.

The MMR to this study comprises the case study (Yin, 2009) and survey (Groves, Fowler, Couper, Lepkowski, & Singer, 2009). A MMR (Creswell & Clark, 2010; Driscoll, Appiah-Yeboah, Salib, & Rupert, 2007) produces a stronger and richer set of evidences, and hence validity of the research. It involves a process of mixing the collection and analysis of qualitative and quantitative data into a converging single line of enquiry.

MMR consists of single-study or/and multiple-study which are explained in Chapter 3.3.2 and in following sections 1.9.1, 1.9.2, 1.9.3 and 1.9.4 for the six research objectives.

The MMR underlines several analytical techniques including non-equivalent dependable variables design with pattern matching (T. D. Cook, Campbell, & Day, 1979; Trochim, 1989), replication logic (McMullan & Seeley, 2007), descriptive and inferential statistics (Capper, 2008; Cavana et al., 2001).

Case Study Method

The case study method is chosen as appropriate part of mixed methods strategy for four considerations: the use of 'why' and 'how' questions to the study with the role of theory development; having no control over actual behavioral objects or events under study; having the extent of focus on contemporary or historical events; it can satisfy the characteristics of complexity science (Anderson, Crabtree, Steele, & McDaniel 2005: 673-680; 681).

This thesis has applied the case study five components for study process (Yin, 2011): study questions; study propositions; units of analysis; the logic linking data to the propositions, and; the criteria for interpreting the findings. The case study method is based on analytical generalization for the role of theory development. Each and every case is considered as important as an experiment for analysis on replication logic. However the limited established analytical tools in case study data analysis has been offset by mixing methods research with survey.

Survey Method

Survey is chosen together with the case study to provide triangulation of multiple sources of evidence into a converging line of inquiry, hence this enriches research validity. Unlike the case study, survey research is quantitative and based on principles of statistics and probability. Types of study questions start with what, who, where, how many, and how much. The sample size and sampling design of a population are very important for survey research. Survey differs from but strengthens validity of the case study by statistical generalization for the role of theory development.

This study applies non-parametric descriptive statistics (mean, mode, median and frequency) and parametric inferential statistics (t-tests) for determining architectural design criteria. In addition, this study also applies inferential statistics (correlation and regression) for investigating the relationships between design quality and market price of multi-storey residential buildings.

1.9.1 Single-Study for RO1

The single-study of MMR is applied for determining a set of architectural design criteria for multi-storey residential buildings and ranking of these criteria (RO1). This single-study involves collecting and analysing qualitative and quantitative data from multiple sources into a single line of inquiry as shown in Figure 1.2. The literature review provides for the qualitative data, while survey for the quantitative data. This survey was conducted on a sample of ninety five architectural professionals that based on 5% of 1775 registered architects in 2011.

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┌─────────────────────────────┐        ┌─────────────────────────────┐
│   Qualitative Data:         │        │   Quantitative Data:        │
│ Literature Review &         │        │ Survey A of 95 Respondents  │
│ Experience                  │        │                             │
└─────────────────────────────┘        └─────────────────────────────┘
                    ╲                      ╱
                     ╲                    ╱
                ┌──────────────────────────────┐
                │       RO1 Results:           │
                │   Interpretation based on    │
                │ Qualitative & Quantitative   │
                │         results              │
                └──────────────────────────────┘
```
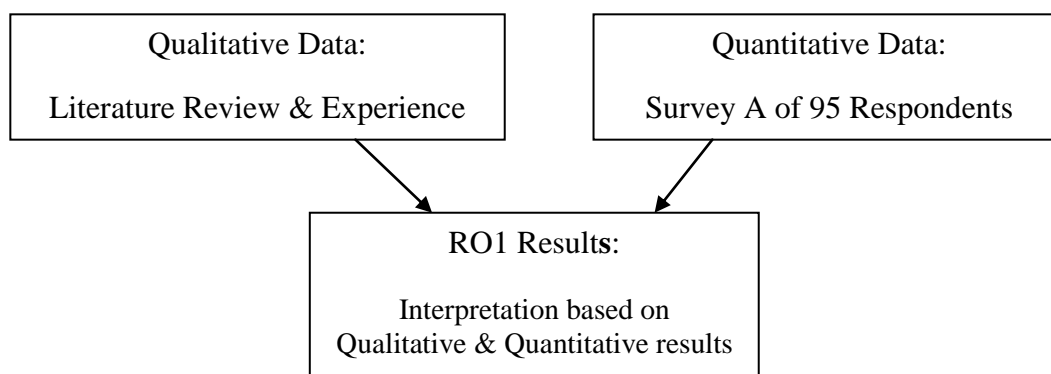
Figure 1.2 Single-study with triangulation design for objective RO1

1.9.2 Multiple-Study for RO2, RO3, RO4 and RO5

The multiple-study of MMR is applied for addressing RO2, RO3, RO4 and RO5. This multiple-study involves collecting and analysing qualitative and quantitative data from multiple sources into a single line of inquiry as shown in Figure 1.3. It includes survey of ninety five professionals, case studies of eight selected developers, case studies of seven architectural firms, and survey of random multi-storey residential buildings. The case study method (Yin, 2009) provides for qualitative data, while survey for quantitative data.

Study 1: Qualitative data and results Case study I of 8 developers	Study 2: Qualitative data and results Case study II of 7 architectural firms	Study 3: Quantitative data and results Survey I-36 buildings Survey II-45 buildings	RO2, RO3, RO4 & RO5 Results: Interpretation based on Qualitative results
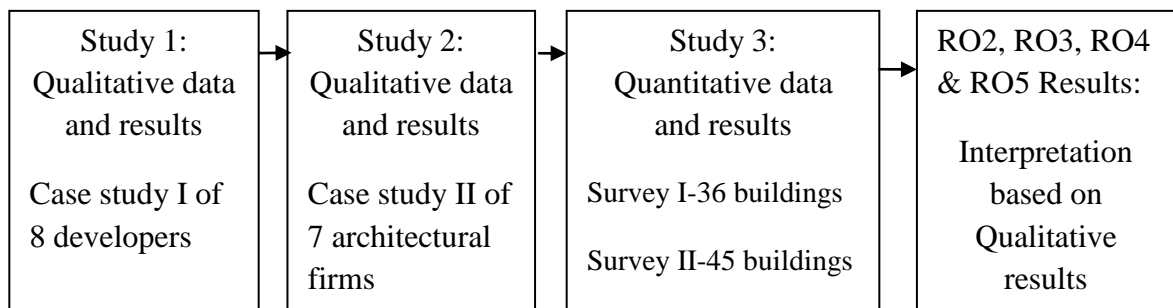
Figure 1.3 Multiple studies for objectives RO2, RO3, RO4 and RO5

1.9.3 Multiple-Study for RO5

The multiple-study of MMR and non-equivalent dependable variable design (NEDV) with pattern matching (T. D. Cook et al., 1979; Trochim, 1989) are applied for testing the RH1. The collection and analysis of qualitative and quantitative data includes survey of professionals, case studies of developers, case studies of architectural firms and survey of multi-storey residential buildings. The NEDV with pattern matching for testing can be represented as shown in Figure 1.4, and explained briefly as follows:

Predicted patterns   Observed patterns

N	O_{RH1-7}	X	O_{DV1-7}
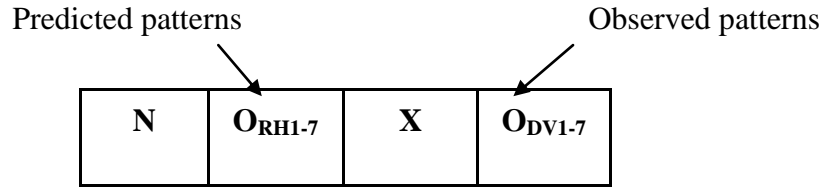
Figure 1.4 NEDV with pattern matching for testing RH1 hypothesis

- O_{RH1-7} are theoretical predicted patterns of the RH1 bivariate relationships and used as a template as follows:

    O_{RH1}=site context, O_{RH2}=aesthetics, O_{RH3}=function, O_{RH4}=sustainability,

    O_{RH5} =cost, O_{RH6} =socio-culture, O_{RH7} =Feng Shui.

- O_{DV1-7} are observed patterns of the architectural design criteria with the market price (low, medium and high cost) under investigation:

    $O_{DV\ 1}$=site context, O_{DV2}=aesthetics, O_{DV3}=function, O_{DV4}=sustainability,

    O_{DV5} =cost, O_{DV6} =socio-culture, O_{DV7} =Feng Shui.

- Pattern matching is aimed to establish initially if there were observed patterns of the bivariate relationships from correlation, regression or/and other analyses.

- If these observed patterns O_{DV1-7} and the theoretical predicted patterns O_{RH1-7} were matched, the pattern matching is obtained and the results will become stronger if the following conditions were fulfilled.

    Two and more cases providing similar results;

    Two and more studies providing similar results;

    Replication across two and more cases or/and studies;

    Analytical generalisation and statistical generalisation

1.9.4 Single-Study for Objective RO6

The single-study of MMR is applied for validating RH2 and RH3. This single-study involves

collecting and analysing qualitative data from multiple sources into a single line of inquiry as

shown in Figure 1.5. It includes case studies of eight selected developers and case studies of seven architectural firms.

Qualitative data and results: Case study I of 8 developers	Qualitative data and results: Case study II of 7 architectural firms

RO6 Results:
Interpretation based on Qualitative results
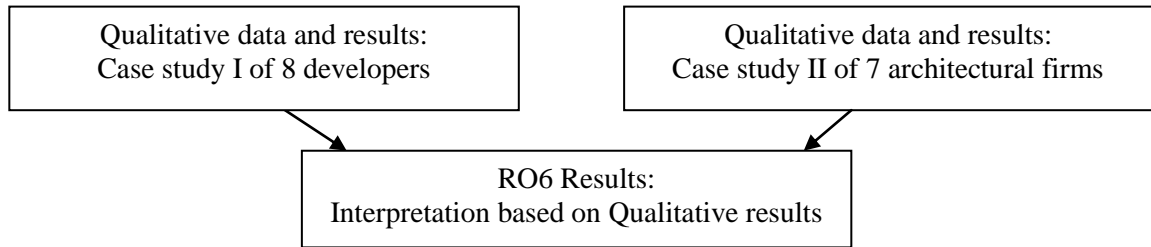
Figure 1.5 Single-study for objective RO6

1.10 Data Collection and Analysis

Data collection and analysis are briefly described as follows:

a. Survey A of Ninety Five Professionals

This survey aims to determine a set of criteria for architectural design of multi-storey residential buildings, and their application for investigation in practice.

The survey sample size is 95 professionals that based on 5% of the 1775 professional architects registered with the LAM. The minimum sample size for t-test is 30, following Roscoe's (1975) rules. A stratified purposive sampling was used for a representativeness and generalizability of population. Structured interviews with predetermined questionnaires were conducted on face to face and or telephone basis.

Data were collected and analysed by descriptive statistics of the mean, median, mode, frequencies as well as inferential statistics of the t-tests. The results of frequency, mean, mode and median show an important finding for the first ever set of seven architectural design criteria except for the Feng Shui in Malaysia: the frequency scores are 98.9% for site context; 93.7% for aesthetics of art; 100% for function; 89.5% for sustainability; 97.8% for cost;

98.9% for socio-culture; 49.5% for Feng Shui with 36.80% neutral and 13.7% disagree. The results of three t-tests (test results>4 "agree") with ρ-value of 95% confidence level showed positive majority opinion on agree with six design criteria except for the Feng Shui.

b. *The Case study I of Eight Developers*

This case study aims to investigate the relationships between architectural design criteria and market price of multi-storey residential buildings. In addition, it aims to test the RH1 research hypothesis and validate RH2 and RH3.

There are eight cases of developers. They are selected for their company profile and performance in housing property product quality. Four developers are among top 30 winners of The Edge Top Property Developers Awards Malaysia for the past several years. Structured interviews with predetermined questionnaires were conducted on face to face basis.

Data were collected and analysed by replication, non-equivalent dependable variables design, pattern matching, correlation and regression. The results show six important findings comprising positive and significant correlation ($p \leq 0.05$), linear and causal regression, case replication, pattern-matching, positive results of RH1, RH2 and RH3 research hypotheses. The exceptions of cost criterion and the variability of Feng Shui are discussed in Chapter 5.

The Case study II of Seven Architectural Firms

This case study aims to investigate the relationship between the established architectural design criteria and market price (low, medium and high cost) of multi-storey residential buildings from the perspectives of developers and architectural firms. In addition, it aims to test the RH1 research hypothesis, and validate RH2 and RH3.

There are seven cases of seven architectural firms. They are selected by virtue of appointment by the developers. Three architectural firms have been winners of the PAM Architectural Awards. Structured interviews with predetermined questionnaires were conducted on face to face and or telephone basis. However the interviews with the architectural firms were conducted twice as pre-survey interview and post-survey interview. This was because of some peculiar espoused theories or theories in use by the architects. These peculiarities are explained in Chapter 5 Discussion.

Data were collected and analysed by replication, non-equivalent dependable variables design, pattern matching, correlation and regression. The results of the pre-survey interviews show no findings for correlation, regression, case replication, pattern-matching, RH1 hypothesis testing and investigation of the RH2 and RH3.

However the results of the post-survey interviews show almost similar findings to that of the developers. The findings are positive and significant correlation ($p \leq 0.05$), linear and causal regression, case replication, observed and predicted pattern-matching, positive results of RH1, RH2 and RH3 research hypotheses. The exceptions of cost criterion and the variability of Feng Shui are discussed in Chapter 5.

c. *Survey I and Survey II of Buildings*

These two surveys aim to evaluate the application of architectural design criteria on selected low, medium and high cost multi-storey residential buildings, and to establish the relationship between architectural design criteria and market price. In addition, it aims to test the RH1 research hypothesis.

The first survey I of buildings was conducted in 2009/2010 on 36 buildings by 36 respondents. The second survey II was conducted in 2010/201 on 45 buildings by 49 respondents. Structured interviews with predetermined questionnaires were conducted with the respondents after they had completed the survey assignments. Data were collected and analysed by correlation, regression, replication, non-equivalent dependable variables design, and pattern matching. The results of the two surveys show six important common findings comprising positive and significant correlation ($p \leq 0.05$), linear and causal regression, case replication, observed and predicted pattern-matching, positive RH1 hypothesis testing, and triangulation of the multiple sources of case study evidences into single line of enquiry. The exceptions of cost criterion and Feng shui to the findings are discussed in Chapter 5.

1.11 Limitations of this Study

There are several limitations of this study as social science or business research that is based on mixed methods approach comprising the case studies and surveys.

Firstly, the case studies were based on several selected cases without randomization which have elements of bias to the construct validity, data collection and analysis. These threats occurred among the structured interviews, predetermined questionnaires, and human subjects. The predetermination of elements with the weighted questions restricted interviewees to provide further information. The preconditioning of interviewers to each interviewee tends to answering the same questions and giving opinions for specific enquiry. The variability of individual human factors such as behavior, attitude and experience among interviewers or interviewees could affect the case studies. Secondly, the measurements were based on interval scale instead of ratio scale which was assumed to be 'true' but not in real sense (Miles &

Shevlin, 2007). Thirdly, the study was conducted on a sole researcher basis with the limited time and effort. Fourthly the survey also has similar but lesser bias threats to the data collection from the structured interviews, predetermined questionnaires, and human subjects. The predetermination of elements with the weighted questions restricted opportunity for respondents to provide further information beyond the predetermined questions. Another threat is the preconditioning of the survey to each respondent answering the same questions and giving opinions for specific enquiry. The variability of individual human factors such as behavior, attitude and experience among respondents could affect the surveys.

1.12 Structure of Thesis Chapters

This thesis consists of six chapters which are described briefly in the following.

Chapter 1 Introduction starts with a brief description of the research purpose and significance of this thesis. It explains some main activities of the research design process: the literature review, research gap, problem statement, scope, questions, objectives, hypotheses, theoretical framework, methods, data collection and analysis, and a summary of the thesis structure.

Chapter 2 continues to elaborate literature review that is built round the research questions and purpose on four areas comprising: a historical review of the architectural profession and practice in Malaysia; studies of residential satisfaction and quality of Malaysian housing; studies of architectural practice overseas; and a study of a set of architectural design criteria and the market price.

Chapter 3 Research Methodology identifies and maps the types and complexities of investigation with the mixed method research approach to study objectives. It explains the development of a theoretical framework, the application of mixed methods research including case studies and survey, and the analytical techniques including non-equivalent dependable variables design, pattern-matching, replication, descriptive and inferential statistics. This chapter describes the collection of qualitative and quantitative data, and the preparation and techniques for data collection on four empirical field studies: survey I of ninety five professionals, case study I of eight developers, case study II of seven architectural firms and survey I and survey II of low, medium and high cost multi-storey residential buildings.

Chapter 4 Data Analysis and Results describes all analyses and results of the four empirical evidences: quantitative analysis of the survey I of professionals; qualitative analysis of the case study I of developers; qualitative analysis of the case study II of architectural firms; and quantitative analysis of the survey I and survey II of buildings.

Chapter 5 discusses the results and findings of the four empirical evidences linking to the research questions, objectives, and hypotheses. This chapter presents statements of the results and arguments for the measurement of eccentricity of design quality in architecture. The discussions include the interpretation of the results, findings of the research and comparisons with those of previous studies together with their limitations and threats to research validity as a whole.

Chapter 6 Conclusion summarizes six research findings that are based on a theoretical, methodological and empirical framework. It presents implications of the results, significance of the findings, limitations of this study, and suggestion for future works. This chapter ends with some recommendations for practice, research and policy.

CHAPTER 2 LITERATURE REVIEW

This literature review is built round the research problem, questions and objectives that underline three main subjects including architectural design quality, practice and multi-storey residential buildings. It attempts to identify and address a research gap. The brief inquiry of the literature review has indicated that studies on factors that influenced architectural design can be categorised into several groups. Some of these groups include study of practice (Blau, 1987; Gutman, 1988; Symes et al., 1995); study of history and theory of architecture (Arbi, 2008; Jencks, 2005; Jencks & Ridler, 1973; Kim, 2006; Neumeyer, 1991); study of works of the prominent architects on the styles and the uses (Galster & Hesser, 1981; Marans & Rodgers, 1975); study of relationships between built architectural design and people and the environment (Corbusier, 1986; C. Parker et al., 2004; Scully, 1991); study of specific environmental design criteria for buildings and people (Capper, 2008; Olesen, 2007); study of residential quality and satisfaction (Amerigo & Aragones, 1997; Goh, 2007; Salleh, 2008; Tan, 1980); study of user requirements and building performance measurement (Garcia Ferrari et al., 2008; Markus, 1969; Maver, 1970; Preiser, 2001); study of conservation (Y. Ahmad, 2006); study of seismic engineering design criteria for multi-storey buildings (Medhekar & Kennedy, 2000; Palermo et al., 2005).

This literature review covers the four following:

- A historical review of architectural profession and practice in Malaysia
- Studies of residential satisfaction and quality of Malaysian housings
- Studies of architectural practice overseas
- Study of architectural design criteria and market price of multi-storey residential buildings

2.1 A Historical Review: Architectural Profession & Practice in Malaysia

Study of practice in Malaysia has been limited owing to the historical development of the architectural profession, practice and education and training in the country.

This historical review starts from the British Malaya (Butcher, 1979) to post independence. The chronological order of European colonization (Winstedt, 1986) can be represented as follows:

- Portuguese Melaka (1511 – 1641)

- Dutch Melaka (1641-1824)

- British Malaya (1824 – 1946)

The British was chosen among the three colonial powers because of the major role of influence not only in the profession of architecture but also governmental, educational, social-economic and infrastructure systems of Malaysia. Hence the historical review will cover the British Malaya (1824 – 1946) and Post Independent Malaysia (after 1857).

2.1.1 British Malaya (1824 – 1946)

In 1842, the British took over Melaka upon the request of Dutch for protection against the French and the signing of the Anglo-Dutch treaty (Hall, 1968). Thereafter Melaka had become an important turning point in Malayan History. The British then set up the Straits Settlements of Melaka, Penang (1771), and Singapore (1819), and continued to expand in the country including Sarawak (1841 to 1941), Taiping (1874), and Kuala Lumpur (1859-39).

Prior to 1842, the British had already involved with Malay politics in setting up trading ports, the earliest being in Penang by Francis Light and the second in Singapore by Sir Stamford Raffles. In Penang, the British built the first large masonry Fort Cornwallis (1786) on the spot where Captain Francis Light first landed (Yeang, 1992). Subsequently many other buildings

were also built such as the oldest English, Free School (1816), the first Anglican Church St. George Church (1818) in the region, the Penang Museum and Art Gallery (1821, originally a school), the Convent School (1852), St. Xavier's Institution (1852), the Penang Town Hall, Hongkong and Shanghai Bank Building (1884), the E&O Hotel (1885), and the Customs Building (1907, originally the Malayan Railway Building).

Penang's buildings were the earliest influence of British architecture (V. F. Chen, 1998). Most of these buildings show characteristics of the Palladian, neo-Classical and Baroque that were then prevalent in their home buildings in the U.K (Fermor-Hesketh & Morris, 1986).

In 1869 the British continued to develop more projects and buildings when overseas business and trade grew especially demand of rubber and tin for canning in America and Europe. In 1874, upon signing the Pangkor Treaty for Taiping, the British administration brought peace to the local communities and the Royalties. Following this the tin-mining industry grew rapidly in Perak. With the wealth of tin mines and the political stability many more buildings and projects were developed in Taiping. Many of these projects have today become the 'first' and there is now in Taiping a total of 40 firsts in the country. These projects comprise a list of buildings, monuments and events. Some of the firsts of buildings (Vlatseas, 1990) include the administrative office (1879), Post and Telegraph office (1880), Railway Station and Warehouse (1881), Taiping Gaol (1885), Taiping Central Market (1884), All Saints Church (1886), the Museum (1886-1903), Clock Tower (1890), and Catholic Convent school (1899).

In 1884, Frank Swettenham, the British Resident in Selangor, introduced a legislation of building by-law (Kratoska, 1985; Tiew, 1998) with provision for a five-foot way in front of shop houses. In 1886, Swettenham announced that the duty of Britain to develop the country by infra-structure works such as railways, roads, telegraphs and wharves (Andaya & Andaya,

2001). The first railway project was built from Taiping to Port Weld in 1885, and the second from Kuala Lumpur to Kelang in 1886. Since the late 19th century the professional practice of British architects in Malaya grew to meet the needs and demand of building industry.

In 1896, the British chose Kuala Lumpur as its capital (Gullick, 1983, 1992), while united four Malay States into Federated Malay States. With strong and stable British administration and the rising private enterprise, the commerce and trade grew rapidly, resulting with a building boom. Thus, demand for architectural services for a variety of buildings continued to grow in towns or cities of these Federated States especially the Capital of Kuala Lumpur. These buildings included houses, government offices, palaces, schools, churches, mosques, palaces, shop-houses, railway stations, plantations' workshops and quarters, sport and recreation facilities, hill resorts and so on. Some of these buildings or places have today been preserved as national and cultural heritage listed sites.

The Works of British Architects and Influence of RIBA in Malaya

The first prominent and majestic Sultan Abdul Samad in Kuala Lumpur was completed in 1887 with the British 'Raj' style or Mogul style. The building was designed by British architect Arthur Charles Alfred Norman (Ghafar Ahmad, 1997), a senior government architect of the Public Works Department (PWD) in Malaya. The final design was transpired through a collaboration with another British architect R.A.J. Bidwell and C.E.Spooner, State Engineer in the PWD. The design is a blend of Neo-Classical, Neo-Gothic, and Moorish features of buildings of Muslim India and the Middle East. The building has today become a landmark of Kuala Lumpur under the Antiquities Act of 1976. In addition, Norman designed the Court of Justice (1880), the Central Market (1885), Selangor Club Building (1890), St.

Mary's Church (1894), JKR 92 Memorial Library and Museum (1907), Victoria Institution (1894), Carcosa (1898, Frank Settenham residence), Pudu Gaol (1895) etc.

There was another renounced British architect Arthur Benison Hubbock who designed several other prominent buildings in Kuala Lumpur such as the Jamek Mosque (1909), the Kuala Lumpur Railway Station (1911), and the Malayan Railway Administration Headquarters (1917). These buildings generally show a blend of Neo-Classical, Neo-Gothic, and Moorish features of buildings of Muslim India and the Middle East.

In 1896, Norman became a Fellow of the R.I.B.A. He presented a list of main buildings in Kuala Lumpur to the President and Council of the RIBA.

The RIBA is a professional body of architects in Britain formed in 1834. In response to a number of issues on architecture as art or profession during the industrial Revolution and rising capitalism, the leaders of the profession and educators devised four key measures (Lubbock, 1994):

- Compulsory examinations for membership of the RIBA in 1882

- The first full-time academic courses in 1895.

- The RIBA Board of Architectural Education to oversee courses in 1904 and its Visiting Boards in 1922.

- The Architects' Registration Acts of 1931 and 1938 to restrict the use of the name to qualified people.

The RIBA took almost a century to obtain legal approval of the government for registration of architects in 1927. By registration it means that only those who have qualified professional examinations prescribed by RIBA should be allowed to use the title 'architect' in their

professional practice. However this qualification does not entitle registered architect a legal monopoly of design for all buildings but legal use of the title only.

The British profession of architectural practice has played significant role and left a strong architectural legacy and heritage by prominent buildings and places. Some of these buildings show architectural styles such as Art Deco, Modernism, International style and Brutalism, while others a blend of Neo-Classical, Neo-Gothic and Moorish features of buildings of Muslim India and the Middle East, and still some others the Victorian Garden house, Straits Eclectic villas, Tudor house and early tropical bungalows.

2.1.2 Post Independent Malaysia (After 1957)

The post-colonial period sees progressive development in the architectural profession, practice and education in Malaysia. Since independence in 1957, the profession of architectural practice in Malaysia has advanced phenomenally. This was partly owed to the precedent architectural practice of the British architects and RIBA with more than a century in Malaysia. The other contribution was the British's involvement with the education and training of architecture in the country since1956. The rapport in discreet terms between the two countries continues today. The profession of architectural practice and education in Malaysia is to a great extent a 'continuation' of the legacy of British under the Royal Institute of British Architects (RIBA) or an evolution thereafter the end of nineteen century.

2.1.2.1 The First Decade of Independence Architecture

Within the first decade, architectural practices by local architects had demonstrated commendable high level of knowledge and skills in the building process for the country. The standard of practice had achieved a legal standing on par with the professions in Britain, the United States, and Australia.

Lai (2007) commends of a high quality for some architectural works during the first decade of independence in terms of their historical contexts, considerations, completion and building process in *Building Merdeka: Independence Architecture in Kuala Lumpur 1957-1966*. There were ten large scale national architectural projects including Merdeka Stadium, Merdeka Park, University of Malaya, Dewan Bahasa and Pustaka, Stadium Negara, Muzium Negara, Parliament House, Masjid Negara, Subang Airport, and National Monument. These projects were done by some first generation Malaysian architects including late Dato Hisham and late Dato' Loo. They made profound contributions towards the advancement of the profession and practice. In most of these projects they worked closely as a team with British and Australian architects as well as engineers of Public Works Department in the country.

2.1.2.2 The First Professional Organization 1920

The professional Institute of Architects Malaysia was originally established in 1920 as the Institute of Architects Malaya (MIA) during the British administration. MIA was then changed to the Federation of Malaya Society of Architects (FMSA) in 1948 because of the definition of political context. Finally FMSA was renamed to the Institute of Architects Malaysia or Pertubuhan Akitek Malaysia (PAM) in 1967. Since then PAM has examined the products of practice on design, styles and uses of buildings by prominent architects. The institute has also examined through consolidating the professional matters of practice such as business of practice, building contracts, planning and building bye-laws, code of practice and professional legislation. The institute organises seminars, series of design discourses, lectures, workshops, conferences etc. The knowledge and information have been recorded and classified into various groups of literature as references, practice notes, building regulation circular, standards and guidelines.

Registration for professional membership of MIA and FMSA then was generally quite similar to that of the Royal Institute of British Architects (RIBA). Besides the British architects, the membership was opened generally to all Malayan architects who studied in the United Kingdom or Australia with the corporate memberships of RIBA or RAIA.

2.1.2.3 The First Generation Architects' Five PAM Gold Medalists

In 1988, the professional organisation had introduced the PAM Gold Medal award for outstanding works of architects in practice towards the advancement of architecture and the profession. The five architects of the first generation who received PAM Gold Medal Award are the late Dato' Kington Loo, late Dato' Hisham Albakri, Datuk Seri Lim Chong Keat, Hijjas Kasturi, and Dato' Baharuddin Abu Kassim (Ngiom, 2010).

2.1.2.4 The First Architectural School 1956

The first school of architecture in Malaysia began in 1956 as a Diploma course in Building Design at the Technical College, Kuala Lumpur. The Diploma was equivalent to RIBA Part I professional qualification. Students who completed the course would normally further study the Part 2 in the U.K. or Australia. This Technical College later became the Universiti Teknologi Malaysia (UTM) in 1970. Subsequently five other schools of architecture were established such as the Universiti Teknonlogi MARA (UTiM) in 1967, the Universiti Sains Malaysia (USM) in 1972, University of Malaya (UM) in 1995, Universiti Putra Malaysia (UPM) in 1996, and International Islamic University Malaysia (UIA) in 1996.

Since the 1970s, studies of architecture have started among these universities. The studies include study of history of architecture (Arbi, 2008; V. F. Chen, 1998; Endut, 2001; Ismail, 2005; Rasdi, 2005; Vlatseas, 1990); study of sustainability(Aminuddin & Rao; Bahari & Said, 2011; Kamaruzzaman, Egbu, Zawawi, Ali, & Che-Ani, 2011; Utaberta, Spalie, Abdullah,

Tahir, & Che Ani, 2011); study of conservation (Y. Ahmad, 2006; Ali, 2010; Ashkan, Ahmad, & Arbi, 2012); study of building science and environmental criteria (Kwong, Tang, & Adam, 2009; Qahtan, Keumala, Rao, & Abdul-Samad, 2011; C. Wang, Abdul-Rahman, & Rao, 2010); study of architectural design practice (A. S. B. I. N. Ahmad, 2000; Sandanasamy, 2002).

Since the 1980s, studies of residential satisfaction and qualities of multi-storey housing have started. These studies are related to this study of architectural design qualities for multi-storey residential buildings. The results of these studies show the lack of planning and design quality in the low-cost multi-storey residential buildings.

2.1.2.5 The First Registration of Malaysian Architectural Practices 1973

The Board of Architects Malaysia or Lembaga Arkitek Malaysia (LAM) was established in 1973 under the Architects Act 1967. This started the first registration of architectural practices, architects, graduate architects and building registered draught persons. The Board in collaboration with PAM functions to promote the advancement of the knowledge of architecture, accreditation of architectural education, and code of professional conduct.

Currently there are a total of 1,775 professional architects who have registered with the LAM in Malaysia. Besides, there are a total of 1,371 architectural firms that have registered with the LAM. These practices comprise of 1040 for sole proprietorship, 94 for partnerships, 207 for corporate and 30 for multi-disciplinary. All architectural practices except the multi-disciplinary whose directors or partners must be professional architects.

Architectural practices are a form of services business for clients. These clients include individuals or companies of the private or the public. LAM has a set of guidelines and procedure for rendering architectural services and the charge of fess. The services are

governed by mandatory scale of minimum fees for the remuneration accordingly. There are few categories of services such as the basic and supplementary. The basic services have four phases: schematic, design development, contract documentation and contract implementation and completion. This LAM's guidelines provide architects a framework for serving clients and also working with a team of building professionals comprising consultants, builders, specialists and authorities.

The LAM in collaboration with PAM has achieved several important privileges of the registration for the profession. Firstly it is the title and role of architects. In Britain the registration was able to bestow only legal copyright over the use of the name but not a legal monopoly of design of buildings. Unlike Britain, the Malaysian's registration provides that architects should have the right to use the name of architect as well as legal monopoly of design of buildings. Secondly it is the mandatory Minimum Scale of Fees for architectural services rendered by architects.

Thus registration is a vital part of protective mean by which architects sought to get remuneration with less ambiguity and above this to protect themselves against competitors in the building professions and industry. These privileges have enhanced practices that have grown rapidly and contributed much to the building stock. Architectural practices for the last three decades have designed numerous multi-storey buildings in Malaysian towns and cities, especially Klang Valley in the last decade. As a consequence of these, the impact on people and the environment is getting to be more critical.

2.1.3 Summary

The review of this study contributes to the body of knowledge in history of architecture, the profession and practices in Malaysian context.

The historical review concludes that the profession of architectural practice and education in Malaysia is to a great extent a continuation of the legacy of British architectural practices under the RIBA in Malaysia. The British has played the major role of influence in the architectural profession, practice and education in Malaysia. The early association of MIA with the RIBA has been a contribution to the rapid development.

The architectural practices have demonstrated commendable high level of knowledge and skills in architectural design and the building process locally and internationally. The standard of practice has achieved a legal standing on par with the professions in Britain, the United States and Australia. CLS Associate, GDP, Wooi architect, T. R. Hamzah & Yeang International and Veritas are few examples of practices that are renowned locally and internationally.

However the contemporary architectural practices have been challenged by contradiction between the conception of architectural design and business in the market. Most firms have not been easy making efforts to adapt and cope with the transformation trends in the building industry such as the rise of industrial capitalism, the greater rationality and sophistication of the clients' organizations, the increasing scale and complexity of development projects and the globalization of architectural services.

2.2 Studies of Residential Satisfaction and Quality in Malaysia

Studies of housing quality (Idrus & Ho, 2008) and residential satisfaction (Salleh & Yusof, 2006) form an important part of literature review to the research questions, objectives and study propositions. The residents are users and their responses are important information to identify factors that influence design quality of the multi-storey residential buildings.

2.2.1 Theoretical and Methodological Frameworks for Housing Studies

The housing studies are based on theoretical and methodological frameworks of several researchers on the study of residential satisfaction. These are exemplified by the works of Marans and Rodgers (1975), Galster and Hesser (1981), Cutter (1982), Gifford (1987), Wiesenfeld (1995) and Amerigo and Aragones (1997). The research frameworks process and examine the relationship between residents and dwelling unit design features, dwelling unit support services, public facilities, social environment and neighbourhood facilities. The criteria of the relationships cover cognitive and behavioral characteristics of residents as well as physical and social characteristics of the environment. Measurement of residential satisfaction which is based on those criteria can serve as a criterion for the resident's quality of life. Therefore the conception of architectural design can play an important role in the quality of dwelling units and their surroundings.

2.2.2 Housing Policy: Adequate, Affordable & Quality Housing for All

Since 1957, the Ministry of Housing has committed to ensuring an adequate supply of affordable and quality housing for Malaysians of all income level. The development of the housing policy has undergone three major phases as follows:

- Colonial Housing Policy and Home-owning Democracy Policy (1948-1970)
- New Economic Policy (1971-1990)
- National to Vision Development Plan

The Colonial housing policy under the British administration from 1948 to 1960 committed primarily provision of housing for: government staff quarters; resettlement of people to new villages during communists' threat in the country; resettlement of people to the scheme of Federal Land Development Authority; especially low income group in urban areas. Home-owning Democracy Policy from 1961 to 1970 continued the policy with some improvements such as upgrading of basic infrastructure and inviting private sector to involve in housing provision. The First five year Malaysia Plan (1966 -1970) was introduced in this development period, subsequently followed by the next and so on.

The New Economic Policy (NEP) from 1971 to 1990 saw and created new growths: eradication of poverty and restructure the society; implementation of the concept of human settlement in housing; top priority in national policies for housing the low income people; private sector must play key role in housing provision.

The National Development Plan from 1991 to 2000 created further growths: emphasis on sustainable development in housing; assurance of all people regardless of their income to live in decent house; private sector must continue to play the role of housing provision.

The Vision Development Plan from 2001 to 2010 created further growths: emphasis on sustainable urban and adequate housing for all income groups; integration of housing development with other developments including commercial, offices, industrial, and transportation stations; government play key role in low cost housing provision, and private sector for low, medium and high cost housing provision.

In response to feedback from housing studies, the housing policy of the five year Malaysia Plans has been constantly revising several crucial matters such as the affordability, design

requirements of dwelling units, social facilities, neighbourhood facilities and environment, and location. The reviews and actions in five year Malaysia Plans are as follows:

The First Malaysia Plan was implemented in 1966 with the initial objective being to provide housing as a component of social services, to address the problems of squatter and overcrowded living conditions, and to promote the welfare of the lower income groups.

The Second, Third, Fourth and Fifth Malaysia Plans followed then were meant to improve Malaysia's socio-economy especially on poverty alleviation and the restructuring of society. It was during this time that the first formal and structured housing programs were undertaken to provide low-cost housing to meet the needs of poor. The outcome of housing policy at local and national level in Malaysia does contribute but at the same time poses new challenges towards rural integration, harmony and peace.

The Sixth and Seven Malaysia Plans were intended to provide balanced and equitable development for Malaysia. During the seventh plan period, various programs for the development of housing were implemented in the urban and rural areas. Both the public and private sectors undertook various housing projects. While the private sectors focused more on overall market demand, the public sector continued to provide houses for sale or rent to the low-income sector.

The Eight Malaysia Plan was to increase accessibility to adequate, affordable and quality houses for all income groups. Priority will continue to be given to the development of low and low medium cost houses. Both public and private sectors will intensify their efforts in the implementation of the housing programs to meet increasing demand. The provision of the other social services will be continued and expanded with a view towards improving the quality of life, inculcating positive values and encourage self-reliance.

2.2.3 The First Few Housing Studies 1980s

Housing studies began in the 1980s in response to a number of issues arising out of the housing projects completed. These studies were conducted mainly by the new department of planning or social sciences that had just began in several new public universities.

There have been two major issues of the Government's housing policy for adequate supply of affordable and quality housing to the low-income group. The issues are quantitative as well as qualitative in nature.

Tan (1980) a town and country planner conducted a study of housing quality to investigate the influence of qualitative issue factors. These factors include the location, layout and scale, and design of dwelling units of low cost housings in Malaysia. Responses were collected from household residents through survey interviews and questionnaires. The results of the study concluded that type of housing was lacking of planning and design quality for family housing needs, comfort, socio-cultural, and religious needs. The implications of negative results could affect the quality of life such as the psychological and socio-cultural aspects of the inhabitants. One of the recommendations directed to the housing policy was to improve the planning and design quality of the housing and environment.

Sulong (1984) conducted a study to examine the qualitative and quantitative issues. In the study Sulong investigated the issues and delivery problem of public low cost housing in Trengganu, Malaysia. The results of the study concluded that housing quality and layout also did not met family needs, comfort, socio-cultural, and religious needs. The results also concluded that the delivery of the low cost housing units was delayed and the supply was inadequate to meet the demand of the low income group people.

2.2.4 The First Study of Residential Satisfaction in Housing Quality 1987

Husna and Nurijan (1987) conducted the first study of residential satisfaction for multi-storey low-cost flats in Kuala Lumpur.

There were two objectives for this study. The first objective was to assess the level of residents' satisfaction with the physical attributes of dwelling units and environment in these multi-storey low-cost residential flats. The physical attributes of the dwelling unit include services obtained in each flat, age and type of structure, internal spaces, neighbourhood facilities and environment, height of buildings, person per-bedroom ratio, stage of the family life-cycle, education and income. The second objective was to examine the relationship between selected demographic and socio-economic characteristics of the respondents and reported satisfaction with housing.

Responses of participants were collected from a proportional, stratified, and random sample of 1,005 (out of a total population of 19,300) households in the multi-storey low-cost public housings of Dewan Bandaraya Kuala Lumpur. Stratification was based on type of structure (high rise or walk-up flats), age of building (old if more than 5 years) and ethnicity. Interviews were conducted with questionnaires. The questions were verified as relevant by a panel of housing specialists and Dewan Bandaraya Kuala Lumpur personnel.

The results of the study indicated that the residents were generally satisfied with council support services, public facilities, and neighbourhood facilities. However, the Malays and the educated, as well as those with large families and those in the expanding stage of the family life-cycles were less satisfied with the physical and socio-cultural characteristics of housing or dwelling units. Further analysis of housing deficits indicates that a substantial proportion of

the respondents experienced space/room deficits for bedrooms, dining areas and storage space. This reduced their levels of satisfaction. A large proportion of the residents were not satisfied with the dwelling unit characteristics: 85% needed a dining; 82% needed a separate toilet and bathroom, 41% respondents were dissatisfied with the dwelling unit characteristics. The physical characteristics of dwelling units are internal organisation of spaces for living, dining, bedroom, study, kitchen, storage, bathroom, toilet and drying areas together with provision of adequate natural ventilation, lighting, and view.

From the regression analysis, the results concluded that the predictor variable such as neighbourhood satisfaction contributed the most to overall housing satisfaction, while the physical and socio-cultural characteristics of dwelling units emerged as the second predictor variable in the equation. The space variable such as person-per-bedroom ratio was less significant as compared with internal overcrowding, type of structures (high rise or walk-up apartments) that did lower overall housing satisfaction levels.

2.2.5 Studies of Housing Quality - 1990s and 2000s

Nurizan (1993) conducted a study of the space deficit in low-cost household of Peninsular Malaysia. The results of the study concluded that qualitatively the residents of low-cost housing in Johor Bahru were not satisfied with the size and overcrowding in the house design and layout.

Razali (1993) conducted a study of privatization of low-cost housing in peninsular Malaysia. One of the results of the study concluded that quantitatively the supply of housing units was insufficient, thus did not meet the demands of the low-income group in the country.

Goh, (2007) conducted a study on the development and design quality of public low cost housing in Kuala Lumpur and the Klang Valley. The results concluded that although the recommended improved standard and design of the low-cost houses were implemented, weaknesses in the design of the dwelling units remained. The weaknesses were spatial organization of rooms, requirements for habitability, suitability and safety, the workmanship of construction, and maintenance. The study recommended improvement for design of the dwelling units in the provision of adequate, affordable and quality houses.

2.2.6 Study of Residential Satisfaction in Housing Quality 2008

Salleh (2008) conducted a study of neighbourhood factors in private multi-storey low-cost housing in Malaysia. Residential and neighbourhood satisfaction is an important indicator of housing quality and condition which in turn affects life quality of individuals. The factors that determine the satisfaction are essential inputs in monitoring the success of housing policies. The study is based on two case studies. The first case is a fast-growing state of Penang while the other is a less-developed state of Terengganu. Both low-cost housing projects were developed by private housing developers.

The study aims to investigate essential contributing factors which comprise dwelling units, housing services, neighbourhood facilities and environment. These factors affect the individuals' quality of life.

The methods of study used are surveys on two case studies of housings in the two different states. Data were collected from structured questionnaires on perception of residents on the level of satisfaction. The questions are designed on a five-point Likert scale. Interviews were also used in the surveys to collect data from two random samples of the two cases. The case

study of Penang's housing has collected a sample of 575 respondents from a total of 10,500 dwelling units and that of Terengganu a sample of 223 respondents from a total of 2600 dwelling units. The data analysis was based on descriptive statistics and factor analysis.

The results of the descriptive statistics and factor analyses in general indicated that neighbourhood factors are dominant factors that determine the levels of residential satisfaction. The satisfaction levels are higher with dwelling units and services provided by the developers than neighbourhood facilities and environment. The results concluded that residents in both states were quite satisfied with dwelling units, services rendered by developers, neighbourhood facilities and environment. However residents were particularly dissatisfied with certain factors; firstly, the dwelling units regarding dining room, kitchen, cloth lines facilities; secondly the safety measures to dwelling units and the environment; thirdly, the neighbourhood facilities and environment including public transport, community hall, parking facilities and facilities for disabled and children playground. In response, the study recommended that the government should improve quality of housing or dwelling units by monitoring closely the implementation of low-cost housing policies. The study mentioned that private developers are profit motivated, thus give less attention to the provision of neighbourhood facilities and environment.

2.2.7 Study of Residential Satisfaction in Housing Quality 2010

Mohit et al. (2010) conducted a study of residential satisfaction of dwellers. This study is based on twenty four newly designed and built public low-cost housing projects in Kuala Lumpur during the 8th Malaysia Plan. This new housing is zoned as high density living and has 1896 units within a site of 12.3 hectares. The standard is based on a new generation low-cost high-rise housing CIS: 1998 CIDB (1998). Each dwelling unit should have a minimum

area of 63 m^2 with 3 bedrooms, living room, dining room, kitchen, a separate bathroom and toilet and a drying area. The maintenance of the housing premises is run by the Kuala Lumpur City Hall. The study attempts to address the second of the two main unresolved problems that have developed in the housing sector for the past thirty years. First is the number of housing provided does not meet the demands for the low-income group. Second is the type of housing has not been satisfactory for the family housing needs, comfort, social, cultural and religious needs. The unsatisfactory type of housing could have effects on quality of life of the dwellers and in particular the psychological realm.

There are three objectives of the study. First is to investigate the level of residential satisfaction/dissatisfaction perceived by the residents of the newly designed public low-cost housing project. Second is to examine the elements and types of facilities which influence the residential satisfaction level of the inhabitants. Third is to examine the elements and types of facilities which influence the residential satisfaction level of the inhabitants.

The study methods are based on a theoretical framework built from other frameworks of the residential satisfaction from several researchers such as Francescato, Weidemann, and Anderson (1987), Varady and Carrozza (2000), Oh (2000), and Nurizan and Hashim (2001). The framework was developed for the study with a "residential satisfaction bundle" to contain five components: two sheltered components – (1) the dwelling unit features with 11 variables, and (2) dwelling unit support services with 8 variables; and three non-sheltered components - (1) public facilities with 9 variables, (2) social environment with 5 variables, and (3) neighbourhood facilities with 12 variables.

A survey of stratified random sample of respondents was applied. The respondents are stratified according to block, floor levels and races. Data were collected from respondents using structured questionnaires. The questionnaires are so structured that residents are motivated and attracted to answer across six sections on satisfaction levels on dwelling unit features; dwelling unit support services; public facilities; social environment; neighbourhood facilities. The levels of housing satisfaction are measured by five-point Likert scale.

The results of the study concluded that the residents were quite satisfied with dwelling unit support services, public facilities, and neighbourhood facilities. However the residents were not satisfied with the dwelling unit features including dining space, bedroom 1, bedroom 3, and dry area. The moderate values of beta coefficient suggested that improvement of housing design is required to increase residents' satisfaction with the four predictor variables of the dwelling unit features. The residents were also dissatisfied with the social environment for lacking design content.

2.2.8 Summary

The research findings of these studies contribute to the body of knowledge in planning, architecture and social science. The housing issues of design quality of dwelling units and the built environment in socio-cultural context have been identified. There is a concern of the poor design quality in planning and architecture which has negative effects on the residents. Recommendations have been directed to the Ministry of Housing. Action has been taken to amend the housing policy and to improve the design quality of the housing units and the built environment such as the enforcements of new improved standard of low-cost high-rise housing such as CIS: 1998 CIDB (1998). However the design quality problem remains today as shown in the study of Mohit et al. (2010). This calls for this design research.

2.3 Studies of Practice Overseas

Study of practice in the West has been limited too as compared to the study of architectural history, theory, conservation, building sciences, computer-aided design and drafting (CADD), sustainability and specific indoor environmental criteria. The first written record for design of buildings as art in architecture is found in the 1ST B.C. by Roman architect, Marco Vitruvius.

Study of practice in American has begun in the 1930s, and reached a highly renowned status worldwide in 1993-1994. The Harvard Graduate School of Design (GSD) and Department of Architecture held a year-long symposium. This symposium brought together reputed commentators of the subject such as William S. Saunders, Andrew Saint, Peter Rowe and others who had made the 1996 publication (Saunders & Rowe, 1996).

Since the 1960s, a number of studies in the U.K. have focused on client satisfaction with the construction industry as a whole (Egan, 1998; Latham, 1994). In response, the RIBA has been conducting this type of studies (RIBA, 1962, 1992, 1993, 1995) to address the issues of client-architect relationship in architectural practice. Clients are critical customers, and are no longer easily rely on architects as primary consultants (Nicol & Pilling, 2000). Architects need a radical change to maintain their position within the industry. Therefore it is important for architects to satisfy the requirements of clients (Boyd & Chinyio, 2006) through a social and collective habit (Cuff, 1992).

2.3.1 Architects and Firms

Blau (1987) conducted a study of architectural practice in New York City from 1974 to 1979. The study is based on two surveys on 152 architectural firms with over 400 architects who worked with them. These firms offered a conducive environment including a wealthy clientele, an aesthetic vanguard, professional bodies, design specialists, and professional

architecture and art schools. The study deals with architecture in a social context as profession (J. Cullen, 1977; Larson, 1983), as practice, as business and a set of convictions (Danto, 1964) about how buildings ought to look and function.

There are several research objectives. First is to examine about the socio-culture of contemporary practice. Second is to find out how firm practice changes over times under the social and economic conditions. Third is what features differentiated firms that have failed from those that have not under the social and economic conditions.

The first survey was carried out in 1974 on152 architectural firms. The second survey was carried out in 1979 after a severe economic recession. The 152 firms were selected on a probabilistic random sample, and constituted about one-third of Manhattan offices.

Data collection was based on structured questionnaires through interviews. Interviews were carried out in either face to face or telephone depending on the size of firms and kind of personnel. Some data were occasionally collected by post. Questionnaires were worked out that based on five social concepts as appropriate to practice. The concepts include voice, commitment, convictions and agendas, the eccentricity of merit and dialectics of the marketplace. They are interrelated and exist as a whole for contemporary architectural firms. Each concept was defined operationally into measurable elements or characteristics for descriptive and inferential statistical analysis. The results were remarkably indicative and informative for sociological perspective of architectural practice. The conclusions were based mainly on regression and discriminate function analyses which incorporate principles of probabilistic influences and of causal effects that are independent of other conditions.

The results of the analyses of the five studies concluded that various forms of risk structure firstly cause several intrinsic dilemmas to the professional practice of architecture in real life

context. These dilemmas are: firstly the dependence on commissions; secondly the poor distinction between architecture and building; thirdly the lack of congruence between those to whom the architect is ethically responsible to (for example, residents of a housing project) and those whom the architect is accountable (developers or agencies commissioning it); the constraints imposed on design practice by the increasing size and complexity of architectural offices; the lag between plans and their fully realized built form. Besides, there give rise to other extrinsic secondary dilemmas. These dilemmas are: firstly the professional services of architecture are not vital to people's health and welfare in the same sense of that of physicians or lawyers or dentists; secondly the development and building field is controlled not by architects but by developers, engineers, building contractors, project managers and interior designers, and; thirdly the economics of business profitability and fluctuations.

The measurement of the design quality was based on three sources of evidences. Firstly questionnaires on evaluation of the products of the various firms were mailed to the faculty academic members in each of the five New York Schools of architecture. Secondly questionnaires on evaluation of the number of times the work of the firm were reviewed in the professional journals during the preceding five year period. Thirdly questionnaires on evaluation of the combined number of competitions won and awards received during the preceding five year period. The three sources of measurements are well related, that the different sources of evidences yield the same results and support the assumption that design quality is largely shared.

In conclusion, architecture is subject to structures of risk that contain opposing conditions of various sorts. These contradictory features in contemporary practices are illustrated by the legend of architect Daedalus with his son Icarus (Guerry, 2005).

2.3.2 Architectural Practice: A Critical View

Gutman (1988) conducted a study of architectural practice in New York City in the 1980s. The study is conducted as a result of contradictions in contemporary practice at a fast changing pace. There are several research objectives. The objectives are: firstly to assess the contemporary design and building practice; secondly to examine what trends within the architectural profession and the building industry change the subjective experiences and traditional images of architect; thirdly to find out what problems of practice conditions are; fourthly to find out what implications of the future of architectural practice could be.

Numerous research methods were used pending specific problem-areas of the conditions of practice and sources of data. In the investigation of the supply of architects and firms, data was collected from the Bureau of the Census, and related or matched with information published by the American Institute of Architects (AIA) and the Association of Collegiate School of Architecture (ACSA). In the investigation of the changes taking place in the demand for architectural services, data were collected from interviews with practicing architects and clients, from studies of developments in other producer service businesses, and from biographies of architects and histories of the profession. In the investigation of competition within the profession and among other professions, data were obtained from marketing experts, builders, developers, interior designers, landscape architects and civil engineers. In the examination of the public's relation to architecture, data were collected from interviews with three types of publics including politicians, government officials, representatives of users and community groups, critics, and publishers.

The study results had identified ten trends that have been transforming the subjective views of architects in practice. These trends include: the expanding demand for architects; the changing structure of the demand; the oversupply of entrants into the profession; the scale and complexity of buildings or development; the consolidation and professionalization of the construction industry; the greater rationality and sophistication of the clients' organizations; the greater competition between architects and other professionals; the more intense competition within the profession; the continuing economic difficulties of practice; the changing expectation of architecture among the public.

In recommendations, Gutman proposes several challenges to New York City architecture practices undergoing through these transformation trends and to the profession. The challenges are: to adjust the number of architects to match the demand for services; to develop a consistent philosophy of practice to meet the expectations, requirements and demands of the building industry; to maintain a secure hold on the market for services; to find ways to maintain profitability and solvency in keeping with the increasing running cost of office; to create a competent organization that motivates high morale and good work.

In conclusion, there exists in practice the gap between the expectations of the world and the espoused ideas of architects. The espoused view of architects is to some extent unreal in the world of practice and this is perpetuated by the profession itself, by the schools and considerably by the architectural press.

2.3.3 Architecture: The Story of Practice

Cuff (1992) conducted a study of architectural practice in California in the 1980s. There are numerous issues in practice to create buildings that are aesthetically pleasing and meet the

needs of clients and inhabitants. The issues identified are as a series of dialectical dualities in the neglected domain of the territory of practice.

There are several research objectives. The objectives are: to know and understand what practice is: to define practice as a culture that has not been studied; to determine design as a social process, given what social conditions are to create buildings and cities that both are aesthetically pleasing and meeting the needs and desires of clients or users; to determine also what theoretical development and what methods to use to test these objectives.

The methods of research used are case studies, interviews, and ethnography according to the conditions and focuses. Ethnography was used to study the culture of practice (Saunders & Rowe, 1996) because of what architects said and what they did were frequently two very different systems. To achieve better understanding of practice, cultural analysis (Geertz, 1973) was applied to probe into the significance and meaning of any actions in their on-going context. This is further verified by cultural analysis (Clifford & Marcus, 1986) to hear about the common things of architects' daily life in firms except major problems or great success. The results of ethnographic method together with participant observation showed clearly the complication and sophistication of the apparent dilemmas embedded in daily life of architects and firms.

The analysis results of the case studies of three buildings for excellent quality concluded and tested the hypotheses. Firstly excellent projects showed design process characterized by dynamics, warm, familial as well as conflict relationship among participants for achieving optimal solution (Coxe et al., 1986). Secondly excellent projects emerged a strong architectural concept understood by the principal participants for a sense of ownership among them. Thirdly excellent projects were related to office characteristic such as strong leadership,

a high set of quality, a respect for the creative genius, a loose organizational structure, a clear set of values, face-to-face communication, and informal. Fourthly excellent projects presented a set of contradictory forces at work that frame the development of excellent buildings, but the architects attempted dialectically to resolve these dilemmas in seven excellent attributes: quality demands; simplicity within complexity; stereovision; open boundaries; flexibility with integrity; teamwork with independence; exceeding the limits.

In the professional practice of architecture, excellent buildings evolve from interactions that embody seven dialectical principles emerging out of a dynamic and complex set of circumstances. Design excellence and profitability may be incompatible. Design excellence does not come out from a talented architect or exceptional client alone but from an emergent 'chemistry' among principal participants. The mythical architect as lone genius-artist is a false image insofar as it represents a simplification of actual circumstances. Design of building in architecture is a social art considering a fluctuating constellation of possibilities in a vital, dynamic and formative social context in which it is developed.

2.3.4 Architects and their Practices

Symes, Eley and Suidel (1995) conducted a study of architectural practice in the United Kingdom. The study was based on a number of studies of architects and their practices.

These studies were built upon the review by (Esher & Llewelyn Davies, 1968). The review focused on four main changes which might affect architectural profession by 1988: firstly a growing trend of specialization within design groups, a consolidation of the industry in construction, an uncertainty over the role of the professional institute and changes in architectural education. The predictions were broadly apt but insufficiently dealt with the role

of architects and how far their practices would be exposed to the rise and fall of business activities of a market economy.

There are five study questions and three main objectives. The objectives are: firstly to explore what might be changes which had hit the architect profession in the last two decades; secondly to search on how the once highly traditional professional role had responded to the challenge of the economic and social changes in the construction industry; thirdly to predict the future role of the architectural profession.

The study methods adopted were survey and case studies. The authors conducted studies of a professional group based on functional and critical approaches by Dingwall and Lewis (Evetts, 2003) and (J. H. Parker, 1983). The functional approach uses membership of group, examines activities of those members who organize themselves, and then discusses function of specialized pattern of work and associated behaviour that may have for the position of group in society. While the critical approach takes a point of view outside the situation being studied. This assumes that there are forces which create a structure to society.

The survey was based on wide-ranging 171 questionnaires, and a significant cross-section of partners or principals of RIBA firms. It was a simple random sample of 1173 names of principals taken from the RIBA directory of member firms. In the end 610 respondents had replied by post. The number and variety of respondents could represent architects' behavior and attitudes towards the changes and perception of practice. Data were collected by post. The analysis was carried out by SPSS computer package.

The case studies comprise seven architectural firms of a wide range of practice types. They were selected for a comprehensive picture of the problems and achievements of contemporary practice in the early 1990s. The case studies used questionnaires and semi-structured

interview for data collection. They involved visiting the seven firms, meeting their partners or principals and staff, reviewing the history of their firms, examining a number of their projects and asking them about their experiences. The critical approach of study was applied for making sense of the cases for two reasons: firstly to see how architects were affected by economic forces to diversify and to compete with other professions in the building development process; secondly to see how the process of development and design had been affected by such changes of context.

The conclusions of studies to the five questions were: firstly the results on the question on the highly traditional professional practices concluded that the role of the architects as designers had been at the mercy of economic change in the construction industry, and if the situations were not corrected the quality of the designed environment will surely suffer; secondly the results of the question on the development of specialization within the profession were not always essential but only in certain situations; thirdly the results of the question on the introduction of new technology were important and useful and in particular the small firms; fourthly, the results of the question on how the organization of the professional body could support practices of members were useful and worthy; fifthly the results of the question on whether architects remain personally enthusiastic for their work and committed to their profession were positive for most of them who commented of the need of passion and efforts, and a sense of worth to maintain the creative skill and expertise.

2.3.5 The Social Foundations of Architectural Distinction

Stevens (2002) conducted a study of architecture in the 1990s. The study objectives are: to develop a conceptual model of the field of architecture; to demonstrate that sociological

approach as an appropriate and relevant strategy; to examine architects in practice or academe owe their success much to their social background and other factors than just to genius; to understand and explain the division between the Department of Architecture, Planning and Allied Arts (DAPAA) and the Department of Architectural and Design Science (DADS) at the University of Sydney. The history of this division goes back to lectures by T.L. Donaldson in 1841 (Crook, 1969), the first professor of architecture in Britain.

The study is based on a critical analysis of the data from the 1982 Macmillan Encyclopaedia of Architects (Pressman, 1999), the conceptual toolkit of French sociologist Bourdieu (1984), architectural theory and various literature review. Firstly he analysed the nature and characteristics of the field, explaining the different components and their relationships of its synchronic structure. Secondly he analysed the history of the dynamics of the field in general from the Renaissance to the present, discussing its changing structure and growth through time. Thirdly he analysed the field historically from 1980s to 1980s the system of architectural education as new growth method of reproduction on the transmission of symbolic culture. These analyses are referred to some European countries and the U. S. The formal system of education has enhanced the growth of accredited architects and architecture, producing research or scholarship which informs teaching and the knowledge base of the profession. In the process of analysis, there is an on-going tension between the formal education and the practices.

The results of the analyses have developed the conceptual model of the field of architecture as appropriate for a social study of architecture rather than a social study of architects. The model is to consider a much larger social entity of the members of the occupation of architecture, including practice, academe, among others related. The model describes the field

of architecture, which structures the entire social universe of the architects and of which architects are only one part. This larger social entity of architecture is so important that has been ignored in much previous work of studies done. The field has immense analytic power and clarity. The field of architecture is an inclusive model to explain and describe the social foundations of architectural distinction for successful architects in practice and academe. The field is a social arena comprising architects, architectural academics, clients, builders, authorities of the state, financial bodies, architectural, discourse, among other things. The arena has two main characteristics of a place. The arena is a place of a battlefield where architects to compete for control of the resources and capitals such as for status as great creative designers or architectural award winners. The arena is also a place of a field of force. There exist forces acting on its members, and each member exerts a force according to the composition and nature of the economic and cultural capital that he or she has in that field.

The model justifies the sociological approach as appropriate strategy for the study of architecture for several reasons as follows:

Firstly sociologists are critical and see problems beyond the individuals into human society including the origin, development, organization and functioning (Cuff, 1992; Gans, 1982; Gutman, 1988; Summerson, 1963). These architectural sociologists perceive that architects do not pay much attention to the social community and to the needs of the users of the buildings.

Secondly architects are not socially minded, as researched in the psychological studies (Mackinnon, 1965). The more eminent architects tend to be most unsociable. Most of them regard their responsibility to society as unimportant. The most creative architects were not really interested in interacting with other people at all, and they preferred to be giving orders to people. Cuff (1989) found in a survey interview of architects in New York's office that

some eminent architects conceived people as spectators, think fit agents. Being interested in the social, they fundamentally were not well informed of the social notions in design such as community, friendship, family and work relations.

Thirdly architectural discourse avoids the social. Tavernor (2005), explains the main issue in the architectural theory of the abstract principles as the determination for built form. Kostoff remarked on the Modern Movement of architecture: ''Modernist rhetoric waxed eloquent about the needs of users. It represented architecture as the vehicle of social welfare and set public housing issues as the highest priority of architecture. But there was no question of consulting with the user of the housing estate during the course of their design.… Users did not know what they wanted or, more importantly, what they should have. Their collective needs, interpreted by the architect and the sponsoring agency, would be codified in the 'program'… Architectural revolutions required the redesign of humanity.' Motloch (2000), believe that architecture ought to be more inclusive and recommended in the report for architectural education: 'the nobility of architecture has always rested on the idea that it is a social art.' Morgan (2005), has pointed out that sociology in design is ill developed in France.

Fourthly it is thought that sociology of creativity and aesthetic may not exist. Wotton (1970) and Palladio (2002) argued that the general response from philosophers to the sociological challenge of aesthetics has been to ignore the validity. There exists three ways: firstly the denial of mainstream Anglo-American philosophy of art; secondly the wrong conception of philosophers; thirdly the transcendental argument of art over the conditions of production. Before this, Brown and Gillespie (1995) explain aesthetic of taste as a sociological, economical and anthropological concept with reference to cultural patterns of choice and preference. Historically the concept of aesthetics has been the interest of philosophers such as

Hume and Plato as the ontology of aesthetics. Since the discourse of aesthetic by Kant, philosophers are working on the notion of art as autonomy or just what aesthetic is or how to measure aesthetic quality, ignoring the investigation of the correlation between the social and art movements. There has been conflict between the sociologies of architecture and the assumptions of aesthetic theory of architecture. The conflict points to several aspects: firstly art theory centers on the individual while that of sociology on the collective; secondly there is redundancy of architectural sociology as great buildings of architecture are unique expression of the singular genius, acknowledging the resulting irreducibility of aesthetic values.

In conclusion, the developed model explains the concept of social foundation of architectural distinction. The model explains the perception of most eminent architects in practice or academe who owe their success much to their social background and other elements than just to genius. The eminent architects have been connected to each other by master-pupil and collegial relations. These social connections are basis for architectural influence that runs parallel to that of the architectural schools of university. This has dispelled the traditional and popular view of architecture that geniuses have designed all the most famous buildings. The results provide the reasons for tensions between his own department of Architectural and Design Science and that of Architecture at the University of Sydney.

2.3.6 Summary

The research findings of these studies contribute to the body of knowledge in architecture the profession, practice and social science. The problem of design quality of architecture in buildings and the built environment has been identified. In addition there exists a concern of the difficult measurement of architecture and design quality. All five studies focus on sociological perspective of architectural practice with reference to history of architecture

(Groat & Wang, 2002) and aesthetic theory which provides an inclusive and comprehensive coverage. The studies include the clients, the market, and design and management of firms.

The approaches of these studies are single or and mixed methods design research comprising survey, case studies, and ethnography. Methods of analysis of data include cultural analysis, interpretation, descriptive and inferential statistics. The results of the analyses generally conclude complexities and contradictions in architectural practice. These complex and contradictory features are; the structure of risks, eccentricity of merit and dialectics of the marketplace (Blau, 1987); the social foundations of architectural distinction that the most eminent architects in practice or academe owe their success much to their social background and other elements than just to genius (Stevens, 2002); the espoused view of architects is to some extent unreal in the world of practice and this is perpetuated by the profession itself, by the schools and considerably by the architectural press (Gutman, 1988); the practice issues of a series of dialectical dualities in the neglected domain of the territory of practice, and architectural design excellence of buildings does not come out from a talented architect or exceptional client alone but from an emergent collaboration among principal participants (Cuff, 1992); the role of the architects in practice as designers had been at the mercy of economic change in the construction industry, and if the situations were not corrected the quality of the designed environment will surely suffer (Symes et al., 1995).

Most studies deal with the subjective or philosophical issue of design quality. Design quality can be a case of phenomenology (Blau, 1987; Cuff, 1992) in which it can be measured objectively. This phenomenal approach has been considered and applied to guide this study on measurement of architectural design quality i.e. a theoretical, methodological and empirical framework.

2.4 Study of Architectural Design Criteria and the Market Price

This literature review is built round the research problem, questions and hypotheses. Architectural design quality has always been a controversial debate, thus its measurement is hard to deal with. Blau (1987) explains there exists polarity of view of quality between the professional standards derived from consensual judgment and the judgments of their successors or the public. Cuff (1992) comments the controversy from the philosophical question of whether design quality can ever be absolutely determined to the phenomenological entity. M. Cook (2007) states architecture and design quality is seldom without controversy, as it is generally viewed as subjective.

Since 1999 Commission for Architecture and the Built Environment (CABE) in UK has done and advised design quality indicators in nine areas of work on architecture, urban design and public space. The areas of work include housing, school design, public space, education, health and wellbeing, planning, inclusion and diversity and sustainability. Most of these works are published online www.cabe.org.uk with more than three hundred publications e.g.: 'Creating Excellent Buildings' provides expert advice for anyone commissioning and managing building projects; 'Large Scale Urban Design' offers practical guidance to local authorities on how to prepare, deliver, monitor and review an open space strategy.

2.4.1 A Set of Seven Criteria for Architectural Design quality

Architectural design quality is based on a set of seven criteria which are described briefly in Chapter 1 on page 8. These criteria are identified in literature review as follows:

2.4.1.1 Site Contexts

Site context is concerned of the planning and design of buildings to respond for harmony between the environment, buildings and people. This involves principles of site planning

(Lynch & Hack, 1984), landscaping design (Brown & Gillespie, 1995; McHarg & History, 1969; Motloch, 2000) and place making (CABE, 2011c).

Buildings are sited to orientate to maximize optimal effects of winds, sun and views as well as macro and micro-climate. This reduces energy used in buildings (McMullan & Seeley, 2007; J. H. Parker, 1983). Buildings are sited also to response with the existing environment in particular the art and architecture of historical buildings and planning patterns in urban areas (Bently, Alcock, Murrain, McGlynn, & Smith, 2001). In this context it involves principles of conservation, especially the preservation of the heritage buildings or places. The essence of site context makes places and senses with buildings which enhance everyday life (G. Cullen, 2012), liberate their inhabitants, give them sense of the world they live in, and ultimately create a evocative, meaningful and sustainable living environment.

2.4.1.2 Aesthetics of Art

Since the beginning of history, art and architecture has created together a sense of aesthetic quality in buildings for the human spirit, emotion and thoughts. Beauty of art in architectural design is an essence of aesthetics which has value beyond measure (Bakhshi, 2010). The first record of written form for design as art in architecture brings the route back to the first century B.C Roman architect, Marco Vitruvius (Morgan, 2005). Vitruvius describes three conditions for design which are *firmit as, utilitas* and *venustas*. These are ltranslated as firmness, commodity and delight (Wotton, 1970). Art according to Vitruvius should be deliberately expressed as delight of a building in design together with firmness and commodity for architecture. However design as art has become a dominant condition passing down for centuries, and has influenced the works of many architects. The success and popularity of Andrea Palladio (Tavernor, 2005) owed much to the three conditions. Palladio had become one of the classical revival architects (Summerson, 1963). The works and treatise

(Palladio, 2002) exerted wide influence on architecture (Farber & Reed, 1980) in the British Isles well into the nineteenth century. During this period many buildings of architecture were designed with these three conditions i.e. engineering sound to resist all forces, functionally fit for all purposes, and delightfully stimulating to the human spirit, emotion and thoughts.

In 1648, the Ecole des Beaux-Arts in Paris (Drexler, Chafee, beaux-arts, & Art, 1977)was established to develop design as art for a unique expertise of architects. The Ecole had become the most celebrated school of architecture in the nineteenth century and taught students to design buildings that were classical, monumental, symmetrical, and sculptural. This has become the legacy for generations in architecture. The Beaux-Arts classicism had influenced the City Beautiful Movement in the United States (Noffsinger, 1955; Stern, 1962) at the end of nineteenth century and created some major public buildings as the Grand Central Terminal and New York Public Library in New York. The climax of Beaux-Arts classicism in the United States is occasionally called the American Renaissance.

In1850, the famous Victorian John Ruskin (Ruskin, 1904) delivers lectures on design as art in architecture and painting '…No person who is not a great sculptor or painter can be an architect. If he is not a sculptor or painter, he can only be a builder.'

In 1919, the school of Bauhaus in Germany was founded by Gropius (1965). (Bayer, Gropius, & Gropius, 1938). Some renowned persons who had worked in the school were architects such as Ludwig Mies van der Rohe and marcel Breuer; artists such as Paul Klee, Wassily Kandinsky, and Jossef Albers; artisans such as Anni Albers. Bauhaus (Bayer et al., 1938) has become an extraordinary modernist design school that was founded on the idea of creating a total work of art, craft and technology including architecture as a whole. The name of Bauhaus has become synonymous with European architecture of the machine age. Pevsner

and Forsyth (2009) comment that the style of Bauhaus school had become one of the most influential impacts in modern design and Modernist architecture. The Bauhaus has played a significant influence upon subsequent developments in art, technology and architecture.

Basically art are simple elements such as lines, curves, angles, surfaces, solid, solid geometry, void and color. With these elements, art creates compositions such as massing, linear, planar, cube, symmetry, scale, proportions and balance. With theories and works of fine arts, art goes beyond and makes representation, abstraction and impression (Lazzari & Schlesier, 2005), iconic things or buildings. Through art in architecture, numerous outstanding buildings are created with rich culture and heritage of civilizations for appreciation. Architecture has been characterised by W. W. R. Dalzell as the 'indispensable art' (Hartt, 1985) and rightly so. The three conditions today in which design as art is one of still holds true in the search for architectural quality after about two thousand years ago.

2.4.1.3 Function

Function is an essence of good design which can help create places or spaces and work for everyone (CABE, 2011b). Function is so important that it leads to form follows function (Sullivan, 1896) and building ornament to have function. The functionalism today (Adorno, 1979) is important to be resolved for the good of humanity. The function of a dwelling unit design aims to achieve a useful, purposeful and valuable commodity for users. Most or all buildings today are built for one or more functions. Typically, functions of dwelling units include characteristics of enclosing spaces: function, gender, sizes, proportion, shape, relationships, accessibility, internal environment, natural ventilation, lighting, view, privacy, flexibility and adaptability. Like aesthetic quality, the functions of building bring the route back to the first century B.C same Roman architect, Marco Vitruvius (Wotton, 1970). He

describes three conditions for design of buildings viz. firmness, commodity and delight. Buildings of architecture according to Vitruvius should manifest the condition of commodity, meaning that the building spaces are functionally fit for all purposes.

During 600 B.C.,Tzu (2004) observes usefulness of spatial concept from ordinary things around us. This is recorded in chapter 11 of Tao Te Ching: thirty spokes can be formed into the hub of a wheel, and it is the in-between spaces of the spokes that make it useful; clay can be shaped into a vessel, and it is the enclosed spaces empty within that makes it useful; doors and windows can be made for a room, and it is the opening spaces which make it useful; therefore gain may come from what is there, and it is what is not there that is useful.

Ching (2007) explains vividly the concept of function. Functional design considers creative relationship and organization of living spaces in three dimensional quality; adequate sizes of spaces; privacy; flexibility; space and light; ventilation; thermal comfort; views; tactile and visual quality of internal environment including materials, color and furniture.

2.4.1.4 Sustainability

The essence of sustainability is to design buildings or places for protecting people and the environment. It fulfills the environmental, social and economic needs (CABE, 2011d). Typically sustainability today is characterized by three major dimensions comprising community, economy and environment being connected to function as a whole for a life-long self-generating process (Williams, 2007). The three realms of sustainability are interdependent and complimentary elements, and must be design-resolved simultaneously, similarly to the three design elements in Vitruvius principles – commodity, firmness, and delight. Thus, sustainable design is three-dimensional solution provider that lasts for generations. Williams (2007) poses a challenge to architects from the exclusive concern for

form making to the art and science of place making in sustainable design through ecology, architecture and planning. Pritzker Prize winner architect Murcutt (Murcutt, Beck, & Cooper, 2002) for green architecture in Australia shows that sustainable building design has minimum harmful effects on human health and the environment. B. Edwards (2000) address perceptions of sustainable housing from the importance the individual dwelling to the neighborhoods and communities with key principles for UK practices.

Strategies of sustainable building design are constantly developing in active or passive environmental control means by public and private institutions or research centers. Some of these strategies have been well developed for practice such as rain water harvesting, energy efficiency strategies, sustainable building materials and construction, natural ventilation strategies, solar heat gain co-efficiency of facades, sun shading devices, photovoltaic, daylight factor, wind turbine power, reuse and recycle of wastes and carbon footprint.

Many countries throughout the world have been legislating sustainable design strategies in planning and building bye-laws. Some are LEED, BREEAM, GREEN STAR, HQE and GBI.

In the U.S., the Leadership in Energy and Environmental Design Green Building Rating System (LEED) was developed by the U.S. Green Building Council (USGBC) in 1994 (Council, 2003). The inception of LEED was established in 1998. In the U.K., BRE Environmental Assessment Method (BREEAM) was established in 1990 as a tool to measure the sustainability of new non-domestic buildings (Cole, 2005). BREEAM is now a voluntary measurement rating for green buildings. Since its inception it has since grown in scope and geographically, being exported in various guises across the globe. In Australia, GREEN STAR was established in 2003 as a tool to assess management (Australia, 2009); transport; ecology; emissions; water; energy; materials indoor environmental quality; innovation. In Malaysia, the Green Building Index (GBI) was proposed in 2008 as a tool to assess the energy

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efficiency; indoor environmental quality; sustainable site and management; materials and resources; water efficiency (Begum & Pereira, 2010; Oh & Chua, 2010). The legislation of the GBI is pending. Installation of systems to achieve these green indices requires greater capital costs, and clients or developers are careful in consideration for multi-storey residential buildings, especially the low and medium cost typology.

2.4.1.5 Cost

Anyone, especially developers or clients will need to know in advance the probable costs involved in the works for development, design and construction of buildings (Ashworth & Hogg, 2007). All of these costs need to be accounted for in cost control and planning (K. H. Ahmad, 2011). Failing which cost planning for the projects will not complete.

Cost design of a project, a pre-contract matter (Ashworth, 2008) concerns planning cost effectiveness for building performance and quality over time. Cost effectiveness accounts optimal total cost of project including preliminary cost, design cost, construction cost, maintenance and building operating cost and replacement cost estimated at every 30 years for an average 60 years building's life span.

Value for money, cost/risk reduction (CABE, 2010), construction technologies and materials are some key effective cost elements to total cost of project. Sustainable design in inclusive design is efficient energy consumption, thus cost saving. Equipment or devices may initially cost higher capital costs but over a period of time it can lower maintenance costs for the buildings and the environment. Inclusive design provides flexible and adaptable options to re-arrange or change function of spaces and construction components.

2.4.1.6 Socio-culture

Design for people today is highly regarded by politicians, architectural critics, sociologists and psychologists. Sir Winston Churchill declares, "…We make buildings and afterwards they make us. They regulate the course of our lives." Architectural critic Paul Goldberger (2009) explains architecture of its meaning, culture and symbol "Great architecture affects the quality of life… at its best it can help to heal and to teach by creating a comfortable and uplifting environment for these things to take place…it makes life better."

Socio-cultural design in residential buildings is important for people as individual, community or the public. A good design can help create places or spaces that work for everyone (CABE, 2011b), and the quality of open spaces have a high impact on resident's well being and health (CABE, 2011a). This includes life styles; social and cultural activities and interactions; sport and recreation: social facilities for children, mothers, the aged and disabled; spaces for spirituality; reading and learning; eat, play and pray; health and wellness.

Since 1960s sociological studies of architecture in the West has begun. Sociologists are perceptive of the society as a whole and are able to discern what the problems are and possible solutions on what society ought to look like. Over a period of time, sociologists have gathered insights on architects where they do not pay much attention to the social needs of people living in their built environment (Blau, 1987; Gutman, 1988). The problem is identified by Dana Cuff in her interviews with architects practicing in New York City. The architects were perceived as more of themselves than the customers, and had poor social notions of friendship, family, community and work relations. This is evidenced by pictures of their works in the architectural magazines depicting buildings devoid of people or users. Sociologist Kostoff remarks, "…Architectural revolutions are required for the redesign of humanity." (Saunders & Rowe, 1996).

2.4.1.7 Feng Shui

In Mandarin, Feng Shui literally means 'wind' and 'water'. Feng Shui has been a traditional practice of Chinese who believe would help people to live in harmony with their natural environment for more than two thousand years (Mak, 2011; Yoon, 1976).

Thompson (1998), identifies that in Feng Shui the Chinese perceives their universe as nature and has three features of cyclical processes: day and night, growth and decline, and rotation of seasons. Feng Shui focuses on the landforms and landscape to the flow of Da Qi (the Universal Force) and the balance of Yin and Yang. It applies the use of Elements and Animals, Stems and Branches, the Oracle Coins, Bagua, the Luo Pan or Compass, Numbers and Square, Ruler and Symbols.

Teather and Chow (2000), geographers concluded in a study that Feng Shui is a way to regain our ability to look into our landscape as a continuously produced expression of human action, as produced space. Feng Shui helps to explain how people in East Asian countries with a Feng Shui tradition perceive, apprehend, make sense of, and manipulate space. Lip (1995) explains 'Feng Shui represents the power of the natural environment – the wind and the air of the mountain and hills; the streams and the rain; and the composite influences of the natural process.' Mak and Thomas Ng (2005) concluded in an empirical survey of architects in Sydney and Hong Kong that the selection of surrounding environment for a building and interior layout generally concurs with the ideal Feng Shui model established more than two thousand years ago. The ideal Feng Shui model comes from Form School rather than Compass school. Form School has been more recognised by building professionals because of its more scientific analysis of built environment. The Form School is based on principles of physical configuration of geographical features, and these principles can be applied to both macro (e.g. urban design) and micro (e.g. building orientation) built environment.

2.4.2 RIBA Validation Criteria for Architectural Schools (2010)

In March 2010 David Gloster of RIBA director of education has published a document as RIBA Validation Criteria at Part 1 and Part 2 professional qualifications for schools of architecture. The document serves to define academic objectives for RIBA's schools of architecture to achieve quality of students. The general criteria of the part 1 and part 2 documents have covered the first six criteria including site context, aesthetics of art, function, sustainability, cost, and socio-culture.

2.4.3 Market Price

In Washington, Benson, Hansen, Schwartz, and Smersh (1998) concluded in a study that the highest-quality ocean views for houses of the city Bellingham were found to increase the market price of an otherwise comparable home by almost 60%; the lowest-quality ocean views were found to add about 8%. In Hong Kong, Chau, Wong, and Yiu (2004) concluded in a study that a balcony was found to have a positive effect on the market value of a private housing property irrespective of the quality of the view. Similarly Banfi, Farsi, Filippini, and Jakob (2008) concluded that the apartment tenants' willingness to pay for energy-saving measures and environmental benefits in Switzerland's residential buildings.

Market price has been a price tag on multi-storey residential buildings in Malaysia. This tag has become name of the types of multi-storey residential buildings across the price that ranges from low cost, medium cost to high cost or end. In the last three years the low cost ranges from $35,000.00 to $ 42,000.00 (Government, 2002), the medium cost from $ 50,000.00 to $ 450,000.00 and the high end from $ 500,000.00 and above on average. The medium cost has a range too from medium low, medium to medium high. Market price is an economic index, and resulted of supply and demand in a free market by certain factors. Multi-storey housing has become a commercial commodity more than a house to live in. The public by and large

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buy and sell these properties as house owners or investors. In Malaysia, the free market situation is applied mainly to the high end and medium cost but not the low cost. The market price of low cost is controlled and determined by the Government for social and economic factors. This fulfils the main objective of the Housing Plan of National Economic Plan (NEP) since 1957. The first Housing Plan was implemented in 1966 to provide housing as a component of social services. Subsequently the NEP ensures that all Malaysians have access to adequate and affordable shelter. Further the NEP emphasizes that the human settlement philosophy through the provision of socio-physical and economical services and amenities. The provision is necessary for the attainment of the better quality of life, national integration and unity through the National Housing policy from the NEP. The National Housing Policy is administrated by the Housing Ministry and Planning Departments at the State and the Local Authorities. Such good action encourages rapid and massive development of low cost housing in the Klang Valley. The policy involves both public and private agencies.

2.4.4 Summary

The literature review has identified seven criteria for architectural design quality. These criteria are site context, aesthetics of art, function, sustainability, cost, socio-culture and Feng-Shui. All these studies contribute to the body of knowledge in architectural theory and history, the profession and practice of architecture and social science.

However these design criteria are studied separately as an individual criterion. There has been limited study in a single study of a set of seven architectural design criteria from literature review and a verification of these criteria by survey of professionals in local context. In addition, there has been limited study to apply these seven criteria for analyzing architectural design quality of multi-storrey residential buildings in practice.

CHAPTER 3 RESEARCH METHODOLOGY

This thesis has a research design (Creswell, 2007; Frankfort-Nachmias & Nachmias, 1992; Philliber, 1980). The research design is developed as a logical process from the onset to its conclusions as shown in Figure 3.1. It comprises eight main activities that are connected or interconnected to each other as a whole. They are explained briefly in following sections.

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                    ┌──────────────────────────────┐
              ┌────▶│  1.  Research Title:          │
              │     │  Opportunities and Purpose     │
              │     └──────────────┬────────────────┘
              │                    ▼
              │     ┌──────────────────────────────┐
              │     │  2. Literature review:        │
              │     │  Research gap & Problem        │
              │     │  definition                    │
              │     └──────────────┬────────────────┘
              │                    ▼
              │     ┌──────────────────────────────┐
              │     │  3. Research Questions         │
              │     └──────────────┬────────────────┘
              │                    ▼
              │     ┌──────────────────────────────┐
              │     │  4. Objectives and Hypotheses  │
              │     └──────────────┬────────────────┘
              │                    ▼
              │       ┌──────────────────────────┐       ┌─────────────────────────┐
              │       │  5. Theoretical Framework  │       │  Mixed Methods:          │
              │       └────────────┬──────────────┘       │  ● Case Study            │
              │                    ▼                       │  ● Survey                │
              │        ┌──────────────────────────┐        │                          │
              │        │  6. Research Method        │◄─────▶│  Analytical techniques:  │
              │        └────────────┬──────────────┘        │  - Replication logic     │
              │                     ▼                        │  - Pattern matching      │
              │     ┌──────────────────────────────┐        │  - NEDV                  │
              │     │  7. Data Collection and       │        │  - Descriptive statistics │
              │     │  Analysis:                     │        │  - Inferential statistics │
              │     │  Qualitative and Quantitative  │        │                          │
              │     └──────────────┬────────────────┘        │  Research validity:      │
              │                    ▼                          │  - Construct validity    │
              │     ┌──────────────────────────────┐          │  - Internal validity     │
              └─────┤  8. Interpretation and         │          │  - External validity     │
                    │  Findings: Conclusions         │          └─────────────────────────┘
                    └──────────────┬────────────────┘
                                   ▼
                    ┌──────────────────────────────┐
                    │  Contributions                 │
                    └──────────────────────────────┘
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Figure 3.1 Research Design Process

3.1 Introduction

This thesis is based on a mixed methods research approach to address the research questions, purpose, and objectives or hypotheses and provide an explanatory type of reasonable answers. The research approach to this study is summarised in Table 3.1. As a methodology the approach is designed to guide the direction of data collection and analysis, and the mixing of qualitative and quantitative data. As a method, it centers on collecting, analyzing and mixing the qualitative and quantitative data in a single study or multiple studies. Prior to defining this mixed methods research, a theoretical framework is first developed to attend to the types and complexities of investigation, and in particular the study proposition and hypothesis testing.

3.2 Theoretical Framework

This thesis was began with the first question that is why certain multi-storey residential buildings lack to some extent architectural design quality and second question on how architectural practice can contribute to this phenomenon..

A theoretical framework was developed to study the relationships between the established architectural design criteria and market price (low, medium and high cost) of multi-storey residential buildings. In addition it guided determination of the architectural design criteria and their application. As there was no existing theory fitting to the concepts of the study, the development of a conceptual framework was deemed necessary to identify and explain the relationships among the concepts. A theoretical framework provides a broader explanation of the relationships among the concepts by determining the types, direction and magnitude of relationships through their measurable variables.

Table 3 1 A Summary of Research Approach to this Study

Research questions (RQ)	Research Objectives (RO) Research Hypothesis (RH)	Research Methods		
		Methods/ Activities	Instruments	Analytical Techniques
RQ1: Why do certain multi-storey residential buildings lack to some extent architectural design quality?	• RO1 Determine the set of architectural design criteria.	Mixed Methods Research: • Literature Review • Survey I: A 5% (95) Sample of Professionals	Questionnaire Survey I: Stratified, Structured, Purposeful, Interviews.	The Means, Mode and Frequency; Single t-test; 2 Independent Sample t-test
RQ2. How does the practice of architecture contribute to this phenomenon?	• RO2 Investigate the relationship between the established architectural design criteria and market price (low, medium & high cost) of MSRB from the perspectives of developers & architect firms. • RO3 Evaluate the application of architectural design criteria on random low, medium and high cost MSRB. • RO4 Establish the relationship between architectural design criteria and market price of MSRB. • RO5 Test RH1 research hypothesis	Mixed Methods Research: • Case Study I: 8 Developers • Case Study II: 7 Architectural Firms • Survey I: 36 Buildings; 12 low cost; 12 medium; 12 high cost. • Survey II: 45 Buildings; 15 low cost; 15 medium; 15 high cost.	Case Study I, Case Study II Questionnaires: Stratified, Structured, Purposeful Interviews. Survey II, Survey III Questionnaires: Stratified, Structured, Purposeful.	Correlation; Regression; Replication; Non-Equivalent Dependent Variable (N O X O); Pattern-Matching.
	● RO6 Validate RH2 and RH3 research hypotheses	Mixed Methods Research: • Case Study I: 8 Developers • Case Study II: 7 Architectural Firms	Case Study I, Case Study II Questionnaires: Stratified, Structured, Purposeful Interviews	Qualitative analysis and interpretation of responses to questions on 'why' and 'how'.

3.2.1 Conceptual Framework

The conceptual framework was first to identify a set of concepts that fit the study of the relationship between the design criteria and market price of multi-storey residential buildings. It relied on some theoretical frameworks related such as history and architecture theory, aesthetic theory, art theory, design theory, social theory, cost theory, price theory and Feng Shui model.

For this study, architectural design for multi-storey buildings is defined as a process of creative visualizing of concepts to actualizing optimal solutions that serve human needs and goals in a built environment. The concepts are site context, aesthetics of art, function of dwelling units, sustainability, cost, socio-culture and Feng Shui. These seven concepts were explored by literature review as criteria to represent quality of architectural design. Cuff (1998) defines design quality as a phenomenological entity perceived by individuals, not as an inherent quality of the object or building. Hence, the measurement of design quality can be achieved, depending on those who have the training and experience to judge quality with appropriate research methods.

Studies (Benson, Hansen, Schwartz, & Smersh, 1998; Chau et al., 2004) show that there is a relationship between design quality and market price for multi-storey residential buildings. Market price can be defined as a concept of value resulted from supply and demand situation in a free market. Architectural practice is a professional activity in which the design and production of buildings take place in a social context among clients or/and users, architects, consultants, builders, and authorities.

Briefly, a conceptual framework is developed for architectural design of multi-storey residential buildings as shown in Figure 3.2. This conceptual framework connects a set of

related concepts that describe and explain phenomena of the concerned, makes assumptions and reflects a philosophical stance.
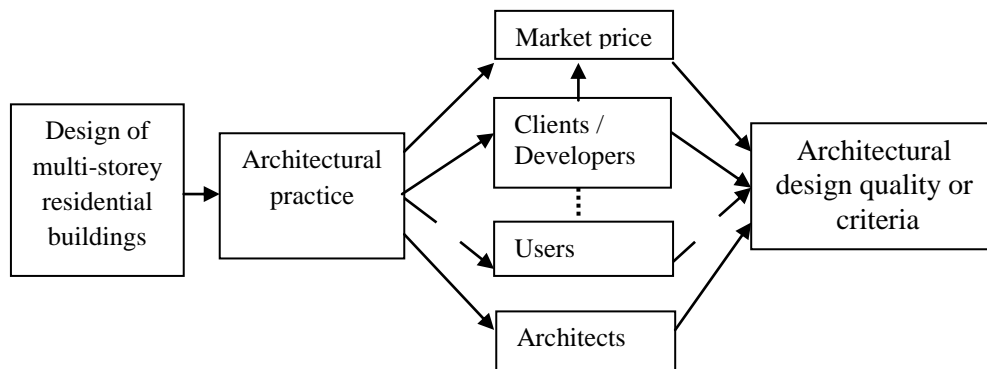
Figure 3.2 A conceptual framework for architectural design

The quality of architectural design or criteria becomes a function of the social interaction among architects, users and developers with market price. Contrary to good practice, users have no direct access to the design process as shown in Figure 1. In Malaysia, the users do not participate in housing design of multi-storey residential buildings. This phenomenon is shown by two broken arrows around the users in the diagram. The dotted line indicates that there is a certain link between the users and some big developers. These developers actually conduct user feedback surveys of certain medium to high end properties for better yield from sale with design meeting buyers' trend. This has become a problem which undermines the social importance of user participation in housing design process (Ferrari, et al.2008). There exists a dialectic duality of intent between the developers' strong financial interests and the architects' trained ideas about how buildings ought to look and function. If this social dynamic were in distress, there can be a dire client-architect interaction which undermines the intended goals (Anthony, 2001; Mrema, et la. 2005; Pressman, 2005; Siva & London, 2011).

3.2.2 Operational Definition of Concept

The concept of the architectural design quality with the market price is generally abstract, intangible and even contradictory in practice at times. This concept is characterised to some extent by subjective feelings, attitudes or opinions. To measure these characteristics, operational definition of the concept was applied but not delineating the reasons, consequences or correlates of the concept. The operational definition of a concept operates in three levels as shown in Figure 3.3.

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┌─────────────────────────┐
│         Concept         │
└─────────────────────────┘
            │
            ▼
┌─────────────────────────┐
│       Dimensions        │
└─────────────────────────┘
            │
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┌─────────────────────────┐
│        Elements         │
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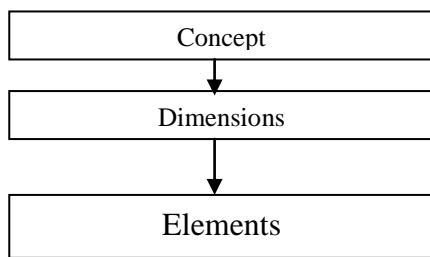
Figure 3.3Three levels of operational definition process

The operational definition of design quality concept was rendered to measurable by examining at the behavioural dimensions or properties associated with the concept. These dimensions are then translated into observable and measurable elements to become an index of measurement of the concept.

An operational definition of the concept for observable and measurable elements and dimensions is illustrated in a Figure 3.4.

Elements of Site Context Dimensions

- Location

- Orientation

- Topography and contour of the site

- Existing built-environment and patterns

- Social and economic characters

- Historical values and heritage

Elements of Aesthetics Dimension

- Scale, proportion, order, geometry, balance, etc

- Sculpture

- Symbols or icons

- Representation

- Contemporary and classical arts

- Art and socio-culture

Elements of Sustainability Dimension

- Holistic energy analysis

- Day-lighting

- Sun-shading

- Ventilation

- Humidity

- Rain water harvesting

- Reuse and recycle energy sources

- Optimal energy consumption of energy

- Use of sustainable materials and construction

Elements of Function Dimension

- Size of unit.

- No of appropriate rooms

- Privacy

- Natural lighting & ventilation

- Views

- Storage

- Needs of family

Elements of Cost Dimension

- Professionals

- Design

- Construction

- Maintenance

- Replacement

- Return

- Salability and Profitability

Elements of Socio-culture Dimension

- Community facilities

- Open spaces

- Children play areas

- Sport & recreation

- Reading

- Elderly facilities

Elements of Feng Shui Dimension

- Landforms or Five Elements
- Principles of Physical Features of Geography
- Harmony with Nature the 'Wind' and Water'
- No or Minimum Cutting Down Hill Slopes and Plants
- Orientation to Cardinal Points
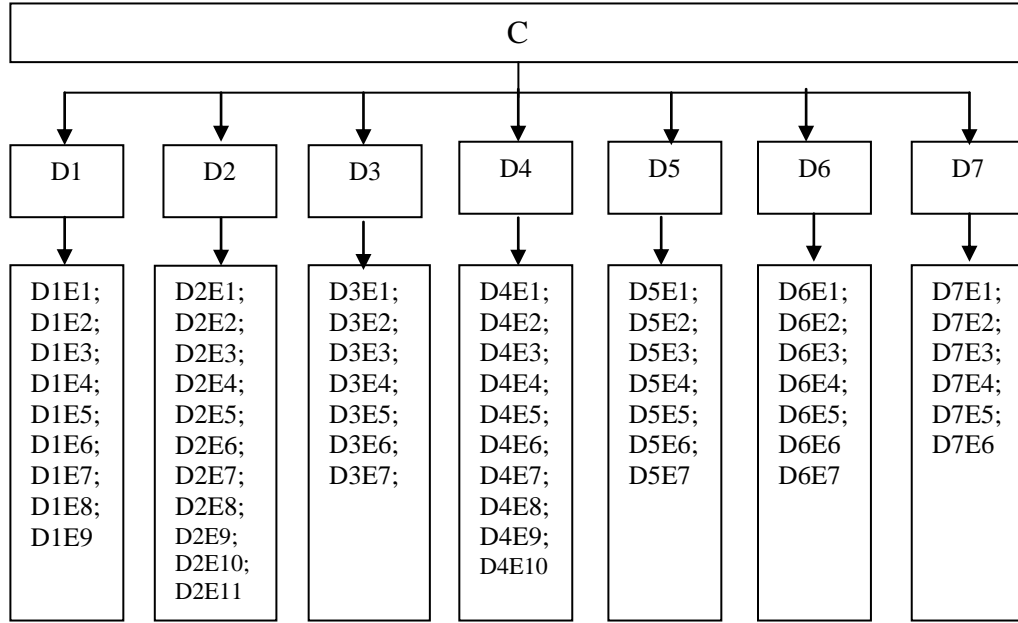
C = concept of architectural design quality

D1=site context; D2=aesthetics of art; D3=function; D4=sustainability; D5=cost; D6=socio-culture; D7=Feng Shui

D1E1=location; D1E2=orientation; D1E3=topography; D1E4=existing surrounds; D1E5=history; D1E6=views; D1E7=heritage site; D1E8=socio-culture; D1E9=site planning.

D2E1=scale; D2E2=proportion; D2E3=order; D2E4=balance; D2E5=patterns; D2E6=sculpture; D2E7=icon; D2E8=symbolism; D2E9=representation; D2E10=metaphor; D2E11=aphorism.

D3E1=uses; D3E2=dwelling unit size; D4E3=number of rooms; D4E4=privacy; D4E5=views; D3E6=storage; D3E7=family needs.

D4E1=low energy consumption; D3E2=daylight factor; D3E3=natural ventilation; D3E4=rain water harvesting; D3E5=carbon foot print; D3E6=solar photo-voltaic; D3E7=recycle & reuse wastes; D3E8=sun shading coefficient; D3E9=orientation; D3E10=landscaping.

D5E1=professionals; D5E2=design; D5E3=construction; D5E4=maintenance; D5E5=replacement; D5E6=return; D5E7=salability.

D6E1=community facilities; D6E2=open spaces; D6E3=child play areas; D6E4=reading rooms; D6E5=sport & recreation provisions; D6E6=elderly facilities; D6E7=prayer room.

D7E1=respond to nature: wind, water; D7E2=manipulate spaces for living with the environment; D7E3=preserve land forms; D7E4=landscapes; D7E5=orientation; D7E6=Flow of 'Qi' or energy

Figure 3.4 Operational definition of a concept to dimensions and elements

Figure 3.5

3.2.3 Measurement of Concept

The concept was measured through its observable operational defined elements or variables. These variables are characteristics or behavior of the dimensions or cases. Cases are objects such as ideas, opinions and thoughts of the concept of design quality. Hence cases can be studied or observed through measuring their behavior or characteristics of the variables.

3.2.4 Causal Measurement Models for Variables

There are two types of causal measurement models. They are reflective and formative. Bollen and Lennox (1991) noted that the causality of these two models is conceptually, substantially and psychometrically different. Edwards and Bagozzi (2000) distinguish these two models with structural equation modeling in two contrasting diagrams in Figure 3.6.
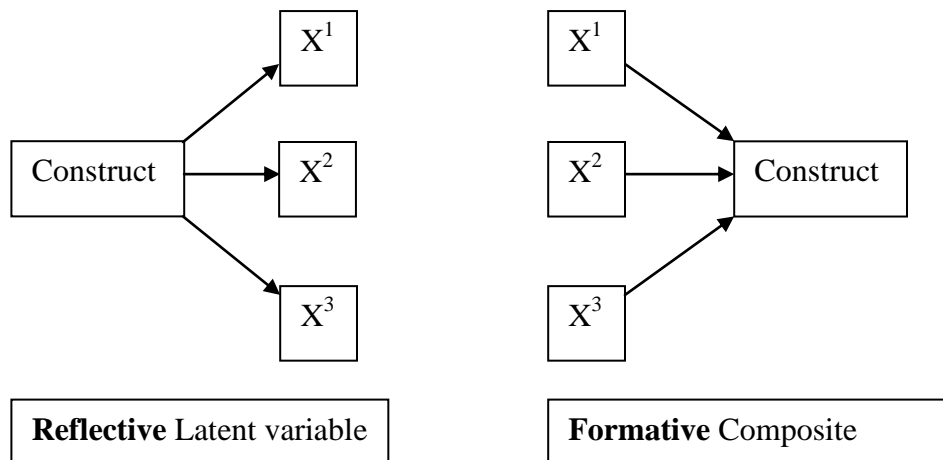
Figure 3.6 Casual structures

Constructs are defined as the unobservable, and are known as latent variables. Indicators X^1, X^2 and X^3 are defined as 'an observed score gathered through self-report, interview, observation, or some other means', and are influenced by latent variables. They are quantifiable and can be gathered from survey instruments. In a reflective model, a latent

variable such as market pricing is posited as the cause of indicator behavior for example site context etc. The causality flows from the latent variable to the indicators. Hence manipulation of the latent variable through changing prices causes a change in indicator behavior. However, manipulation of indicators is not expected to have causal effect on the latent variable. In a formative model, the indicators X^1, X^2 and X^3 influence the construct that is usually termed as a composite variable. Hence the indicators cause the construct and the construct is mainly derived by the measurement of the indicators.

This study adopts the reflective model in which the latent variable is market price and the indicators are architectural design quality. A causal relationship between market price and design quality of multi-storey residential buildings is represented in Figure 3.7.
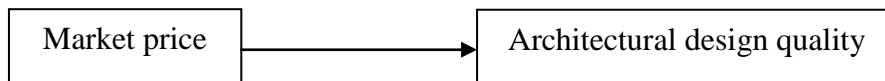
Figure 3.7 Theoretical framework for market price and architectural design

A construct of the theoretical framework for studying relationship between market price and architectural design quality for multi-storey residential buildings is represented in Figure 3.8. This has guided the study proposition or hypothesis that architectural design quality decreases as market price decreases for multi-storey residential buildings.
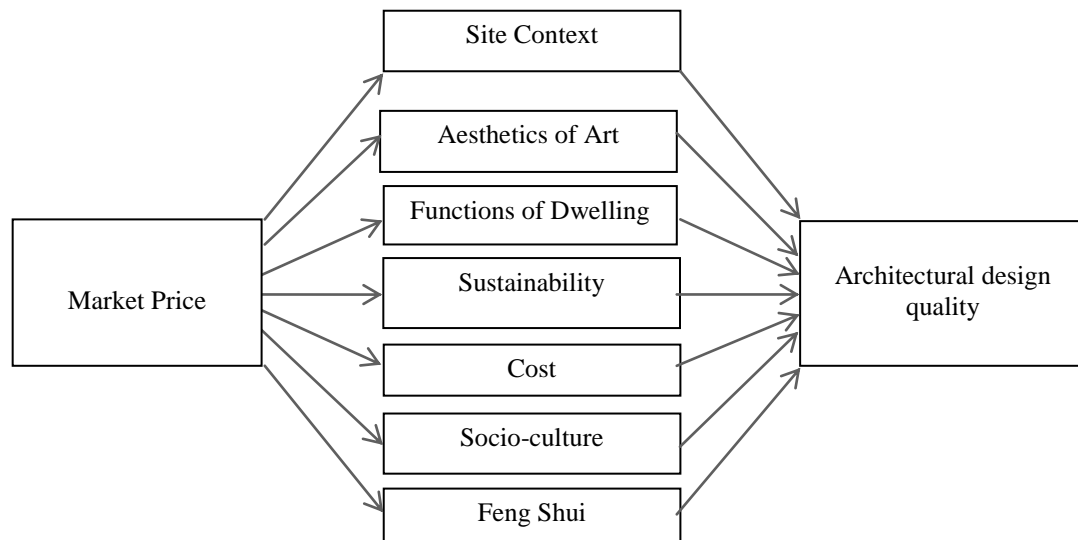
Figure 3.8 A theoretical framework for architectural design quality

3.2.5 Four Types of Variables

For this study there are four types of variables according to their roles. Two key roles are independent and dependent variables. Dependent variable is the outcome or indicator variable that will be studied for its variation. Architectural design quality is the dependent variable. The independent variable is the predictor or latent variable that causes the variation in the dependent variable. Market price is the independent variable.

There are two other kinds of independent variables which operate a little differently. These are moderating variable and intervening variable. The moderating variable can be legislation while the intervening variable can be design competition. A moderating variable changes the original relationship between the independent and dependent variable. An example of this variable can be legislation of sustainable building design requirement to be included in the planning and building bye-laws. An intervening variable is affected by the independent variable and then affects the dependent variable. This variable has a time dimension, and an

example of this variable is design competition. The relationships among the four types of variables are shown in Figure 3.9. For this study the moderating and intervening variables are not considered.
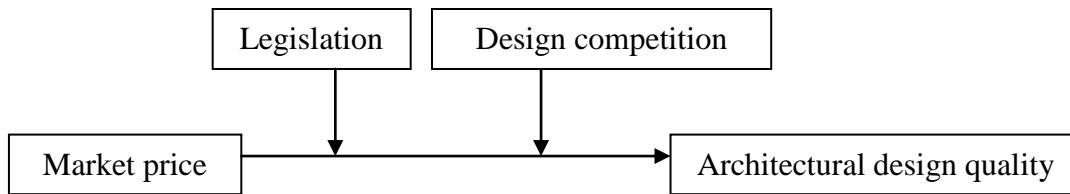
Figure 3.9 The relationship of the four types of variables

3.2.6 Types of Measurement Scale

There exist four types of measurement scale. Ratio scale was not applied for this study that based on quasi-experiment. A ratio scale has an absolute zero point instead of any arbitrary point. This justifies ratio scale being the highest or most powerful among the four scales. It is generally applied in experiments.

This study applied the first three types except ratio scale as shown in Figure 3.19. These measurement scales measured the operationally defined concept of its dimensions and elements of the variables. The measurement scale facilitated data analysis and selection of types of statistical testing.

Steven S.S (1946, 1951) and Nunnally and Bernstein (1994) highlight four types of measurement scale for research in psychology, social sciences and business as shown in Figure 3.10.

SCALE	OPERATION	EXAMPLES
Nominal	Equal versus not equal	Telephone number
Ordinal	Monotonically increasing	Rank order in class
Interval	Equality of intervals	Temperature (Celsius)
Ratio	Equality of ratios	Temperature (Kelvin)

Figure 3.10 Four types of measurement scale from Steven S.S (1951)

3.2.7 Methods of Measurement Scaling

Methods of scaling were also applied for this study. These methods are different from the four types of measurement scale. The methods drew meaning from the responses of subjects towards behavioral dimensions or properties of the concept. The scaling assigns numbers or symbols to measure the magnitude of differences in the preference order.

There exist two methods of scaling such as the ranking scale and the rating scale.

Some ranking scales are paired comparison, forced choice and comparative scale.

Some rating scales are Dichotomous, Category scale, Likert scale, Numerical scale, Semantic differential scale, Itemised rating scale, Fixed or Constant sum rating scale, Stapel scale, Graphic rating scale, and Consensus scale.

With the measurement scale types, the scaling methods measured the operationally defined concept of its dimensions and elements of the variables and facilitated too data analysis and selection of types of statistical testing.

3.2.8 Measurement Scale Types and Scaling Methods

Nominal Scales:

Nominal scale or category scale was used to collect data for observing people or program under study. The data of this scale are discrete and mutually exclusive manner. An example was the record of sex of respondents: male could be label '1'; female could be a category label '2'. This is used for a survey or case study question Q1. Gender: Male [   ]Female [   ]. The actual numbers of the data assigned to the observations are rather arbitrary. The nominal number 2 in this example is not the largest or greater than the nominal number 1. The numbers are just different, and are not appropriate for computing the means or the extent of relationships between two variables.

Ordinal Scale:

Ordinary scale was used to measure data in both the differences among the various categories and the ranking order among the categories in more meaningful way. The order was assigned according to some preferences. The preferences could be ranked from highest to lowest or best to worst and numbered 1, 2, 3, 4, 5, and so on.

An example of ranking order is a case study question Q17. This question asks for respondents to indicate their preferences by ranking the importance from 1 to 5 or 7 for a criterion in design of high cost multi-storey residential buildings.

Q17. Rank the following seven design characteristics in the design of high cost multi-storey residential buildings in terms of how important they are for you. You should rank as follows:

1: Most important 2: Very important 3: Important 4: Normal 5: Not important 6: Very not important 7: Least important

Design Criteria	Ranking of importance
1. Aesthetics of art	[ ]
2. Function of a dwelling unit	[ ]
3. Social-cultural factors	[ ]
4. Cost factors	[ ]
5. Sustainable building design	[ ]
6. Site context	[ ]
7. Feng Shui	[ ]

The ordinal scale provided more information than the nominal scale. It described the differences among the categories by providing information how respondents distinguish among them by ranking them in order of preferences. The ordinal scale could determine the responses by percentage of respondents for each design criteria. However the ordinal scale has not given any direction of the magnitude of differences among the ranks.

Interval Scale:

Interval scale or three folded scale was applied for this study. It represented a much higher grade than the nominal and ordinal scales because of its three fold performance for certain arithmetical operations on the data collected from respondents. The interval scale had enabled to measure the distance between any two points on the scale, and hence to compute the means and standard deviations of the variables' data. The interval scale was able to record a set of data for the observed according to certain categories, to rank the order of these data for the

observed, and lastly to measure the magnitude of the differences in the preferences among the observed.

Generally the interval scale is more robust then the nominal and ordinal scales. It can identify the differences, the order and the magnitude of the differences in variables. As such it has properties of its measure of central tendency, and its measure of dispersion.

Nominal or Ordinal and Dichotomous scale:

The dichotomous scale is used to elicit a yes or no answer. The definitive nature is important confirmation of an event, object or person in a research. An example of this scale for this study applied in a research questionnaire is Q47 as follows:

Q47. Do you apply any aesthetics of art in the design of the high cost medium to high-rise residential project? Yes [   ] or No [   ]

Interval and Category Scale:

The category scale is used to elicit a single response from several items. Zikmund (2000:292) has produced a range of such category scales and a part is illustrated in Figure 3.11. The importance category scale is applied for this study.

QUALITY				
Very Good	Good	Fair	Not very good	Not good at all
IMPORTANCE				
Very important	Fairly important	Neutral	Not so important	Not at all important
SATISFACTION				
Very satisfied	Somewhat satisfied	Neither satisfied	Somewhat dissatisfied	Very dissatisfied

Figure 3.11 Selected category scales

An example for this study research questionnaire is Q16 is as follows:

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Q16. How do you rank the importance of the following parties in working out the design brief for the high cost high-rise residential projects? Please fill in the brackets with No. 1 to 7 ranking in the following order of importance:1: Most important 2: Very important 3: Important 4: Normal 5: Not important 6: Very not important 7: Least important.

Design Characteristics	Ranking of Importance
Users	[ ]
Client	[ ]
Architect	[ ]
Authorities	[ ]
Geomancers (Feng Shui expert)	[ ]
Property Market Professionals (In-house or out-source)	[ ]
Project Managers (In-house or out-source)	[ ]

In order to measure responses as interval scale for data analysis, the assignment of numbers to the different categories is common among cases and the interval between each category is equal. The wording is important for the effective use of these scales. Examples for this study research questionnaire are case study questions Q 35 and Q36 and survey questions Q1 and Q2 as follows:

Q35. How do you rank the importance of site context in the design criteria for the market price of a unit around $80,000 for the multi-storey residential buildings under study? (Please answer by ticking [/] in appropriate bracket)

5-Very important[ ]; 4-Important[ ]; 3-Normal[ ]; 2-Not important[ ]; 1-Very not important[ ]

Q36. How do you rank the importance of site context in the design criteria for the market price of a unit around $350,000 and above for the multi-storey residential buildings under study? (Please answer by ticking [/] in appropriate bracket)

5-Very important[ ]; 4-Important[ ]; 3-Normal[ ]; 2-Not important[ ]; 1-Very not important[ ]

Q1. How do you rank the aesthetic of art in design criteria for the market price of about $750,000 for the multi-storey residential buildings under study?

(Please answer by ticking [ ] in appropriate bracket)

5-Very developed[ ]; 4-Developed[ ]; 3-Normal[ ];2-Not developed[ ]; 1-Very not developed[ ]

Q2. How do you rank the aesthetic of art in design criteria for market price of about $1,000,000 and above for the multi-storey residential buildings under study?

(Please answer by ticking [/] in appropriate bracket)

5-Very developed[ ]; 4-Developed[ ]; 3-Normal[ ];2-Not developed[ ]; 1-Very not developed[ ]

LIKERT Scale

LIKERT scale is applied for this study to measure respondents' judgment to what extent on agree or disagree with the seven design criteria. The Likert scale has five choices (strongly disagree; disagree; don't know/neutral; agree; strongly agree). A numerical value is assigned to each choice as shown in Figure 3.12.

Strongly disagree	Disagree	Neutral/Satisfactory	Agree	Strongly agree
1	2	3	4	5

Figure 3.12 LIKERT Scale

The LIKERT scale is based on equal interval between each different category. The collected responses are analysed over a number of items describing a particular variable by summing up for every respondent. The mean or average score represents overall level of results toward the subject matter of the design criteria. An example for this study research questionnaire of the case study is Q 76 as follows:

Q 76 Please indicate the extent to which you agree with the following factors as architectural design criteria for designing multi-storey residential buildings. Tick the appropriate scale number:
[1]Strongly disagree; [2]Disagree; [3]Don't know/Neutral; [4]Agree; [5]Strongly agree.

Design criteria   Ranking

Site context_____ [1] [2] [3] [4] [5]
Art_____ [1] [2] [3] [4] [5]
Function of dwelling units_____ [1] [2] [3] [4] [5]
Sustainability_____ [1] [2] [3] [4] [5]
Cost _____ [1] [2] [3] [4] [5]
socio-culture_____ [1] [2] [3] [4] [5]
Feng Shui_____ [1] [2] [3] [4] [5]

3.3 Mixed Methods Research

Johnson and Onwuegbuzie (2004) explain mixed methods research as a class of research where researchers mixes or combine quantitative and qualitative research techniques, methods, approaches, concepts or language into a single study. Creswell and Plano Clark (2007) define,

> "…*Mixed method research is a research design with philosophical assumptions as well as quantitative and qualitative methods of inquiry. As a methodology, it involves philosophical assumptions that guide the direction of the collection and analysis of data and the mixture of qualitative and quantitative approaches in many phases in the research process. As a method, it focuses on collecting, analyzing, and mixing both quantitative and qualitative data in a single study or a series of studies. Its central premise is that the use of quantitative and qualitative approaches in combination provides a better understanding of research problems.* …Pg. 5"

3.3.1 The Choice of Mixed Methods Research (MMR)

Mixed methods research (Creswell & Clark, 2010; Johnson & Onwuegbuzie, 2004) provides triangulation for empirical evidences of multiple cases and multiple studies into a single converging line of inquiry. This ability can tackle more complex issues and aims of the research. Generally mixed methods research produces stronger and richer set of evidences than that of a single method, and this enhances validity of the research. The approach involves a process of mixing or integrating of quantitative and qualitative data during collection and analysis stages.

3.3.2 Single and Multiple Study Mixed Methods Designs

The mixed methods research can be a single study or multiple-study (a series of studies) as shown in Figure 3.13.

Single study:

| Qualitative | | Quantitative |

| Results |

Multiple-study:

| Study 1: Qualitative data and results | → | Study 2: Qualitative data and results | → | Study 3: Quantitative data and results | → | Results |
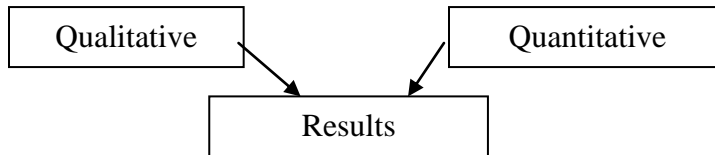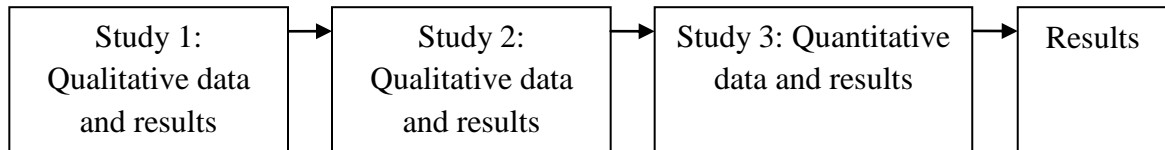
Figure 3.13 Single study and Multiple-study

There are four types of mixed methods design comprising triangulation, exploratory, explanatory, and embedded design as indicated in Figure 3.14. Morse (1991) states that the purpose of triangulation design is to obtain different but complementary data on the same topic to best understand the research problem. Creswell and Plano Clark (203) state that the triangulation design is the most common approach that has four variations such as convergence, data transformation, validating quantitative data, and multilevel model.

Triangulation design:

| Qualitative | | Qualitative |

| Results |

Embedded design:

| Qualitative data | | Interpretation based on Qualitative results |
| Quantitative data | → | |

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or

Quantitative data	
Qualitative data	

→ Interpretation based on quantitative results

Explanatory design:

Quantitative data → Qualitative data → Interpretation based on quantitative results

Exploratory design:

Qualitative data → Quantitative data → Interpretation based on qualitative results

Figure 3.14 Four types of mixed methods design

3.3.2.1 Single Study for Objective RO1

This single study for objective RO1 is described in Chapter 1.9.1.

3.3.2.2 Multiple studies for Objectives RO2, RO3, RO4 & RO5

This multiple studies for objectives RO2, RO3, RO4 and RO5 are described in Chapter 1.9.2.

3.3.2.3 Multiple study for Objective RO5

This multiple studies for objectivesRO5 are described in Chapter 1.9.3.

3.3.2.4 Single Study for Objectives RO6

This single study for objective RO6 is described in Chapter 1.9.4.

3.4 Case Study

Robert K Yin (2009) defines case study research method in twofold: first, the scope of a case study '*It is an empirical inquiry that investigates a contemporary phenomenon within its real life context, especially when the boundaries between phenomenon and context are not clearly evident.':* second, the technical aspects of a case study inquiry: '*The case study inquiry copes with the technically distinctive situation, in which there will be many more variables of interest than data points, and as one result relies on multiple sources of evidence, with data needing to converge in a triangulating fashion, and as another result benefits from the prior development of theoretical propositions to guide data collection and analysis....Pg. 18'*

As history is importantly rooted in architecture, Linda Groat and David Wang (2002) revise the definition for architectural research by "...deleting the word 'contemporary' and adding the word 'setting,' we include historic phenomena and both historic and contemporary settings as potential foci of case studies. ...Pg. 346"

3.4.1 The Choice of Case Study

Case study has been used as a common research method in real life context. The choice of case study is influenced by four factors. Firstly it is the type of question that would answer issues or test hypothetical propositions. The questions commonly used are 'why' and 'how', focusing on the role of theory development. These questions are more explanatory and deal with operational links between variables. Besides explanatory, case studies can also be exploratory or/and descriptive. Secondly, investigators do not need to have control over actual behavior of the real persons, objects or events under study. Thirdly investigators have certain degree of flexibility of focus of the phenomenon under study on contemporary and historical setting in real life context. Lastly, the case study satisfy the characteristics of complexity science (Anderson, Crabtree, Steele, & McDaniel 2005: 673-680; 681) because of

its holistic approach framework for analyzing case materials. Unlike experiment or quantitative analysis, it does not break, control and randomize wholes into variables and relationships to be studied separately.

3.4.2 Case Study Research Design

Case study has a research design of five components comprising 1. a study's questions; 2. its propositions, if any; 3. its unit(s) of analysis; 4. the logic linking data to the propositions, and; 5. the criteria for interpreting the findings. The five components have guided the study as shown in the following and Figure 3.15.

1. Research Questions:

- Why are certain multi-storey residential buildings lacking architectural design quality?
- How does architectural practice contribute to this phenomenon?

2. Study Propositions:

- Architectural design quality for multi-storey residential buildings decreases as market price decreases.
- Clients are more dominant than architects in making design decisions.
- There is a lack of congruence in design quality of the multi-storey residential buildings between the building users to whom the architects are ethically responsible and clients to whom the architects are accountable.

3. Units of Analysis:

Multiple Units: Clients; Architects; Multi-storey residential buildings

Multiple Data Sources: Interviews; Direct observation at site; Documents Study; Survey

4. Linking Data to Propositions

Some data analysis tools applied: replication; nonequivalent group dependent variables design with pattern matching*;* correlation analysis*;* regression analysis

5. Criteria for Interpreting the Findings:

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1. STUDY QUESTIONS: Why; How.

1. Why are some multi-storey residential buildings lacking architectural quality in practice?
2. How does architectural practice contribute to this phenomenon?

2. STUDY PROPOSITIONS: Hypotheses; Theories.

1. Architectural design quality for multi-storey residential buildings decreases as market price decreases.
2. Clients are more dominant than the architects in making design decisions.
3. There is a lack of design congruence in buildings between the users whom the architects are responsible to and clients whom the architects are accountable

3. UNITS OF ANALYSIS:

Multiple Units: 1. Clients
           2. Architects
           3. Multi-storey residential buildings
Multiple Data Sources: 1. Interviews
                2. Direct observation at site
                3. Documents Study
                4. Survey

4. LINKING DATA TO PROPOSITIONS:

   Some data analysis tools applied:
1. Replication
2. Nonequivalent Group Dependant Variables Design with Pattern Matching
3. Correlation Analysis
4. Regression Analysis

5. CRITERIA FOR INTERPRETING THE FINDINGS:

   4 validity criteria
1. Construct validity
2. Internal validity
3. External validity
4. Reliability

Figure 3.15 A case study research design process of the five components

3.4.3 Case Study Theory Development with Survey

The role of theory development is important for the case study that adopts analytical generalization (Stenbacka, 2001). The analytic generalization is based on a previously developed or proposed predicted theory as a template with which to compare the observed results of the case study. The process applies replication logic in the multiple-case studies to determine two or more cases to have the results to support the previously developed or predicted theory. The empirical results may be more convincing if the two or more cases concur with the same theory but do not concur with an equally plausible theory. The case study is a level two inference for such generalization. In contrast survey is based on statistical generalization (Fowler Jr, 2008) that makes level one and two inference about an assumed population on the basis of a sample. This study applies level one and two inference as shown in Figure 3.16.
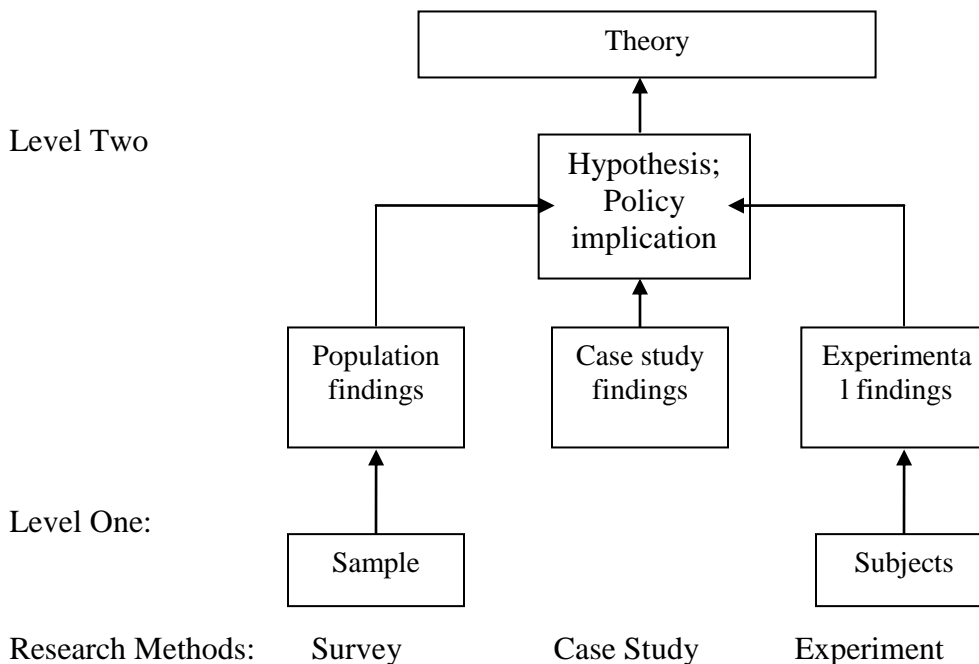
Figure 3.16 Making inferences at level one or two

3.5 Survey

Survey is based on mathematical principles of statistics and probability. For data analysis, survey relies on the means, mode, median, range, standard deviations, frequencies, correlation, regression, t-test, chi-square test, analysis of variance (ANOVA), and factor analysis.

3.5.1 The Choice of Survey Method

Survey is chosen as part of mixed methods design to validate the results of case studies for validity. This is done through triangulation (Patton, 2001) of multiple sources and multiple studies of evidence into a converging single line of inquiry.

Unlike the case study, survey places no importance on question 'why' but places utmost importance on the number for data collection. The types of study questions are on what, who, where, how many, and how much. Hence sample size and sampling design of a population are very important.

Survey differs from the case study by statistical generalization for the role of theory development as shown in Figure 3.18. This study applied both descriptive and inferential statistical analyses.

The descriptive statistics were used to determine RO1 with the means, mode, median, range, standard deviations, and frequencies. All the six statistical concepts are non-parametric nature because of making no assumption on the normal distribution of the population or its sample, and collecting data based on an ordinal or nominal scale. Descriptive statistics concern with the research upon description of the phenomena of interest. It aims to find out the frequencies of the phenomena of interest, the mean of a set of data collected, and the central tendencies and dispersions of the dependent and independent variables.

The inferential statistics were used to determine RO1, and triangulate RO2 and RO3 with the analyses of correlation, regression and t-tests. All the three statistical concepts are parametric nature because of making assumption on the normal distribution of the population or its sample, and collecting data based on an interval or ratio scale. The inferential statistics concern the research beyond that, seeking to find out the relationship between the dependent and independent variables in terms of positive or negative or/and casual effects. The correlation analysis determined the direction and magnitude of relationship between dependent and independent variables (architectural design quality and market price), while the regression analysis determines causal relationship between the two variables

The inferential t-tests were used for RO1 to validate the initial results of architectural design criteria determined by the descriptive statistics.

3.6 Analytical Techniques

This study is based on quasi-experiment method. In an ideal world, experimental design would be used for all research evaluations because they are the strongest in internal validity due to the random assignment. However, randomization is not always possible with studies in this real world, which leads to quasi-experiments such as case study, survey, ethnography and history. This lack of control leads to use of non-equivalent groups of events, objects or peoples as units of analysis.

Some common types of quasi-experimental design are as follows:

1. Pretest-Posttest Nonequivalent Groups Design
   N O X O
   N O   O

2. Double-Pretest Nonequivalent Groups Design

   N O O X O
   N O O   O

3. Nonequivalent Dependent Variables Design (NEDV)
   N O1 X O1
      O2   O2

3.6.1 Non-equivalent Dependable Variables Design (NEDV)

Non-equivalent Dependent Variables Design (NEDV) is applied for this study. NEDV is often used in evaluations of human social service programs because of the non-randomization. The design notation of non-equivalent group design has five basic elements which can be represented in Figure 3.17 as follows:

N	O	X	O

Figure 3.17 NEDV design notation

The design notation of N O X O has a single line. The N at the beginning of the line equals to a nonequivalent group that are not randomly assigned for a quasi-experimental design. The N in a single line indicates a single group. There are two Os in the notation, one on before the X and one on after the X. The O before the X is taken before any program or treatment is given, that is the pretest. The O after the X is taken after any program or treatment is given, that is the posttest. The X equals to the program or any treatment or pracitce. There is a time that moves from left to right.

There are several threats to the validity of quasi-experiments such history, maturation, the method of testing, the type of instrumentation, regression, mortality. Hence selection of subjects under study must be carefully worked out to minimize threats.

Don Campbell comments quasi-experimental designs to be less superior than randomized experiments in terms of internal validity. However in a real life context, when they are taken as a group or combined with other methods such as pattern matching, they are more often and easily applied than their randomized experiments.

3.6.2 NEDV with Pattern-matching for RH1 Hypothesis Testing

This study applied the NEDV with pattern matching (T. D. Cook et al., 1979; Trochim, 1989). Trochim comments that the NEDV alone can be rather weak with respect to internal validity. But in combination with pattern matching, it strengthens the design for causal assessment and becomes extremely powerful. The NEDV can have a single dependent variable and thus a single group of participants**.** This single dependent variable design can have more than one dependent variable. Thus two or more dependent variable design would be made considerably stronger because of the higher level of internal validity and the multiple outcomes from several dependent variables. This is briefly described in the following.

The NEDV with pattern -matching was described by T. D. Cook et al. (1979). Trochim (1989) describes that the theory of pattern matching will help researchers to develop theory to a greater height. He states that pattern matching emphasizes the importance of theory driven approach in applied research. This importance has been reemphasized by concerted efforts (Campbell, Stanley, & Gage, 1963; H. T. Chen & Rossi, 1987). Trochim commends favourably Chen and Ross for critical view on a research paradigm which has encouraged an experimental perspective at the expense of richer theoretical elucidation. Pattern matching has a long tradition of research thinking, and was originated from Chen and Rossi in 1987. Among the concerted efforts, Ferrari et al. (2008) address the construct validity of measures

by developing a "nomological network" to link theoretical propositions and constructs with operational definition as part of the inferential process.

The theory of pattern matching (Trochim & Cook, 1992)states that pattern matching specifies a predicted pattern from a theoretical framework, acquires an observed pattern from an empirical study, and attempts to match these two patterns. If the two patterns match, the results can help to make stronger the internal validity of the case study for the quality of research. The general idea of pattern matching is illustrated in Figure 3.18.
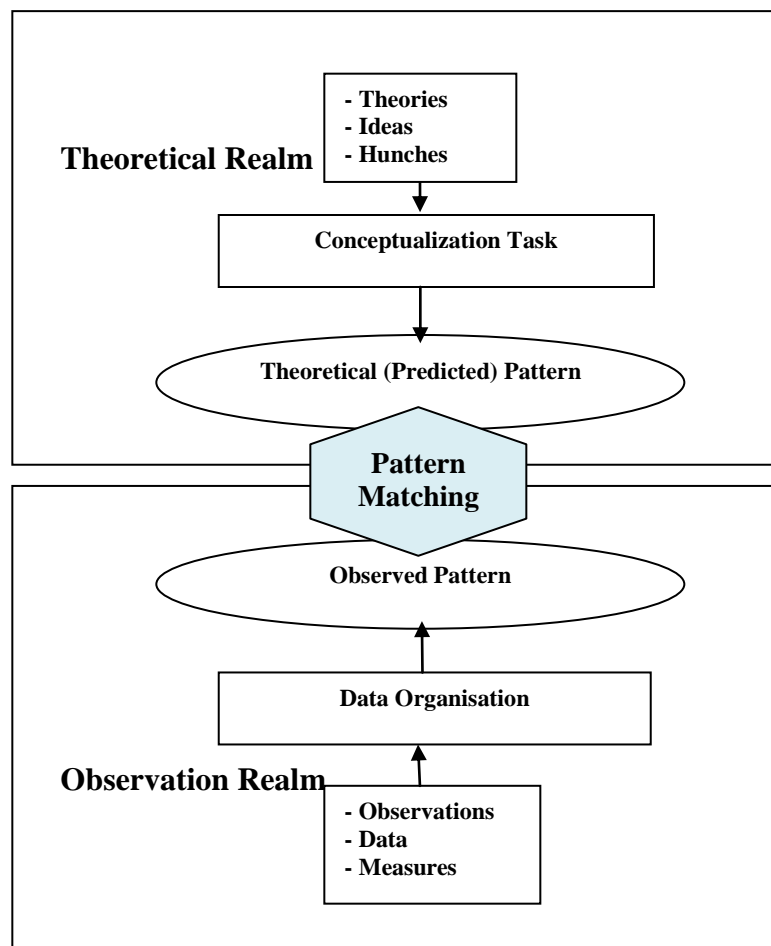
Figure 3.18 Pattern Matching Logic

There are two activity realms comprising theoretical realm at the top and observational realm at the bottom. In the theoretical realm at the top, there originates the theory which might come

from a formal tradition of theorizing or the ideas by researchers. These ideas are then translated and specified into a theoretical pattern as shown in the oval shape through the process of conceptualization. Trochim states that a theoretical pattern is a hypothesis about what is expected in the data, while the observed pattern is the acquired data which are used to examine the theoretical model.

In the observational realm at the bottom, there will be the direct observation of study objects or entities at real or controlled environment in the data form of field or lab notes, and formal objective measures. The collected data will be analysed and organized through an operational definition process, becoming the observational pattern. The definition is vital for the relevant linkage of the observational pattern to the theoretical pattern.

At centre of the figure is where the inferential role plays to match the two patterns. If the patterns match, a conclusion can be drawn to support the theory which might predicts the same observed patterns. If the patterns do not match, a conclusion can be drawn that the theory may be not correct or the observation may not be correct. The evidence provides for internal validity of the case study research (Herriott & Firestone, 1983).

The NEDV with pattern matching was applied to test hypothesis RH1 that architectural design quality decreases as market price decreases as shown in Figure 3.21. This test presented analytical generalisation. With replication logic and inferential statistical testing as described in next sections 3.6.4 and 3.6.5, statistical generalisation for the role of theory development is obtained as shown in Figure 3.19.

	Predicted Patterns		Observed Patterns
N	O1	X1	O1
	O2		O2
	O3		O3
	O4		O4
	O5		O5
	O6		O6
	O7		O7

Figure 3.19 NEDV with Pattern Matching for testing RH1

- NEDV with pattern-matching logic provides a test for the hypothesis RH1. If the predicted patterns and observed patterns match, the results can strengthen its validity. The predicted patterns are the hypothetical proposition while the observed patterns are the empirical evidences of the subjects under observation study.

- There are seven dependable variables (DV), hence a variety of seven expected outcomes that are represented by O_1 to O_7. The seven DVs are the seven design criteria. The first DV_1 = site context criterion given a market price, and DV_{2-7} are the other six design criteria.

- Analytical generalization is used for an inference or a priori prediction from cases on the basis of empirical data collected, while statistical generalization is used for the said purpose from survey samples on the basis of empirical data collected.

- The results are stronger if there were multiple outcome variables as proposed in this study or a priori prediction of extent to which each will be effect.

- Previously developed theory or the predicted theoretical pattern is used as a template with which to compare the empirical results of the case study.

- If two or more cases support the same theoretical pattern, replication may be claimed that can strengthen its validity

- Results may be considered more potent if two or more cases support the same theory or predicted theoretical pattern.

3.6.3 Replication Logic

The logic of replication (Yin, 2011) is applied for this study. The number of case replications is the essence of this logic rather than size of case sampling. The logic has five steps as shown in Figure 3.20: firstly, the theory development; secondly the selection of cases and the setting up of specific measurement tools in the data collection; thirdly the conduct of every individual case as a 'complete' study and the conclusions for each case as the required information for replication by other individual cases; fourthly the analysis of the data; fifthly the drawing up of cross-case conclusions on the proposed theory etc.
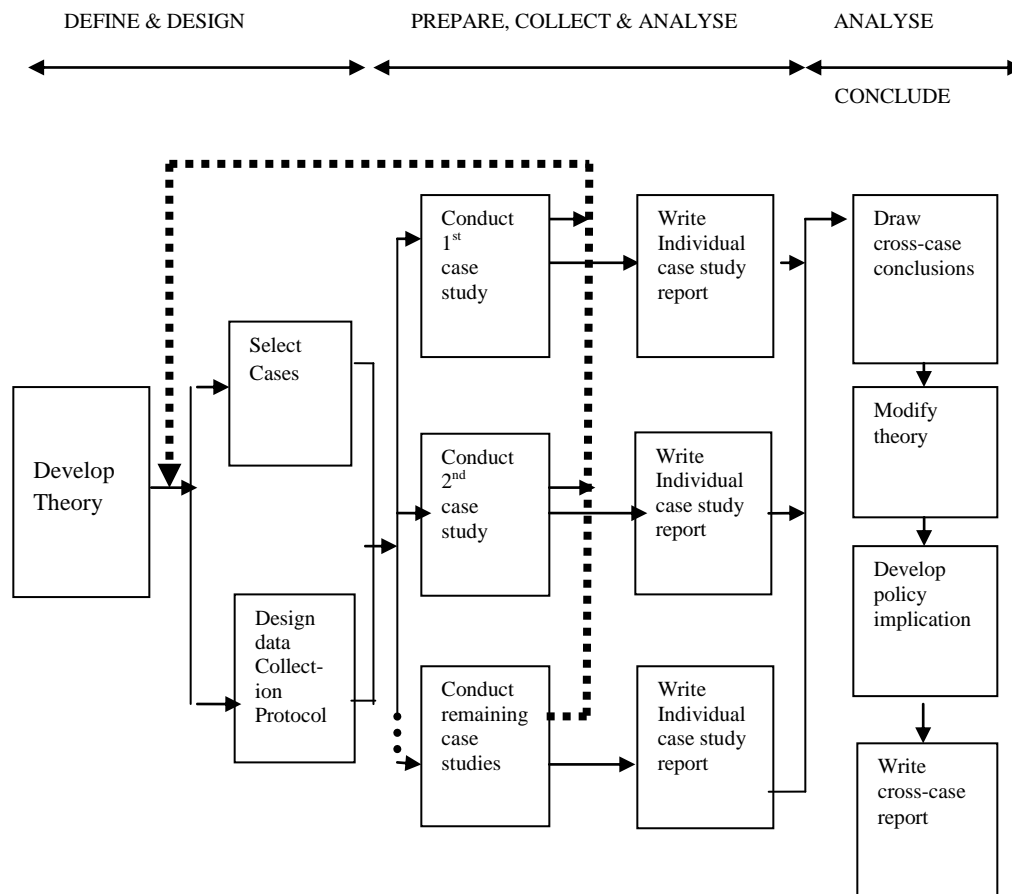
Figure 3.20 Replication Approach of the Case Study Method (COSMOS)

Hersen, Barlow, and Kazdin (1976) comment that replication logic is similar to that in experiments. In a single experiment, a researcher would discover a significant finding of the first experiment that will replicate by repeating a second, third and more experiments. To validate the results, the researcher would conduct some replications using the exact conditions of original experiment, while other replications by changing conditions to the original experiment.

The replication of the case study in multiple-case studies follows the similar logic of experiment. A case study researcher will select and conduct about seven cases. Each case is liked, conducting each experiment, will either predicts similar results or opposite results. The predicted similar results are a literal replication while the opposite results a theoretical replication. If all cases were achieved as predicted, these cases would give significant support for the study propositions. Failing which, the initial study propositions must be corrected and tested again with another set of cases.

3.6.4 Statistical Hypothesis Testing

Statistical hypothesis testing (Cavana et al., 2001) is applied for this study investigation that based on the relevant measurement scale, type of variables, or whether one-tailed, two-tailed test, parametric or non-parametric. An outline process of the statistical hypothesis testing using a computer package is shown in Figure 3.21.

The common acceptable significance level for testing hypothesis is at the 5 per cent score. This can be expressed as alpha (α), while the confidence level would be ($1 - \alpha$). The values inform that the smaller the percentage would be the stronger significance level, and hence with 1% the significance level is very strong.

```
                    ┌─────────────────────────────────────┐
                    │   Select a research question.       │
                    └─────────────────────────────────────┘
                                     │
                                     ▼
                    ┌─────────────────────────────────────┐
                    │ Choose the variables that relate to │
                    │      the research question.         │
                    └─────────────────────────────────────┘
                                     │
  ┌──────────────────┐     ┌─────────────────────────────────────┐     ┌──────────────────┐
  │ Decide on a one  │     │ Clearly state the null (Ho) and     │     │ Determine which  │
  │ or two tailed    │────▶│ alternate (Ha) hypotheses.          │◀────│ are the dependent│
  │ test.            │     │                                     │     │ or independent   │
  └──────────────────┘     └─────────────────────────────────────┘     │ variables        │
                                     │                                  └──────────────────┘
  ┌──────────────────┐     ┌─────────────────────────────────────┐     ┌──────────────────┐
  │ How are the      │     │ Choose the relevant statistical     │     │ Other factors to │
  │ variables        │     │ test.                               │     │ consider:        │
  │ measured?        │────▶│                                     │◀────│ ● Are one or more│
  │ ●Nominal,        │     │                                     │     │ samples being    │
  │ ordinal,         │     └─────────────────────────────────────┘     │ compared         │
  │ interval or      │               │                                 │ ● Are the samples│
  │ ratio?           │     ┌─────────────────────────────────────┐     │ dependent or     │
  │ ●Will parametric │     │ State the desired significance level│     │ independent?     │
  │ statistical tests│     │ or alpha (α) value (α =0.05) as the │     └──────────────────┘
  │ be required?     │     │ decision criterion                  │
  └──────────────────┘     └─────────────────────────────────────┘
                                     │
                                     ▼
                    ┌─────────────────────────────────────┐
                    │ Analyse the data with an appropriate│
                    │ computer package (identify the      │
                    │ calculated ρ-value)                 │
                    └─────────────────────────────────────┘
                                     │
                                     ▼
                    ┌─────────────────────────────────────┐
                    │ Compare the calculated ρ-value (Sig.)│
                    │ with the desired α value (α=0.05)   │
                    └─────────────────────────────────────┘
```

Clearly state the null (H_o) and alternate (H_a) hypotheses.

Choose the relevant statistical test.

State the desired significance level or alpha (α) value ($\alpha = 0.05$) as the decision criterion

Analyse the data with an appropriate computer package (identify the calculated ρ-value)

Compare the calculated ρ-value (Sig.) with the desired α value ($\alpha=0.05$)

Yes,   Make a statistical decision re the null hypothesis (Ho): Is $\rho=0.05$?   Yes,

Accept H^o. question   Reject H^o.

Provide a commonsense interpretation of the results

Figure 3.21 Process of statistical hypothesis testing

3.6.5 Descriptive Statistical Analysis

The descriptive statistics are applied for determining RO1. The analytical tools are the means, mode, median, range, standard deviations, and frequencies.

All the six statistical tools are non-parametric nature because of making no assumption on the normal distribution of the population or its sample, and collecting data based on an ordinal or nominal scale. Descriptive statistics concern with the research upon description of the phenomena of interest. It aims to find out the frequencies of the phenomena of interest, the mean of a set of data collected, and the central tendencies and dispersions of the dependent and independent variables.

3.6.6 Inferential Statistical Analysis

The inferential statistics are applied for investigating and determining RO1, RO2 and RO3. The tools of the inferential statistics are correlation, regression and t-tests. All three statistical tools are parametric nature because of making assumption on the normal distribution of the population or its sample, and collecting data based on an interval or ratio scale. The inferential statistics concern the research beyond that, seeking to find out the relationship between the dependent and independent variables in terms of positive or negative or/and casual effects.

The correlation analysis determines the direction and magnitude of relationship between dependent and independent variables (architectural design quality and market price), while the regression analysis determines causal relationship between the two variables

The inferential t-tests are used for RO1 to validate the initial results of architectural design criteria determined by the descriptive statistics.

3.7 Collection of Data

This study is based on mixing qualitative and quantitative data. The collection of these data came from the evidences of the case study and survey.

The collection of data from interviews in both case study and survey had been complex and not easy. Two groups of respondents were developers and professional architects in practice and teaching. They were leaders of the local business or education communities of the building industry. Some initial preparation was needed for success before commencing the techniques for data collection.

3.7.1 Preparation and Techniques for Data Collection

The initial preparation for data collection is investigator oriented. Prior to interviewing with the respondents, there has been the needed preparation of skills for investigators for asking right questions, exercising patience and flexibility, avoiding impartiality, having known well the issues under study, attending to confidentiality nature of business information, pending accessibility, dealing with rejections and individual characteristics of respondents, overcoming atmosphere of strangers with each other, planning types of questionnaires, observing time and duration of the interviews. Besides, the needed preparation also include skills for training for a specific case study or survey, selecting respondent cases, setting up a protocol for the collection investigation, and planning a pilot case study. All these skills are important for the success of data collection.

The techniques for data collection were research content oriented. The collection techniques covered several sources of evidences, and made sure that the collected data were closely linked to research aims, questions and hypothetical propositions. Hence the collection

techniques have three rules (Yin, 2009): first, use multiple sources of evidence; second, create a case study data base; third, maintain a chain of evidence.

3.7.2 Qualitative and Quantitative Data

Qualitative data were collected from case study evidence while quantitative data were collected from survey. Data collection techniques for this study were based on five sources of evidences. The five sources were interviews, documents, physical buildings or artefacts, archival records, and direct observation. These sources of evidence are exemplified by some case studies such as 'fieldwork' (Murphy, 1980), 'field research' (Bouchard, 1976) and 'social science method' (Kidder & Judd, 1986).

Although the case study differed from survey in research questions or substance, the collection of data shared some common sources. The common sources of collection for both methods were interviews, and physical buildings or artefacts.

The qualitative data of case studies were based on questions of 'why' and 'how' on about actual human behaviour, events or objects. In contrast, the quantitative data of survey were based on questions of 'how many' or 'how much' on attitudes, perceptions and verbal reports about human behaviour, events or objects. Both types of data are complimentary to each other for this study.

3.7.3 Quantitative Data – Survey A of Architectural Professionals

Aim: To explore and determine a set of architectural design criteria for multi-storey

residential buildings (RO1);

The quantitative data were collected and based on survey of a sample of ninety five (95) architectural and related professionals. The sample size of 95 respondents was computed slightly more than 5% of the population of 1775 professional architects registered with the LAM in 2011, instead of the 1576 corporate members of PAM. The minimum sample size for conducting statistical analysis is thirty (30) based on Roscoe (1975) rules.

The collection technique was based on structured survey interviews (Schober & Conrad, 2008) with a cross section of the architectural and related professionals in the business and education communities of the building industry. Besides, a stratified purposive sampling was used to achieve the representation and general expert view of the population. The stratification comprised: practicing architects who were principals or directors of architectural firms; winning architects of PAM Awards for outstanding architectural works; members of the council of architectural education accreditation of the LAM; member of the council of architectural education accreditation of the Royal Institute of British architects (RIBA); lecturers and professors of higher learning institutions in architecture and built environment including UiTM, UTM, UPM, and UM; and some selected developers of large corporations that were winning award developers of The Edge Malaysia Top Developers.

The structured interviews (Merton, 1990) were conducted on face to face or through telephone (Frey, 1983; Lavrakas, 1993). The interviews were based on predetermined questionnaire related to research questions, objectives and hypotheses. A copy of the survey questionnaire is attached in Appendix B and described briefly as follows:

- RESPONDENTS: gender; age; education; professional qualifications; organization; experience.

- ARCHITECTURAL DESIGN CRITERIA: architectural design criteria for multi-storey residential buildings using five point LIKERT scale; [1]strongly disagree [2]disagree [3]don't know[4]agree [5]strongly agree

3.7.4 Qualitative Data - Case Study I of Developers

Aims:

i. To investigate the relationships between architectural design criteria and market price of multi-storey residential buildings (RO2);

ii. To establish the relationship between architectural design criteria and market price of multi-storey residential buildings (RO4);

iii. To test the RH1 research hypothesis RH1 (RO5);

iv. To validate the RH2 research hypothesis and the RH3 research Hypothesis (RO6)

The qualitative data were collected and based on the case study of eight developers. The number of 8 case studies was considered more than sufficient for the case study method as a research strategy (Hartley, 2004; Merriam, 1998; Yin, 2009). The minimum number of case studies is one (Liebow, 2003; Lynd & Lynd, 1929).

The collection technique was based on structured case study interviews with directors or senior executives of the eight developer companies as follows:

- S P Setia Bhd (SP Setia)

- Bandar Raya Developments Bhd (BRDB)

- LION Development Bhd (LION)

- YTL Land & Development Bhd (YTL)

- P J Development Holdings Bhd (PJD)

- E&W Sdn Bhd (EW)

- UOA Sdn Bhd (UOA)

- UNIGAP Sdn Bhd UNIGAP)

The developers are located in the Klang Valley. The eight study cases were not randomly chosen. They were selected on the basis of the company profile, experience and performance in housing property product quality, and the respect that they command within the property industry especially the users and the public or are recipients of properties awards. This significant selection enhanced the representation and general practice standard of residential buildings of the population.

The first four developers were ranked among the EDGE Malaysia Top 30 Property Developers Awards 2008, 2009, 2010 and 2011 during the course of this study. They are Spsetia Bhd, Bandar Raya Development Bhd, YTL Land and Development Bhd and PJD Developments Holdings Bhd. They have been consistently demonstrated their excellence in creativity and innovations by the EDGE.

The four top property developers are shown in Table 3.1 in bold fonts. Currently S P Setia Bhd is being ranked the top of the EDGE Malaysia Top Property Developers Awards 2011.

Table 1.2 Ranking of the EDGE Malaysia Top 30 Property Developers Awards

The EDGE Malaysia Top 30 Property Developers Awards		
2011	2010	2009
1. S P Setia Bhd	**1.S P Setia Bhd**	1. Sime Darby Property Bhd
2. Sime Darby Property Bd	2.Sime Darby Property Bhd	**2. S P Setia Bhd**
3. Sunway City Bd	3.Sunway City Bhd	3. Sunway City Bhd
4. IGB Corp Bd	4.Sunrise Bhd	4. IGB Corp Bhd
5. I & P Group Sdn Bhd	5.IGB Corp Bhd	5. Island & Peninsular Sd
6. IOI Properties Bhd	6.IOI Properties Bhd	6. IOI Properties Bhd
7. Mah Sing Group Bhd	7.I & P Group Sdn Bhd	**7. Bandar Raya Dev. Bhd**
8. Sunrise Bhd	**8.Bandar Raya Dev. Bhd**	8. Eastern & Oriental Bhd
9. IJM Land Bhd	9.Mah Sing Group Bhd	9. Sunrise Bhd
10. Bandar Raya Dev. Bhd	10.IJM Land Bhd	10. BandarUtama City Co SB
11. BandarUtama City Co. Sd	11.Paramount Corp Bhd	11. Gamuda Bhd
12. Eastern & Oriental Bhd	**12. YTL Land & Dev. Bhd**	12. IJM Land Bhd
13. UEM Land Holdings Bhd	13. Glomac Bhd	**13. YTL Land & Dev. Bhd**
14. YTL Land & Dev. Bhd	14. Dijaya Corp Bhd	14. Paramount Corp Bhd
15. AlBatha B.K. Holding Bd	15. Plenitude Bhd	15. Selangor Dredging Bhd
16. Glomac Bhd	16. Selangor Dredging Bhd	16. Mah Sing Group Bhd
17. Dijaya Corporation Bhd	17. Naza TTDI Sdn Bhd	17. Naza TTDI Sdn Bhd
18. Naza TTDI Sdn Bhd	18. Eastern & Oriental Bhd	18. Selangor Properties Bhd
19. Paramount Corp. Bhd	19. TA Global Bhd	19. Dijaya Corporation Bhd
20. Selangor Dredging Bhd	20. UEM Land Holdings Bhd	20. UEM Land Holdings Bhd
21. Malton Bhd	21. YNH Property Bhd	**21. PJ Dev. Holdings Bhd**
22. YNH Property Bhd	22. Bolton Bhd	22. WCT Land Sdn Bhd
23. Hunza Properties Bhd	23. Malton Bhd	23. MetroKajang Holdings Bd
24. Bolton Bhd	24. United Malaya Land Bd	24. Plenitude Bhd
25. Plenitude Bhd	25. Selangor Properties Bhd	25. Naim Holdings Bhd
26. Mulpha Land Bhd	26. MetroKajang Holding Bd	26. Malton Bhd
27. Ivory Property Group Bd	**27. PJ Dev. Holdings Bhd**	27. United Malayan Land Bd
28. PJ Dev. Holdings Bhd	28. Naim Holdings Bhd	28. Hunza Properties Bhd
29. Nadayu Properties Bhd	29. Hunza Properties Bhd	29. Sagajuta (S) Sdn Bhd
30. United Malaya Land Bd	30. Mulpha Land Bhd	30. Bolton Bhd

The structured interviews were conducted on face to face only because of the nature of the case study strategy. No telephone interviews were used except the follow up sessions. The interviews were based on predetermined questionnaires linking to research questions, objectives and study propositions. The structure of the questionnaires is described briefly in the following and a copy is attached in Appendix C: C1, C2 and C3.

PART 1: LOW COST BUILDINGS
      SECTION A: RESPONDENTS
      SECTION B: PARTIES AND FACTORS CONCERNED
      SECTION C: DESIGN CRITERIA

PART 2: MEDIUM COST BUILDINGS
      SECTION A: RESPONDENTS
      SECTION B: PARTIES AND FACTORS CONCERNED
      SECTION C: DESIGN CRITERIA

PART 3: HIGH COST BUILDINGS
      SECTION A: RESPONDENTS
      SECTION B: PARTIES AND FACTORS CONCERNED
      SECTION C: DESIGN CRITERIA

The case study questionnaires are organized according to types of multi-storey residential buildings. There are three building types that are labeled according to market price range as low cost, medium cost and high cost or high end. Thus there are three separate parts (Part 1, Part 2, and Part 3) to the questionnaires. Each part contains three similar sections A, B and C and same number of questions. Section A has eighteen questions from Q1 to Q14, Section B has nineteen questions from Q15 to Q33, and Section C has forty two questions from Q34 to Q75.

Part 1 of the questionnaire for the low cost includes $35,000.00 and $42,000.00. Part 2 for the medium cost includes $80,000.00 and $350,000.00. Part 3 for high end includes $750,000.00 and $1,000,000.00 and above. The three different sections are briefly described as follows:

- SECTION A

  Respondents:
  - Company particulars: respondents; size; types; organizations; vision and mission statements and; goals for undertaking multi-storey residential buildings.

- SECTION B

  Parties and factors involved in the design process:
  - Design brief;
  - Parties involved; users, clients, architects, authorities, geomancers (Feng Shui expert), property market professionals (either in-house or out-source), project managers (either in-house or out-source);
  - Factors involved; aesthetics of art, function of a dwelling unit, social-cultural factors (life-style, feng shui), cost, sustainable building design, site context, planning and building laws

- SECTION C

  Relationships between design criteria and market price:
  - Design Criteria: Site context; Aesthetics of art; Function of a dwelling unit; Sustainability; Cost; Social-culture; Cost; Feng Shui
  - Market Price: Low, Medium and High Cost

3.7.5 Qualitative Data - Case Study II of Architectural Firms

Aims:

   i.   To investigate the relationships between architectural design criteria and market price of multi-storey residential buildings (RO2);

  ii.   To establish the relationship between architectural design criteria and market price of multi-storey residential buildings (RO4);

 iii.   To test the RH1 research hypothesis (RO5);

 iv.   To validate that RH2 research hypothesis and RH2 research hypothesis (RO6)

The qualitative data were collected and based on the case study of seven architectural firms. The number of 8 case studies was considered more than sufficient for the case study method as a research strategy (Hartley, 2004; Merriam, 1998; Yin, 2009). The collection technique was based on structured interviews with the principals or directors of the seven architectural firms as follows:

- GDP Architects Sdn Bhd (GDP),

- Veritas Architects and TAC Architects (V-Tac),

- YTL Design Group (YTL DESIGN),

- Atelier ADT Arkitek Sdn Bhd (ATELIER),

- AkiPraktis (AKIPRAKTIS),

- Akipanel Architects (AKIPANEL).

These firms are located in Kuala Lumpur City. They were directly appointed by the respective developers as the architects for the multi-storey residential building projects.

The first three architectural firms GDP, VERITAS and YTL DESIGN GROUP were winning architects of PAM Architectural Awards for outstanding works.

The structured interviews were conducted on face to face only because of the nature of the case study strategy. No telephone interviews were used except the follow up. The interviews were based on predetermined questionnaires linking the collected data to research questions, objectives and study propositions. The questionnaires are attached as per Appendix D: D1, D2 and D3. The interviews with architects were conducted in two phases: pre-survey and post-survey. The pre-survey refers to the period before the survey of building, while the post-survey after the survey. The period between the two surveys was about a year. There were some significance that discussed in Chapter 5.6.1.

3.7.6 Quantitative Data: Survey I and Survey II of Buildings

Aims:

i. To evaluate the application of architectural design criteria on selected low, medium and high cost multi-storey residential buildings:

ii. To establish the relationship between architectural design criteria and market price of multi-storey residential buildings (RO4);

The quantitative data were collected from Survey I and Survey II from 2009 to 2011.

First Survey I

The first Survey I was based on a sample of thirty six (36) multi-storey residential buildings in Klang Valley. The buildings comprised three types of 12 low cost, 12 medium cost and 12 high cost. These buildings were random selection that was conducted by thirty six (36) participants from end December 2009 to end March 2010. The participants were divided into four (4) groups of nine (9) persons. Each group selected three buildings of each three types.

Each group worked together to review literature on the design criteria, to observe the buildings at sites, to collect and study plan documents of the buildings, discuss and comment the relationships between architectural design quality and market price.

The participants were final third year architectural students of the University of Malaya. They were doing the course of Professional Studies, and assigned to conduct field studies per Appendix G.

The participants were considered appropriate and suitable investigators as they were taught the six design criteria except Feng Shui during the three year architectural course. The three year course program has been accreditated by RIBA as Part 1 architectural professional qualifications. Generally the participants had a firm grasp of the design issues in the professional practice of architecture.

At the end, each group of the participants submitted written assignments with results of their findings, discussion and implications. They made a power point presentation of the findings in class as a seminar, discussed and learned from each other of what they had learned. There was a question and answer session at the end of the presentation. Following, every participant filled in the two sets of questionnaires and submitted upon completion.

The two sets of questionnaires are attached as per Appendix E: E1 and F: F1. Appendix E: E1 is for direct observation buildings at site. Appendix F: F1 is for document study of building plans. The structure of questionnaires is described briefly in the following:

QUESTIONNAIRE: Direct Observation of Buildings at Site
    SECTION A: RESPONDENTS
    SECTION B: BUILDINGS – LOW, MEDIUM AND HIGH COST
    SECTION C: RANKING OF BEING DEVELOPED FOR DESIGN CITERIA

QUESTIONNAIRE: Document Study of Building Plans
      SECTION A: RESPONDENTS
      SECTION B: BUILDINGS – LOW, MEDIUM AND HIGH COST
      SECTION C: RANKING OF BEING DEVELOPED FOR DESIGN CITERIA

The two sets of questionnaires for Survey I as well as Survey II are organized according to two different sources of evidences. One set is the direct observation of buildings studied at site. The other set is the plan documents of buildings studied. These two sets serve as a check of balance. The questionnaires contain three similar sections A, B and C with same number of questions. Section A has six questions. Section B has three component questions for the low cost, medium cost and high cost building types. Section C has forty two questions for 'ranking of being developed' for design criteria against low cost, medium cost and high cost. The low cost buildings include $35,000.00 and $42,000.00. The medium cost buildings include $80,000.00 and $350,000.00. The high cost buildings include $750,000.00 and $1,000,000.00 and above.

Survey II

The second Survey II was carried out in similar procedure, except some important details are briefly described in the following.

The second Survey II was based on a sample of forty five (45) multi-storey residential buildings in Kuala Lumpur and the Klang Valley. The buildings comprised three types of 15 low cost, 15 medium cost and 15 high cost. These buildings were a random selection that was conducted by forty nine (49) participants from end December 2010 to end March 2011. They were divided into five groups of nine or ten persons. Each group randomly selected three

buildings for each three types. Each group worked together to review literature on the design criteria, to observe the buildings at sites, to collect and study plan documents of the buildings, discuss and comment architectural design quality and market price.

Similarly the participants were final third year architectural students of the University of Malaya. They were doing a course of the Professional Studies on similar assignment as that of the Survey I in the preceding section.

3.7.7 Pilot Case Studies

There were two sets of pilot case studies according to the type of empirical evidence. One set was the survey questionnaires of the architectural professionals for determining architectural design criteria for multi-storey residential buildings. The other set was the case study questionnaires for investigating the relationships between architectural design quality and market price.

Pilot case studies acted like a check loop, and provided feedback to develop relevant questionnaires as well as conceptual clarification for the research design process. Few pilot cases were initially explored including academicians, practitioners and architectural firms. The collection of data of the pilot case studies was important in shaping the preparation and techniques for collection especially the predetermined questionnaires.

One pilot case study was selected eventually from an architectural firm because of several factors: accessibility, close proximity, research contents, openness, availability, and practice experience.

3.8 Summary

In summary, this chapter of methodology highlighted the importance of theoretical, methodological and empirical approach to this research. This study applied mixed methods

design approach. The mixed methods research can tackle more complex research questions, problems and aims, and provide more focus on the data collection and analysis. The analytical techniques included non-equivalent dependent variable design with pattern matching, replication logic, descriptive and inferential statistics.

The theoretical framework was developed to better understand and study the relationships between the architectural design quality and market price. The framework identified the independent and dependent variables of the concepts related to the study. The reflective causal measurement model defined the indicators or dependent variables such as site context, aesthetic of art, function of the dwelling unit, sustainability, cost, socio-culture and Feng Shui, while the latent or independent variable as market price. The framework provided the research hypothesis RH1 that architectural design quality for multi-storey residential buildings decreases as market price decreases.

Data to be collected were qualitative and quantitative from case studies and surveys respectively. Data were collected from four empirical investigations comprising Survey A of architectural professionals, Case Study I of eight developers, Case Study II of seven architectural firms, and Survey I and Survey II of multi-storey residential buildings for the low, medium and high cost types.

CHAPTER 4 DATA ANAYLYSIS AND RESULTS

4.1 Introduction

Data analysis is linked to the research topic, questions or problems, objectives and propositions or hypotheses. The analysis is based on mixed methods of quantitative and qualitative data from empirical evidences of case studies and surveys.

Several analytical techniques are used for the empirical studies as follows:

- Quantitative data of the survey A of architectural and related professionals (95)

- Qualitative data of the case study I of eight developers

- Qualitative data of the case study II of seven architectural firms, and

- Quantitative data of two survey I and survey II of multi-storey residential buildings

The analytical techniques are as follows:

- descriptive statistics

- inferential statistics,

- non-equivalent dependable variables design

- pattern matching, and

- replication logic

These analytical techniques are selected appropriately for each empirical study to achieve the research objectives in following sections.

4.2 Analysis and Results of Survey I of Architectural Professionals

4.2.1 Introduction

This data analysis was based on the Survey A of ninety five architectural professionals. Response data were recorded in the Survey A questionnaires Q1 to Q8 as per Appendix B1, while data input in variable view and data view (data not inserted) of SPSS Data Editor as per Appendix B2.

4.2.2 Methods of Analysis

The analytical methods comprised descriptive and inferential statistics.

4.2.3 Survey A Questionnaires and Data Validity Check

For statistical results, Q8 of the questionnaire was analysed.

For t-test analysis, the validity of the variable data set was checked for skew-ness and kurtosis values. The values within acceptable range of values for a normal distribution are as follows:

$-1.9 <$ Skewness $< +1.9$
$-1.9 <$ Kurtosis $< +1.9$

The computed values of skew-ness and kurtosis for this dataset tested were found to be within satisfactory range as shown in Table 5.1 below.

Table 4.1 Skewness and Kurtosi for the Response Dataset

	N	Skew-ness	Kurtosis
Site Context	95	-1.56	1.34
Aesthetics/Art	95	.58	.56
Function	95	-1.70	.91
Sustainability	95	-.32	-.67
Cost	95	.10	-1.05
Socio-Culture	95	-.37	-1.34
Feng Shui	95	-.33	-.12

4.2.4 Descriptive Statistics: Survey A of 95 Architectural Professionals

The analysis of the questionnaires included the mean, mode, median, range, standard deviation and frequencies.

4.2.4.1 Results of Analysis for the Frequencies

For the frequencies' results, Q76 was analysed. The results for each variable of design criteria are displayed in the data output files, presented as in Table 4.2 frequencies in number, Table 4.3 frequencies in percentage, Figure 4.1 frequencies in bar charts and Figure 4.2 frequencies in histograms with distribution curves.

The frequencies' results show the number of times that respondents had responded to the design criteria and the percentage of their occurrence. These results have determined three purposes of the questionnaire: firstly, the number of respondents to each category of the classifications; secondly the range of scores for the dataset such as the highest and lowest scores; thirdly an initial examination of the opinions of the respondents.

Table 4.2 shows the computed number of respondents who had indicated the extent of agreement towards design criteria for designing multi storey residential buildings. Table 4.3 shows the computed percentage of respondents for easy comparison and contrast. Figure 4.1 shows a visual representation of frequencies in bar charts. Figure 4.2 shows another type of visual representation of frequencies in histograms with distribution curves.

Table 4.2 Frequencies Expressed in Number

	N	Strongly disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly agree 5	Agree + Strongly agree (4+5)
Design Criteria							
Site Context	95	0	0	1	21	73	94
Aesthetics/Art	95	0	0	6	42	47	89
Function	95	0	0	0	17	78	95
Sustainability	95	0	0	10	49	36	85
Cost	95	0	0	2	56	37	93
Socio-Culture	95	0	0	1	42	52	94
Feng Shui	95	1	12	35	41	6	47

Table 4.3 Frequencies Expressed in Percentage (%)

	N	Strongly disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly agree 5	Agree & Strongly agree 4 & 5
Design Criteria							
Site Context	95	0.0	0.0	1.1	22.1	76.8	98.9
Aesthetics/Art	95	0.0	0.0	6.3	44.2	49.5	93.7
Function	95	0.0	0.0	0.0	17.9	82.1	100
Sustainability	95	0.0	0.0	10.5	51.6	37.9	89.5
Cost	95	0.0	0.0	2.1	58.9	38.9	97.8
Socio-Culture	95	0.0	0.0	1.1	44.2	54.7	99.9
Feng Shui	95	1.1	12.6	36.8	43.2	6.3	49.5
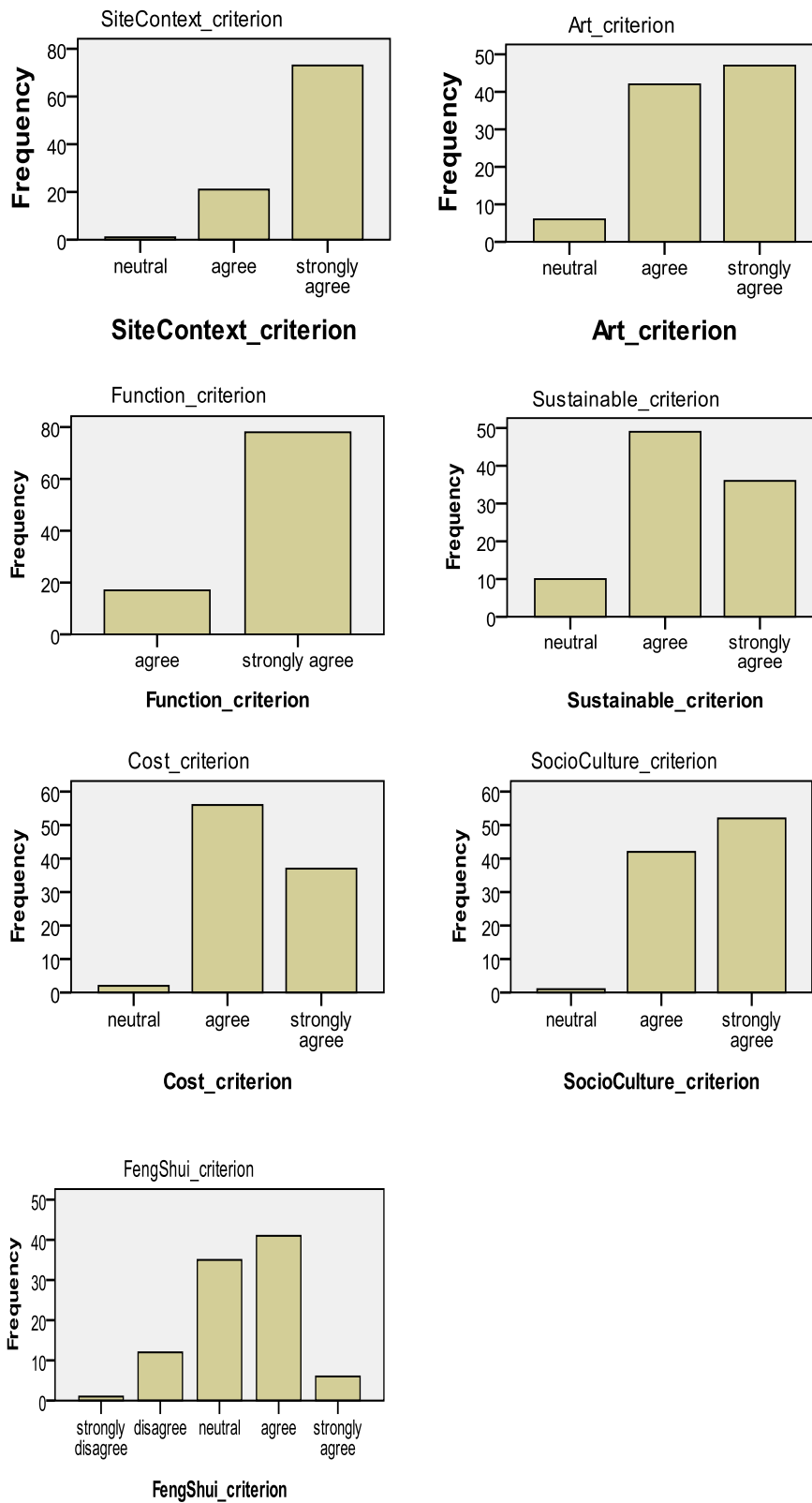
Figure 4.1Frequencies in Bar Charts
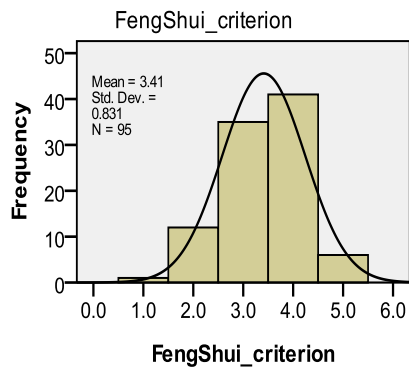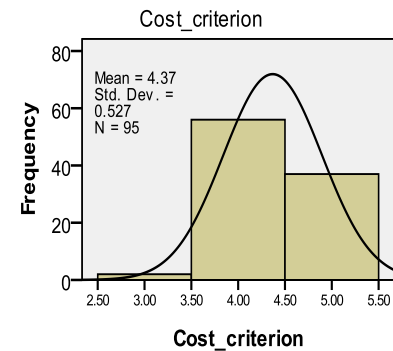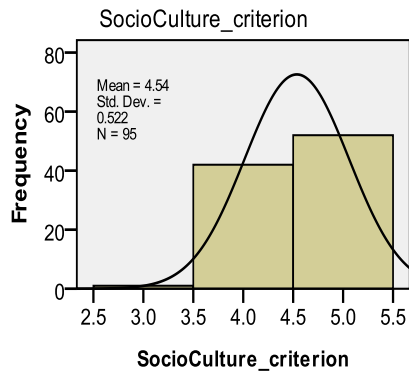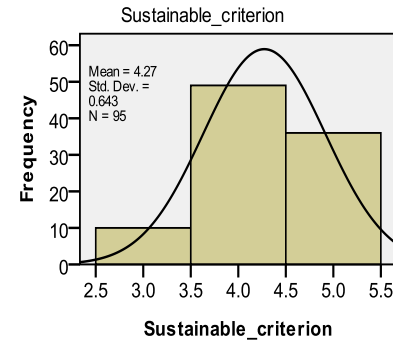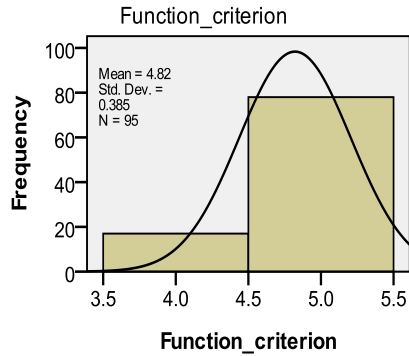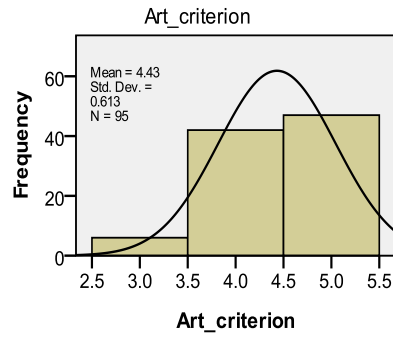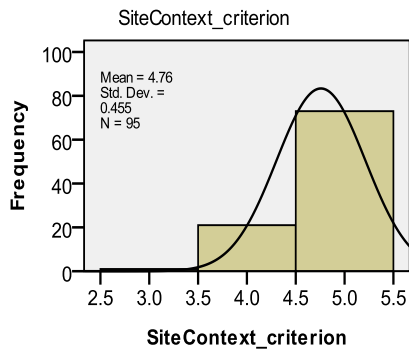
Figure 4.2 Frequencies in Histograms with Distribution Curves

4.2.4.2 Results of Analysis for the Mean, Mode and Median

The results of analyses for the mean, mode and median are presented in Table 4.4 with the standard deviation, variability of certain results, skewness and kurosis.

Table 4.4Results of The Mean, The mode and the Median

	N	Mean	Median	Mode	Std. Deviation	Skew-ness	Kurtosis
Design Criteria							
Site Context	95	4.75	5.00	5.00	.45	-1.56	1.34
Aesthetics/Art	95	4.43	4.00	5.00	.61	.58	.56
Function	95	4.82	5.00	5.00	.38	-1.70	.91
Sustainability	95	4.27	4.00	4.00	.64	-.32	-.67
Cost	95	4.36	4.00	4.00	.52	.10	-1.05
Socio-Culture	95	4.53	5.00	5.00	.52	-.37	-1.34
Feng Shui	95	3.41	3.00	4.00	.83	-.33	-.12

4.2.5 Inferential Statistics: Survey A of 95 Architectural Professionals

The t-test analysis was carried out to examine and confirm the results of the descriptive statistics analysis. Three main types of t-tests were applied as follows:

- a single sample t-test comparing a sample mean with a hypothesized population mean of the respondents opinion in an architectural community
- a two sample (independent) t-test comparing mean differences between the practicing and academic architectural professionals in the group of respondents
- a two sample (independent) t-test comparing mean differences between the male and female architectural professionals in the group of respondents.

The results of the analysis for the three types of t-tests were in the following.

4.2.5.1 Results of a Single Sample T-test

The results of the analysis for the single sample t-tests are tabulated in Table 4.5.

Table 4.5 Results of One-Sample T-test

	N	Mean	Std. Deviation	Std. Error Mean	Test Value = 4		
					t	df	Sig. (2-tailed) P < .05
Site Context	95	4.75	.45466	.04665	16.247	94	.00
Aesthetics/Art	95	4.43	.61285	.06288	6.864	94	.00
Function	95	4.82	.38534	.03954	20.768	94	.00
Sustainability	95	4.27	.64317	.06599	4.148	94	.00
Cost	95	4.36	.52699	.05407	6.814	94	.00
Socio-culture	95	4.53	.52208	.05356	10.022	94	.00
Feng Shui	95	3.41	.83149	.08531	-6.910	94	.00

The results were further analysed based on the single sample t-test with the hypothesis testing process (Figure 3.23) as follows:

Step 1 Formulation of Hypotheses

1.1 Hypothesis 1 is labelled for variable site context as:

$H1_0$(Null hypothesis): The architectural professionals are generally 'agreed' (test value $=4$) towards site context as an architectural design criterion for multi-storey residential buildings;

$H1_A$(Alternate hypothesis): The architectural professionals are generally not 'agreed' (test value $=4$) to site context as an architectural design criterion for multi-storey residential buildings.

These hypotheses can be expressed statistically as:

$H1_0$: $\mu_1 = 4$ (or $\mu_1 - 4 = 0$)

$H1_A$: $\mu_1 \neq 4$ (or $\mu_1 - 4 \neq 0$)

where μ_1 is the population mean opinion

1.2 Similarly, Hypothesis 2 is labelled for variable art as:

H2$_0$(Null hypothesis): (generally agreed)

H2$_A$(Alternate hypothesis): (generally not agreed)

These hypotheses can be expressed statistically as:

H2$_0$: $\mu_2 = 4$ (or $\mu_2 - 4 = 0$)

H2$_A$: $\mu_2 \neq 4$ (or $\mu_2 - 4 \neq 0$)

where μ_2 is the population mean

1.3 Similarly, Hypothesis 3 is labelled for variabe function as:

H3$_0$(Null hypothesis): (generally agreed)

H3$_A$(Alternate hypothesis): (generally not agreed)

These hypotheses can be expressed statistically as:

H3$_0$: $\mu_3 = 4$ (or $\mu_3 - 4 = 0$)

H3$_A$: $\mu_3 \neq 4$ (or $\mu_3 - 4 \neq 0$)

where μ_3 is the population mean

1.4 Similarly, Hypothesis 4 is labelled for variable sustainability as:

H4$_0$(Null hypothesis): (generally agreed)

H4$_A$(Alternate hypothesis): (generally not agreed)

These hypotheses can be expressed statistically as:

H4$_0$: $\mu_4 = 4$ (or $\mu_4 - 4 = 0$)

H4$_A$: $\mu_4 \neq 4$ (or $\mu_4 - 4 \neq 0$)

where μ_4 is the population mean

1.5 Similarly, Hypothesis 5 is labelled for variable cost as:

H5$_0$(Null hypothesis):

H5$_A$(Alternate hypothesis):

These hypotheses can be expressed statistically as:

$H5_0$: $\mu_5 = 4$ (or $\mu_5 - 4 = 0$)

$H5_A$: $\mu_5 \neq 4$ (or $\mu_5 - 4 \neq 0$)

where μ_5 is the population mean

1.6 Similarly, Hypothesis 6 is labelled for variable socio-culture as:

$H6_0$(Null hypothesis): (generally agreed)

$H6_A$(Alternate hypothesis): (generally agreed not)

These hypotheses can be expressed statistically as:

$H6_0$: $\mu_6 = 4$ (or $\mu_6 - 4 = 0$)

$H6_A$: $\mu_6 \neq 4$ (or $\mu_6 - 4 \neq 0$)

where μ_6 is the population mean

1.7 Similarly, Hypothesis 7 is labelled for varaibel Feng Shui as:

$H7_0$(Null hypothesis): (generally agreed)

$H7_A$(Alternate hypothesis): (generally agreed not)

These hypotheses can be expressed statistically as:

$H7_0$: $\mu_7 = 4$ (or $\mu_7 - 4 = 0$)

$H7_A$: $\mu_7 \neq 4$ (or $\mu_7 - 4 \neq 0$)

where μ_7 is the population mean

Step 2 Selection of a Decision Criterion

The decision criterion was arbritrarily set at a significance level of 5 per cent ($\alpha = 0.05$).

Step 3Making inferences from Results

As shown in Table 5.5, on average the computed mean values for the first six variables are above 4 except Feng Shui. Hence the following inferences are made from these results together with the p-values in Sig. (2-tailed) column.

Step 4 Making a Statistical Decision

The computed significance levels for the seven tested variables are all notably less than 5%, hence for each individual hypothesis H_0 the null hypothesis is rejected and H_A the alternative hypothesis is accepted. From this it can be concluded that at the 5% significance level, the population means for all the design criteria are significantly different from "agree" (test value=4).

Hence it can be concluded that on average the respondents' opinion for the first 6 criteria are at " agree" (test value=4) and for the 7th design criteria Feng Shui their opinion is at "neutral" (test value=3). In summary:

➢ H_0 the null hypothesis is rejected and H_A the alternative hypothesis is accepted for each individual hypothesis

4.2.5.2 Results of Independent Sample T-test for Academicians and Practitioners

The analysis results of t-test for the two independent samples are generated as in Table 4.6.

Table 4.6 Independent Samples T-test for Academic & Practicing Professionals

			Descriptive Statistics			Inferential Statistics		
		N	Mean	Std. Deviation	Std. Error Mean	Test Value = 4		
						t	df	Sig.(2tailed) P < .05
Site Context	academic	33	4.6970	.52944	.09216	-.95	93	.34
	practicing	62	4.7903	.41040	.05212			
Aesthetics/Art	academic	33	4.1515	.66714	.11613	-3.43	93	.00
	practicing	62	4.5806	.52941	.06724			
Function	academic	33	4.7273	.45227	.07873	-1.74	93	.08
	practicing	62	4.8710	.33797	.04292			
Sustainability	academic	33	4.2121	.64988	.11313	-.67	93	.49
	practicing	62	4.3065	.64245	.08159			
Cost	academic	33	4.3333	.59512	.10360	-.47	93	.63
	practicing	62	4.3871	.49106	.06236			
Socio-culture	academic	33	4.5758	.50189	.08737	.52	93	.59
	practicing	62	4.5161	.53537	.06799			
Feng Shui	academic	33	3.4545	.75378	.13122	.37	93	.70
	practicing	62	3.3871	.87506	.11113			

The results were further analysed for the two independent samples with the statistical hypothesis testing process (Figure 3.23) as follows:

Step 1 Formulation of Hypotheses

1.8 Hypothesis 8 is labelled for variable site context as:

H8$_0$(Null hypothesis): Academic professionals are on average not different from practicing professionals towards site context as an architectural design criterion for multi-storey residential buildings;

H8$_A$(Alternate hypothesis): Academic professionals are on average different from practicing professionals towards site context as an architectural design criterion for multi-storey residential buildings.

These hypotheses can be expressed statistically as:

H8$_0$: $\mu_{A8} \leq \mu_{P8}$ (or $\mu_{A8} - \mu_{P8} \leq 0$)

H8$_A$: $\mu_{A8} > \mu_{P8}$ (or $\mu_{A8} - \mu_{P8} > 0$)

Where H8$_0$ = the null hpothesis

    H8$_A$ = the alternate hypothesis

    μ_{A8} is the population mean of the academic professionals' opinion

    μ_{P8} is the population mean of the practicing professionals' opinion

1.9 Similarly, Hypothesis 9 is labelled for variable aesthetics as:

    H9$_0$(Null hypothesis): (on average not different)

    H9$_A$(Alternate hypothesis): (on average different)

These hypotheses can be expressed statistically as:

H9$_0$: $\mu_{A9} \leq \mu_{P9}$ (or $\mu_{A9} - \mu_{P9} \leq 0$)

H9$_A$: $\mu_{A9} > \mu_{P9}$ (or $\mu_{A9} - \mu_{P9} > 0$)

Where μ_{A9} is the population mean of the academic professionals' opinion

    μ_{P9} is the population mean of the practicing professionals' opinion

1.10 Similarly, Hypothesis 10 is labelled for variable function as:

    H10$_0$(Null hypothesis): (on average not different)

    H10$_A$(Alternate hypothesis): (on average different)

These hypotheses can be expressed statistically as:

    Where H10$_0$: $\mu_{A10} \leq \mu_{P10}$ (or $\mu_{A10} - \mu_{P10} \leq 0$)

        H10$_A$: $\mu_{A10} > \mu_{P10}$ (or $\mu_{A10} - \mu_{P10} > 0$)

        μ_{A10} is the population mean of the academic professionals' opinion

        μ_{P10} is the population mean of the practicing professionals' opinion

1.11 Similarly, Hypothesis 11 is labelled for variable sustainability, and this can be expressed statistically as:

    H11$_0$ = the null hpothesis (on average not different)

H11$_A$= the alternate hypothesis (on average different)

Where H11$_0$: $\mu_{A11} \leq \mu_{P11}$ (or $\mu_{A11} - \mu_{P11} \leq 0$)

     H11$_A$: $\mu_{A11} > \mu_{P11}$ (or $\mu_{A11} - \mu_{P11} > 0$)

     μ_{A11} is the mean agreement of academic professionals

     μ_{P11} is the mean agreement of practicing professionals.

1.12 Similarly, Hypothesis 12 is labelled for variable cost, and this can be expressed statistically as:

H12$_0$ = the null hpothesis (on average not different)

H12$_A$= the alternate hypothesis (on average different)

Where H12$_0$: $\mu_{A12} \leq \mu_{P12}$ (or $\mu_{A12} - \mu_{P12} \leq 0$)

     H12$_A$: $\mu_{A12} > \mu_{P12}$ (or $\mu_{A12} - \mu_{P12} > 0$)

     μ_{A12} is the population mean of the academic professionals' opinion

     μ_{P12} is the population mean of the practicing professionals' opinion

1.13 Similarly, Hypothesis 13 is labelled for variable socio-culture, and this can be expressed statistically as:

H13$_0$ = the null hpothesis (on average not different)

H13$_A$= the alternate hypothesis (on average different)

Where H13$_0$: $\mu_{A13} \leq \mu_{P13}$ (or $\mu_{A13} - \mu_{P13} \leq 0$)

     H13$_A$: $\mu_{A13} > \mu_{P13}$ (or $\mu_{A13} - \mu_{P13} > 0$)

     μ_{A13} is the population mean of the academic professionals' opinion

     μ_{P13} is the population mean of the practicing professionals' opinion

1.14 Similarly, Hypothesis 14 is labelled for variable Feng Shui, and this can be expressed statistically as:

H14$_0$ = the null hpothesis (on average not different)

H14$_A$= the alternate hypothesis (on average different)

Where H14$_0$: $\mu_{A14} \leq \mu_{P14}$ (or $\mu_{A14} - \mu_{P14} \leq 0$)

$H14_A: \mu_{A14} > \mu_{P14}$ (or $\mu_{A14} - \mu_{P14} > 0$)

μ_{A14} is the population mean of the academic professionals' opinion

μ_{P14} is the population mean of the practicing professionals' opinion

Step 2 Selection of a Decision Criterion

The decision criterion is set arbritrarily at a significance level at 5% ($\alpha = 0.05$) for the two-tailed tests.

Step 3 Making Inferences from Data

As shown in Table 4.6, on average the computed mean values for the first six variables are above 4 except Feng Shui. Hence the following inferences are made from these results together with the p-values in Sig. (2-tailed) column.

Step 4 Making a Statistical Decision

The statistical decision is now made by comparing the calculated p-values with the selected significance level (α value) of 0.05. The computed p-values for all the design criteria (excluding the art criterion) are all notably higher than 5%. For these six hypotheses, the individual H_0 null hypothesis is retained for each of them. From this, it can be concluded that at the 5% significance level, the population means between the academic and practicing professionals for these six design criteria are on average significantly not different. On the other hand, the art design criterion has a p-value which is notably lower than 5%, hence reject H_0 is rejected and this concludes that at the 5% significance level the population mean for the art design criteria between the academic and practicing professionals are on average significantly different. In summary, the conclusions are

➤ Retain $H8_0$, $H10_0$, $H11_0$ $H12_0$, $H13_0$ and $H14_0$, and reject only $H9_0$.

4.2.5.3 Results of Independent Sample T-test for Male and Female

The analysis results of t-test for the two independent samples are generated as in Table 4.7.

Table 4.7 Independent Samples T-test for Comparing the Female with Male

		N	Mean	Std. Deviation	Std. Error Mean	Test Value = 4		
						T	df	Sig.(2tailed) P <.05
Site Context	Male	76	4.7237	.47885	.05493	-1.47	93	.143
	Female	19	4.8947	.31530	.07234			
Aesthetics/Art	Male	76	4.4605	.59868	.06867	.92	93	.360
	Female	19	4.3158	.67104	.15395			
Function	Male	76	4.8026	.40066	.04596	-.93	93	.354
	Female	19	4.8947	.31530	.07234			
Sustainability	Male	76	4.2763	.66531	.07632	.07	93	.937
	Female	19	4.2632	.56195	.12892			
Cost	Male	76	4.4342	.49895	.05723	2.50	93	.014
	Female	19	4.1053	.56713	.13011			
Socio-culture	Male	76	4.4868	.52898	.06068	-1.89	93	.062
	Female	19	4.7368	.45241	.10379			
Feng Shui	Male	76	3.3553	.85952	.09859	-1.30	93	.197
	Female	19	3.6316	.68399	.15692			

The results of the two independent sample t-test with the hypothesis testing process (Figure 3.23) were further analysed as follows:

Step 1 Formulation of hypotheses

1.15 Hypothesis 15 is labelled for variable site context as:

$H15_0$(Null hypothesis): Male professionals are on average not significantly different from female professionals towards site context as an architectural design criterion for multi-storey residential buildings;

$H15_A$(Alternate hypothesis): Male professionals are on average different from female professionals towards site context as an architectural design criterion for multi-storey residential buildings.

These hypotheses can be expressed statistically as:
$H15_0: \mu_{M\ 15} \le \mu_{F15}$ (or $\mu_M - \mu_F \le 0$)

H15$_A$: $\mu_{M15} > \mu_{F15}$ (or $\mu_M - \mu_F > 0$)

Where H15$_0$ = the null hpothesis

H15$_A$= the alternate hypothesis

μ_{M15} is the population mean of the male professionals' opinion

μ_{F15} is the population mean of the female professionals' opinion

1.16 Similarly, Hypothesis 16 is labelled for variable art as:

H16$_0$(Null hypothesis): (on average not different)

H16$_A$(Alternate hypothesis): (on average different)

These hypotheses can be expressed statistically as:

H16$_0$: $\mu_{M16} \leq \mu_{F16}$ (or $\mu_{M16} - \mu_{F16} \leq 0$)

H16$_A$: $\mu_{M16} > \mu_{F6}$ (or $\mu_{M16} - \mu_{F16} > 0$)

Where μ_{M16} is the population mean of the male professionals' opinion

μ_{F16} is the population mean of the female professionals' opinion

1.17 Similarly, Hypothesis 17 is labelled for variable function as:

H17$_0$(Null hypothesis): (on average not different)

H17$_A$(Alternate hypothesis): (on average different)

These hypotheses can be expressed statistically as:

H17$_0$: $\mu_{M17} \leq \mu_{F17}$ (or $\mu_{M17} - \mu_{F17} \leq 0$)

H17$_A$: $\mu_{M17} > \mu_{F17}$ (or $\mu_{M17} - \mu_{F17} > 0$)

Where

μ_{M17} is the population mean of the male professionals' opinion

μ_{F17} is the population mean of the female professionals' opinion

1.18 Similarly, Hypothesis 18 is labelled for variable sustainability, and this can be expressed statistically as:

H18$_0$ = the null hpothesis (on average not different)

$H18_A$ = the alternate hypothesis (on average different)

$H18_0$: $\mu_{M18} \leq \mu_{F18}$ (or $\mu_{M18} - \mu_{F18} \leq 0$)

$H18_A$: $\mu_{M18} > \mu_{F18}$ (or $\mu_{M18} - \mu_{F18} > 0$)

where μ_{M18} is the population mean of the male professionals' opinion

    μ_{F18} is the population mean of the female professionals' opinion

1.19 Similarly, Hypothesis 19 is labelled for variable cost, and this can be expressed statistically as:

$H19_0$ = the null hpothesis (on average not different)

$H19_A$ = the alternate hypothesis (on average different)

$H19_0$: $\mu_{M19} \leq \mu_{F19}$ (or $\mu_{M19} - \mu_{F19} \leq 0$)

$H19_A$: $\mu_{M19} > \mu_{F19}$ (or $\mu_{M19} - \mu_{F19} > 0$)

Where μ_{M19} is the population mean of the male professionals' opinion

    μ_{F19} is the population mean of the female professionals' opinion

1.20 Similarly, Hypothesis 20 is labelled for variable socio-culture, and this can be expressed statistically as:

$H20_0$ = the null hpothesis (on average not different)

$H20_A$ = the alternate hypothesis (on average different)

$H20_0$: $\mu_{M20} \leq \mu_{F20}$ (or $\mu_{M20} - \mu_{F20} \leq 0$)

$H20_A$: $\mu_{M20} > \mu_{F20}$ (or $\mu_{M20} - \mu_{F20} > 0$)

Where μ_{M20} is the population mean of the male professionals' opinion

    μ_{F20} is the population mean of the female professionals' opinion

1.21 Similarly, Hypothesis 21 is labelled for variable Feng Shui, and this can be expressed statistically as:

$H21_0$ = the null hpothesis (on average not different)

$H21_A$= the alternate hypothesis (on average different)

$H21_0$: $\mu_{M21} \leq \mu_{F21}$ (or $\mu_{M21} - \mu_{F21} \leq 0$)

$H21_A$: $\mu_{M21} > \mu_{F21}$ (or $\mu_{M21} - \mu_{F21} > 0$)

Where μ_{M21} is the population mean of the male professionals' opinion

μ_{F21} is the population mean of the female professionals' opinion

Step 2 Selection of a Decision Criterion

The decision criterion is arbritrarily set at a significance level of 5 per cent ($\alpha = 0.05$) for two-tailed tests.

Step 3 Making Inferences from data

As shown in Table 4.7, on average the computed mean values for the first six variables are above 4 except Feng Shui. Hence the following inferences are made from these results together with the p-values in Sig. (2-tailed) column.

Step 4 Making a Statistical Decision

The statistical decision is now made by comparing the calculated p-values with the selected significance level (α value) of 0.05.

The computed p-values for all design criteria (except cost criterion) are all notably higher than 5%, hence for these H_0 null hypotheses are retained. From this, it can be concluded that at the 5% significance level, the population means between the male and female architectural professionals for these six design criteria are on average significantly not different. In contrast, the cost design criterion has a p-value which is notably lower than 5%, hence H_0 is rejected and this conclude that at the 5% significance level the population mean for the cost design criteria between the male and female architectural professionals are on average significantly different. In summary:

➢ Retain $H15_0$, $H16_0$, $H17_0$, $H18_0$, $H20_0$ and $H21_0$, and reject only $H19_0$.

4.3 Analysis and Results of the Case Study I of Eight Developers

4.3.1 Introduction

This data analysis was based on Case Study I of eight developers including SP SETIA, PJD, BRDB, LION, YTL, E&W, UOA and UNIGAP. Response data were recorded in the Case Study I questionnaires Q1 to Q75 as per Appendix C1, while data input in variable view and data view (data not inserted) of SPSS Data Editor as per Appendix C2.

4.3.2 Methods of Analysis

The analytical methods included preliminary; observed patterns; correlation; regression; replication; pattern matching and analysis sequence. Analyses of the preliminary and observed patterns are explained in following sections, while the others in Chapter 3.6.

Preliminary Analysis:

Preliminary analysis was first to study if there were any simple relationship between the market price and design quality for multi-storey residential buildings.

Study of Observed Patterns:

This study was carried out to find if there were any observed patterns for pattern matching and replication logic. Three study questions were selected as follows:

- What is the relationship between design criteria and market price?
- Who is the leading party in working out the design brief?
- How is the input of users?

In the analysis, some observed patterns or relationships were found between the market price and design quality for multi-storey residential buildings as follows:

- Simple Relationship by Preliminary analysis

- Significant Relationships by Correlation analysis

- Causal Relationships by Regression analysis

- A predicted pattern for working out design brief of projects

- A predicted pattern for users' input to design brief

Sequence of the Data Analysis:

Spsetia data were chosen as the first set for the data analysis in details. Following this, the remaining seven case studies and two surveys were done in simplified summary. As there are seven dependent variables (DV_{1-7}), the correlation and regression analyses were conducted for each DV for Spsetia in the order as follows:

DV_1- Correlation between Price and Site Context
DV_2- Correlation between Price and Aesthetics
DV_3- Correlation between Price and Function
DV_4- Correlation between Price and Sustainability
DV_5- Correlation between Price and Cost
DV_6- Correlation between Price and Socio-culture
DV_7- Correlation between Price and Feng Shui
And
DV_1- Regression between Price and Site Context
DV_2- Regression between Price and Aesthetics
DV_3- Regression between Price and Function
DV_4- Regression between Price and Sustainability
DV_5- Regression between Price and Cost
DV_6- Regression between Price and Socio-culture
DV_7- Regression between Price and Feng Shui

The correlation and regression analyses for the remaining cases of developers, architectural

firms and surveys of buildings were conducted together with their results as follows:

DV_1- Correlation and Regression between Price and Site Context
DV_2- Correlation and Regression between Price and Aesthetics
DV_3- Correlation and Regression between Price and Function
DV_4- Correlation and Regression between Price and Sustainability
DV_5- Correlation and Regression between Price and Cost
DV_6- Correlation and Regression between Price and Socio-culture
DV_7- Correlation and Regression between Price and Feng Shui

4.3.3 SP Setia

For the respective results, data were analysed from questions comprising Q13 to Q29, and Q34 to Q75 accordingly to preliminary, correlation, regression, and observed patterns.

4.3.3.1 Results of Preliminary Analysis

For the preliminary results, Q13, Q14 and Q17 as per Appendix C were analysed.

Q13 and Q14 are referred to as follows:

Q13. What are goals, vision and mission statements of the company?

Q14. Why does your company do multi-storey residential projects (low, medium and high cost)?

The results of Q13 and Q14 are collected in texts. Q13 recorded what vision and mission statements of the company of developer are, while Q14 recorded why the company does multi-storey residential buildings for low cost, medium cost and high cost types. The data provided background information for study of the relationship between two variables and for support to results of analysis. The Q17 is referred to as below. The results are shown in the following Figure 4.3 that there is a simple relationship between the two variables.

	Ranking of Importance		
	High Cost	Medium Cost	Low Cost
Aesthetics/Art	4	3	4
Function	2	2	2
Social-culture	5	4	3
Cost	6	6	1
Sustainable	3	5	5
Site context	1	1	7
Feng Shui	7	7	6

Figure 4.3 Simple Relationship between Market Price and Design Criteria

4.3.3.2a Results of Correlation Analysis

The general results of correlation analysis for Q34 to Q 75 are shown in Table 4.8 for all seven dependent variables (DV). The results were analyzed for each individual DV_{1-7}.

Table 4.8 Correlation between Design Criteria and Market Price

	N	Pearson Correlation	Sig. (2-tailed)
Site Context	6	.98**	.00
Aesthetics/Art	6	.96**	.00
Function	6	.97**	00
Sustainability	6	.96**	00
Cost	6	-.65	.15
Socio-Culture	6	.96**	00
Feng Shui	6	.93**	00

**. Correlation is significant at the 0.01 level (2-tailed).

DV_1 - Correlation between Price and Site Context

For correlation analysis, Q34, Q35, Q36, Q37, Q38 and Q39 were analyzed as follows:

Results of correlation for Q35 and Q36 were shown in Table 4.8 and Figure 4.4.

Descriptive Statistics

	Mean	Std. Deviation	N
Price	3.500	1.870	6
Site Context	3.166	1.471	6

Correlations

		Price	Site Context
Price	Pearson Correlation	1	.980**
	Sig. (2-tailed)		.000
	N	6	6
Site Context	Pearson Correlation	.980**	1
	Sig. (2-tailed)	.000	
	N	6	6

**. Correlation is significant at the 0.01 level (2-tailed).

Figure 4.4 Correlation between market price and site context

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Briefly the results of correlations are described as follows:

The 1ST row shows Pearson correlation coefficients $r = 0.98$, where $-1.0 < r < +1.0$.

The further away r is from 0, the stronger is the relationship between the 2 variables.

Hence, 0.98 shows an extremely high relationship.

In the next row are computed values of significant level (2-tailed) for testing. In hypothesis testing, we assume the null and alternate hypotheses as follows:

$H1_{0s}$(Null hypothesis): The correlation between price and site context is equal to zero or the difference in the population means of the two events is equal to zero (no significant values). Hence,

$H1_{0s}$: $p = 0$ is where p is the correlation between the two variables.

$H1_{as}$(Alternate hypothesis): The correlation between the market price and design criterion site context is not equal to zero or the difference in the population means of the two events are not equal to zero (significant values). Hence,

$H1_{as}$: $p < 0$ is where p is the correlation between the two variables.

The 2ND row shows sig. (2-tailed) of p at 0.00. In hypothesis testing, it is based on probabilities at $p < 0.05$ to reject null hypothesis, and confidence level at 95 % for the decision. In summary:

➤ The correlation between the market price and site context is positive and significant with $r = 0.98$ and $p < 0.05$.

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Results of the related questions Q34, Q37, Q38 and Q39 are as follows:

➢ In Q34, it obtained 'yes' response for medium cost and high cost buildings, but 'no' response for low cost buildings. Such rating scale groups the attitude of the respondents towards the variable in a mutually exclusive and collectively exhaustive manner. The developer explained about cost saving in time, design and construction for landscaping and site planning. The developer said that even before development they would lose on average fifteen thousand dollars for completion of every low cost dwelling unit. Hence they were very careful with cost plan on site context for development, design and construction of low cost buildings.

➢ In Q37, it obtained 'why' respondents had decided on ranking of importance for site context towards market price range for low cost buildings, medium cost buildings and high cost buildings. The developer explained. First the design criterion of site context should meet business objectives of the company in which one of the main objectives being profitability. Thus by applying it should bring income more than expenditure so that business is sustainable and viable for the growth and development of the company. Second the profitability once being achieved, the developer could proceed to work on other objectives such as branding for the company and reinvesting into the communities as well as its organization and staff. Third the business objectives should commensurate with philosophy of the company.

➢ In Q38, it obtained 'how' respondent had decided on ranking of importance for site context towards market price range for low cost buildings, medium cost buildings and high cost buildings. The developer explained some approaches or ways to achieve its objectives. Site context is important for medium cost and high cost residences especially

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the latter. In developing site context, developer applies site planning and landscaping such as ecological parks and organic gardens. To achieve the results, the developer would seek or 'pitch' outstanding design professionals from the local as well as overseas. Developer conducts design competitions. Developer develops innovative concepts of currency and relevance such as "building sustainable communities for all", and providing for tenants who can 'live, learn, work, and play' in creative and inspiring residential environments. The developer has focused on developing innovative solutions for long-term value, and won awards such as the Edge Malaysia Top Property Developers Awards 2011, and FIABCI Prix d' Excellence Awards 2011. Besides, developer has also won award for being best employer from Aon Hewitt Best Employers, 2011 (Malaysia) Best overall employer and 2011 Asia Pacific.

DV$_2$ - Correlation between Price and Aesthetics

For correlation analysis, Q40, Q41, Q42, Q43, Q44 and Q45 were analyzed as follows: Results of correlation analysis for Q41 and Q42 were shown in Table 4.8 and Figure 4.5.

Descriptive Statistics

	Mean	Std. Deviation	N
Price	3.500	1.870	6
Aesthetics of Art	2.833	1.602	6

Correlations

		Price	Aesthetics/Art
Price	Pearson Correlation	1	.960**
	Sig. (2-tailed)		.000
	N	6	6
Aesthetics/Art	Pearson Correlation	.960**	1
	Sig. (2-tailed)	.000	
	N	6	6

**. Correlation is significant at the 0.01 level (2-tailed).

Figure 4.5 Correlation between aesthetics of art and market price

Briefly the results are described as follows:

The 1ST row shows Pearson correlation coefficients r = 0.96, where $-1.0 < r < +1.0$. The further away r is from 0, the stronger is the relationship between the 2 variables. Hence, 0.96 shows an extremely high relationship.

In the next row are computed values of significant level (2-tailed) for testing. In hypothesis testing, it assumed that the null and alternate hypotheses as follows:

$H2_{0a}$(Null hypothesis): The correlation between market price and aesthetics is equal to zero or the difference in the population means of the two events is equal to zero (no significant values). Hence,

   $H2_{0a}$: $p = 0$ is where p is the correlation between the two variables.

$H2_{aa}$(Alternate hypothesis): The correlation between the market price and aesthetics is not equal to zero or the difference in the population means of the two events is not equal to zero (significant values). Hence,

   $H2_{aa}$: $p < 0$ is where p is the correlation between the two variables.

The 2ND row shows sig. (2-tailed) and the probabilities are at 0.00. In hypothesis testing, it assumes probabilities < 0.05 to reject the null hypothesis, and confidence level is 95 % for the decision. In summary:

➢ The results of correlation between the market price and aesthetics are positive and significant with r = 0.96 and $p < 0.05$.

Results of related Q40, Q43, Q44 and Q45 are as follows:

➢ In Q40, it obtained 'yes' response for medium cost and high cost buildings, but 'no' response for low cost buildings. Such rating scale groups the attitude of the respondents towards the variable in a mutually exclusive and collectively exhaustive manner. The developer explained about cost saving in time, design and construction for landscaping and site planning. The developer said that even before development they would lose on average fifteen thousand dollars for completion of every low cost dwelling unit. Hence they were very careful with cost plan on site context for development, design and construction of low cost buildings.

➢ In Q43, it obtained 'why' respondents had decided on ranking of importance for site context towards market price range for low cost buildings, medium cost buildings and high cost buildings. The developer explained. First the design criterion of site context should meet business objectives of the company in which one of the main objectives being profitability. Thus by applying it should bring income more than expenditure so that business is sustainable and viable for the growth and development of the company. Second the profitability once being achieved, the developer could proceed to work on other objectives such as branding for the company and reinvesting into the communities as well as its organization and staff. Third the business objectives should commensurate with philosophy of the company.

In Q44 it obtained 'how' respondent had decided on ranking of importance for site context towards market price range for low cost buildings, medium cost buildings and high cost buildings. The developer explained some approaches or ways to achieve its objectives. Site context is important for medium cost and high cost residences especially the latter. In

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developing site context, developer applies site planning and landscaping such as ecological parks and organic gardens. To achieve the results, the developer would seek or 'pitch' outstanding design professionals from the local as well as overseas. Developer conducts design competitions. Developer develops innovative concepts of currency and relevance such as "building sustainable communities for all", and providing for tenants who can 'live, learn, work, and play' in creative and inspiring residential environments. The developer has focused on developing innovative solutions for long-term value, and won awards such as the Edge Malaysia Top Property Developers Awards 2011, and FIABCI Prix d' Excellence Awards 2011. Besides, developer has also won award for being best employer from Aon Hewitt Best Employers, 2011 (Malaysia) Best overall employer and 2011 Asia Pacific.

DV$_3$ - Correlation between Price and Function

For correlation analysis, response data from Q46, Q47, Q48, Q49, Q50 and Q51 were analyzed as follows:

The results of correlation analysis for Q47 and Q48 are shown in Table 4.8 and Figure 4.6

Descriptive Statistics

	Mean	Std. Deviation	N
Price	3.500	1.870	6
Function	3.333	1.211	6

Correlations

		Price	Function
Price	Pearson Correlation	1	.971**
	Sig. (2-tailed)		.001
	N	6	6
Function	Pearson Correlation	.971**	1
	Sig. (2-tailed)	.001	
	N	6	6

**. Correlation is significant at the 0.01 level (2-tailed).

Figure 4.6 Correlation between market price and function

The results can be expressed as follows:

The 1ST row shows Pearson correlation coefficients r = 0.97, where -1.0 < r < +1.0.

The further away r is from 0, the stronger is the relationship between the 2 variables.

Hence, 0.97 shows an extremely high relationship.

In the next row is the significant level (2-tailed) for testing results. In hypothesis testing, it assumed the null and alternate hypotheses as follows:

$H3_{0f}$(Null hypothesis): The correlation between the market price and function is equal to zero or the difference in the population means of the two events is equal to zero (no significant values). Hence,

$\qquad$ $H3_{0f}$: $p = 0$ is where p is the correlation between the two variables.

$H3_{af}$(Alternate hypothesis): The correlation between the market price and function is not equal to zero or the difference in the population means of the two events is not equal to zero (significant values). Hence,

$\qquad$ $H3_{af}$: $p < 0$ is where p is the correlation between the two variables.

The 2ND row shows sig. (2-tailed) and the probabilities are at 0.00. In hypothesis testing, we assume probabilities < 0.05 to reject the null hypothesis, and confidence level is 95 % for the decision. In summary,

➢ The results of correlation between the market price and function are positive and significant with r = 0.97 and p < 0.05.

➢ The results of the related Q46, Q49, Q50 and Q51are quite similar to that of DV_{1-2}

DV$_4$ - Correlation between Price and Sustainability

For correlation analysis, Q52, Q53, Q54, Q55, Q56 and Q57 were analyzed as follows:

The results of correlation analysis for Q53 and Q54 are shown in Table 4.8 and Figure 4.7

Descriptive Statistics

	Mean	Std. Deviation	N
Price	3.500	1.870	6
Sustainability	2.833	1.602	6

Correlations

		Price	Sustainability
Price	Pearson Correlation	1	.968**
	Sig. (2-tailed)		.000
	N	6	6
Sustainability	Pearson Correlation	.968**	1
	Sig. (2-tailed)	.000	
	N	6	6

**. Correlation is significant at the 0.01 level (2-tailed).
Figure 4.7 Correlation between market price and sustainability

Briefly the results can be expressed as follows:

The 1STrow shows Pearson correlation coefficients r = 0.96, where -1.0 < r < +1.0. The further away r is from 0, the stronger is the relationship between the 2 variables. Hence, 0.96 shows an extremely high relationship.

In the next row is the significant level (2-tailed) for testing results. In hypothesis testing, it assumed the null and alternate hypotheses as follows:

H4$_{0s}$(Null hypothesis): The correlation between the market price and sustainability is equal to zero or the difference in the population means of the two events is equal to zero (no significant values). Hence,

H4$_{0s}$: $p = 0$ is where p is the correlation between the two variables.

H4$_{as}$(Alternate hypothesis): The correlation between the market price and sustainability is not equal to zero or the difference in the population means of the two events is not equal to zero (significant values). Hence,

H4$_{as}$: $p < 0$ is where p is the correlation between the two variables.

The 2ND row shows sig. (2-tailed) and the probabilities are at 0.00. In hypothesis testing, it assumes probabilities < 0.05 to reject the null hypothesis, and confidence level is 95 % for the decision.

➢ In summary, the correlation between the market price and sustainability is positive and significant with r = 0.96 and p < 0.05.

Results of the Q52, Q55, Q56 and Q57 were as follows:

➢ In Q52 it obtained 'yes' response for high cost buildings, 'yes' response for medium cost buildings and 'yes' or 'no' response for low cost buildings. The developer explained that sustainable building design increases cost of construction and hence profitability. However developer is keen and open to explore sustainable design for the high medium cost and high cost buildings.

➢ In Q55 it 'why' respondents had decided on ranking of importance for site context towards market price range for low cost buildings, medium cost buildings and high cost buildings. The developer explained. First the design criterion of sustainability should meet business objectives of the company in which one of the main objectives being profitability. Thus by applying it should bring income more than expenditure so that business is sustainable and viable for the growth and development of the company.

Second the profitability once being achieved, the developer could proceed to work on other objectives such as branding for the company and reinvesting into the communities as well as its organization and staff. Third the business objectives should commensurate with philosophy of the company.

➢ In Q56 it obtained 'how' respondent had decided on ranking of importance for sustainability towards market price range for low cost buildings, medium cost buildings and high cost buildings. The developer explained some approaches or ways to achieve its objectives. sustainability is important for medium cost and high cost residences especially the latter. In developing sustainability, developer applies site planning and landscaping such as ecological parks and organic gardens. To achieve the results, the developer would seek or 'pitch' outstanding design professionals from the local as well as overseas. Developer conducts design competitions. Developer develops innovative concepts of currency and relevance such as "building sustainable communities for all", and providing for tenants who can 'live, learn, work, and play' in creative and inspiring residential environments. The developer has focused on developing innovative solutions for long-term value, and won awards such as the Edge Malaysia Top Property Developers Awards 2011, and FIABCI Prix d' Excellence Awards 2011. Besides, developer has also won award for being best employer from Aon Hewitt Best Employers, 2011 (Malaysia) Best overall employer and 2011 Asia Pacific.

DV$_5$ – Correlation between Price and Cost

For correlation analysis, Q58, Q59, Q60, Q61, Q62 and Q63 were analyzed as follows:

Results of correlation analysis for Q59 and Q60 are shown in Table 4.8 and Figure 4.8.

Descriptive Statistics

	Mean	Std. Deviation	N
Price	3.500	1.870	6
Cost	4.833	.408	6

Correlations

		Price	Cost
Price	Pearson Correlation	1	-.655
	Sig. (2-tailed)		.158
	N	6	6
Cost	Pearson Correlation	-.655	1
	Sig. (2-tailed)	.158	
	N	6	6

Figure 4.8 Correlation between market price and cost

Briefly the results can be expressed as follows:

The 1ST row shows Pearson correlation coefficients r = -0.65, where $-1.0 < r < +1.0$.

The further away r is from 0, the stronger is the relationship between the 2 variables.

Hence, -.65 shows a null relationship.

In the next row there is the significant level (2-tailed) for testing. In hypothesis testing, it assumed the null and alternate hypotheses as follows:

$H5_{0c}$(Null hypothesis): The correlation between the market price and cost is equal to zero or the difference in the population means of the two events is equal to zero (no significant values). Hence,

$H5_{0c}$: $p = 0$ is where p is the correlation between the two variables.

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H5$_{ac}$(Alternate hypothesis): The correlation between the market price and cost is not equal to zero or the difference in the population means of the two events is not equal to zero (significant values). Hence,

H5$_{ac}$: $p < 0$ is where p is the correlation between the two variables.

Hence the results are as follows:

The 2ND row shows sig. (2-tailed) and the probabilities are at 0.15

In hypothesis testing, it assumed probabilities < 0.05 to reject the null hypothesis, and confidence level is 95 % for the decision.

➢ In summary, the correlation between the market price and cost is negative and not significant with r = -0.65 and p larger than p< 0.05.

Results of the related Q58, Q61, Q62 and Q63 are as follows:

➢ In Q58 it obtained 'yes' response for the low cost, medium cost and high cost buildings. The developer explained that cost is a critical factor for profitability of a business. Among the three building types, developer works carefully on the cost plan and design of low cost buildings so that they could keep a minimum loss of money. The market price of all low cost units is fixed by the housing ministry and is always lower than construction cost. It is therefore a matter of how much of the loss. In contrast, developer can explore the cost plan and design of medium and high cost buildings with the design criteria. The business of these developments can often generate higher income than expenditure in design and construction.

➢ In Q61 it obtained 'why' respondents had decided on ranking of importance for site context towards market price range for low cost buildings, medium cost buildings and

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high cost buildings. The developer explained. First the design criterion of site context should meet business objectives of the company in which one of the main objectives being profitability. Thus by applying it should bring income more than expenditure so that business is sustainable and viable for the growth and development of the company. Second the profitability once being achieved, the developer could proceed to work on other objectives such as branding for the company and reinvesting into the communities as well as its organization and staff. Third the business objectives should commensurate with philosophy of the company.

➢ In Q62 it obtained 'how' respondent had decided on ranking of importance for site context towards market price range for low cost buildings, medium cost buildings and high cost buildings. The developer explained some approaches or ways to achieve its objectives. Site context is important for medium cost and high cost residences especially the latter. In developing site context, developer applies site planning and landscaping such as ecological parks and organic gardens. To achieve the results, the developer would seek or 'pitch' outstanding design professionals from the local as well as overseas. Developer conducts design competitions. Developer develops innovative concepts of currency and relevance such as "building sustainable communities for all", and providing for tenants who can 'live, learn, work, and play' in creative and inspiring residential environments. The developer has focused on developing innovative solutions for long-term value, and won awards such as the Edge Malaysia Top Property Developers Awards 2011, and FIABCI Prix d' Excellence Awards 2011. Besides, developer has also won award for being best employer from Aon Hewitt Best Employers, 2011 (Malaysia) Best overall employer and 2011 Asia Pacific.

DV$_6$ - Correlation Analysis between the Market Price and Socio-culture

For correlation analysis, Q64, Q65, Q66, Q67, Q68 and Q69 were analyzed as follows:

Results of correlation analysis for Q41 and Q42 are shown in Table 4.8 and Figure 4.9 as follows:

Descriptive Statistics

	Mean	Std. Deviation	N
Price	3.500	1.870	6
Socio-culture	3.166	1.169	6

Correlations

		Price	Socio-culture
Price	Pearson Correlation	1	.960[**]
	Sig. (2-tailed)		.002
	N	6	6
Socio-culture	Pearson Correlation	.960[**]	1
	Sig. (2-tailed)	.002	
	N	6	6

**. Correlation is significant at the 0.01 level (2-tailed).

Figure 4.9 Correlation between market price and socio-culture

The results are explained as follows:

The 1STrow shows Pearson correlation coefficients r = 0.96, where -1.0 < r < +1.0.

The further away r is from 0, the stronger is the relationship between the 2 variables. Hence, 0.96 shows an extremely high relationship.

In the next row is the significant level (2-tailed) for testing. In hypothesis testing, it assumed the null and alternate hypotheses as follows:

H6$_{0a}$(Null hypothesis): The correlation between the market price and socio-culture is equal to zero or the difference in the population means of the two events is equal to zero (no significant values). Hence,

H6$_{0a}$: $p = 0$ is where p is the correlation between the two variables.

H6$_{aa}$(Alternate hypothesis): The correlation between the market price and socio-culture is not equal to zero or the difference in the population means of the two events is not equal to zero (significant values). Hence,

H6$_{aa}$: $p < 0$ is where p is the correlation between the two variables.

Hence the results are as follows:

The 2ND row shows sig. (2-tailed) and the probabilities are at 0.00.

In hypothesis testing, it assumed probabilities < 0.05 to reject the null hypothesis, and confidence level is 95 % for the decision.

➢ In summary, the correlation between the market price and Socio-culture is positive and significant with r $= 0.96$ and p < 0.05.

Results of the related Q64, Q67, Q68 and Q69 are as follows

In Q64 it obtained a 'yes' response for medium cost buildings and a 'yes' response for high cost buildings, but a 'yes' and 'no' response for low cost buildings. The developer explained that socio-culture design increases cost of construction and hence profitability.

➢ In Q67 it obtained 'why' respondents had decided on ranking of importance for socio-culture towards market price range for low cost buildings, medium cost buildings and high cost buildings. The developer explained. First the design criterion of socio-culture should meet business objectives of the company in which one of the main objectives being profitability. Thus by applying it should bring income more than expenditure so that business is sustainable and viable for the growth and development of the company. Second the profitability once being achieved, the developer could proceed to work on other objectives such as branding for

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the company and reinvesting into the communities as well as its organization and staff. Third the business objectives should commensurate with philosophy of the company.

➢ In Q68 it obtained 'how' respondent had decided on ranking of importance for socio-culture towards market price range for low cost buildings, medium cost buildings and high cost buildings. The developer explained some approaches or ways to achieve its objectives. Socio-culture is important for low cost, medium cost and high cost residences especially the latter. In developing socio-culture, developer applies ecological parks and organic gardens for people and the community. Developer develops innovative concepts such as "building sustainable communities for all", and providing for tenants who can 'live, learn, work, and play' in creative and inspiring residential environments.

Results of the related Q64, Q67, Q68 and Q69 are as follows

In Q64 it obtained a 'yes' response for medium cost buildings and a 'yes' response for high cost buildings, but a 'yes' and 'no' response for low cost buildings. The developer explained that socio-culture design increases cost of construction and hence profitability.

➢ In Q67 it obtained 'why' respondents had decided on ranking of importance for socio-culture towards market price range for low cost buildings, medium cost buildings and high cost buildings. The developer explained. First the design criterion of socio-culture should meet business objectives of the company in which one of the main objectives being profitability. Thus by applying it should bring income more than expenditure so that business is sustainable and viable for the growth and development of the company. Second the profitability once being achieved, the developer could proceed to work on other objectives such as branding for the company and reinvesting into the communities as well as its organization and staff. Third the business objectives should commensurate with philosophy of the company.

➤ In Q68 it obtained 'how' respondent had decided on ranking of importance for socio-culture towards market price range for low cost buildings, medium cost buildings and high cost buildings. The developer explained some approaches or ways to achieve its objectives. Socio-culture is important for low cost, medium cost and high cost residences especially the latter. In developing socio-culture, developer applies ecological parks and organic gardens for people and the community. Developer develops innovative concepts such as "building sustainable communities for all", and providing for tenants who can 'live, learn, work, and play' in creative and inspiring residential environments.

DV$_7$ - Correlation between Price and Feng Shui

For correlation analysis, Q70, Q71, Q72, Q73, Q74 and Q75 were analyzed as follows:

Results of the correlation analysis of Q71 and Q72 are shown in Table 4.8 and Figure 4.10.

Descriptive Statistics

	Mean	Std. Deviation	N
Price	3.500	1.870	6
Feng Shui	2.666	1.366	6

Correlations

		Price	Feng Shui
Price	Pearson Correlation	1	.939**
	Sig. (2-tailed)		.005
	N	6	6
Feng Shui	Pearson Correlation	.939**	1
	Sig. (2-tailed)	.005	
	N	6	6

**. Correlation is significant at the 0.01 level (2-tailed).

Figure 4.10 Correlation between market price and Feng Shui

The results of correlation analysis are described as follows:

The 1ST row shows Pearson correlation coefficients r = 0.93, where -1.0 < r < +1.0.

The further away r is from 0, the stronger is the relationship between the 2 variables.

Hence, 0.93 shows a high relationship.

In the next row are computed values of significant level (2-tailed) for testing. In hypothesis testing, it assumed the null and alternate hypotheses as follows:

H7$_{0f}$(Null hypothesis): The correlation between the market price and Feng Shui is equal to zero or the difference in the population means of the two events is equal to zero (no significant values). Hence,

H7$_{0f}$: $p = 0$ is where p is the correlation between the two variables.

H7$_{af}$(Alternate hypothesis): The correlation between the market price and Feng Shui is not equal to zero or the difference in the population means of the two events is not equal to zero (no significant values). Hence,

H7$_{af}$: $p < 0$ is where p is the correlation between the two variables.

Hence the results are as follows:

The 2ND row shows sig. (2-tailed) and the probabilities are at 0.00.

In hypothesis testing, it assumed probabilities < 0.05 to reject the null hypothesis, and confidence level is 95 % for the decision.

➢ In summary, the correlation between the market price and Feng Shui is positive and significant with r = 0.93 and p < 0.05.

Results of the related Q70, Q73, Q74 and Q75 are as follows:

➢ In Q70, it obtained a 'yes' response for medium cost buildings and a 'yes' response for high cost buildings, but a 'yes' and 'no' response for low cost buildings. The developer explained that Feng Shui design increase cost of construction and hence profitability

➢ In Q73, it obtained 'why' respondents had decided on ranking of importance for Feng Shui towards market price range for low cost buildings, medium cost buildings and high cost buildings. The developer explained. First the design criterion of Feng Shui should meet business objectives of the company in which one of the main objectives being profitability. Thus by applying it should bring income more than expenditure so that business is sustainable and viable for the growth and development of the company. Second the profitability once being achieved, the developer could proceed to work on other objectives such as branding for the company and reinvesting into the communities as well as its organization and staff. Third the business objectives should commensurate with philosophy of the company.

➢ In Q74 it obtained 'how' respondent had decided on ranking of importance for Feng Shui towards market price range for low cost buildings, medium cost buildings and high cost buildings. The developer explained some approaches or ways to achieve its objectives. Site context is important for medium cost and high cost residences especially the latter. In developing site context, developer applies site planning and landscaping such as ecological parks and organic gardens. To achieve the results, the developer would seek or 'pitch' outstanding design professionals from the local as well as overseas. Developer conducts design competitions. Developer develops innovative concepts of currency and relevance such as "building sustainable communities for all", and providing for tenants who can 'live, learn, work, and play' in creative and inspiring residential environments.

4.3.3.2b Results of Regression Analysis

The results of regression analysis for Q34 to Q75 are shown in Figure 4.11 for all seven

dependent variables (DV_{1-7}).
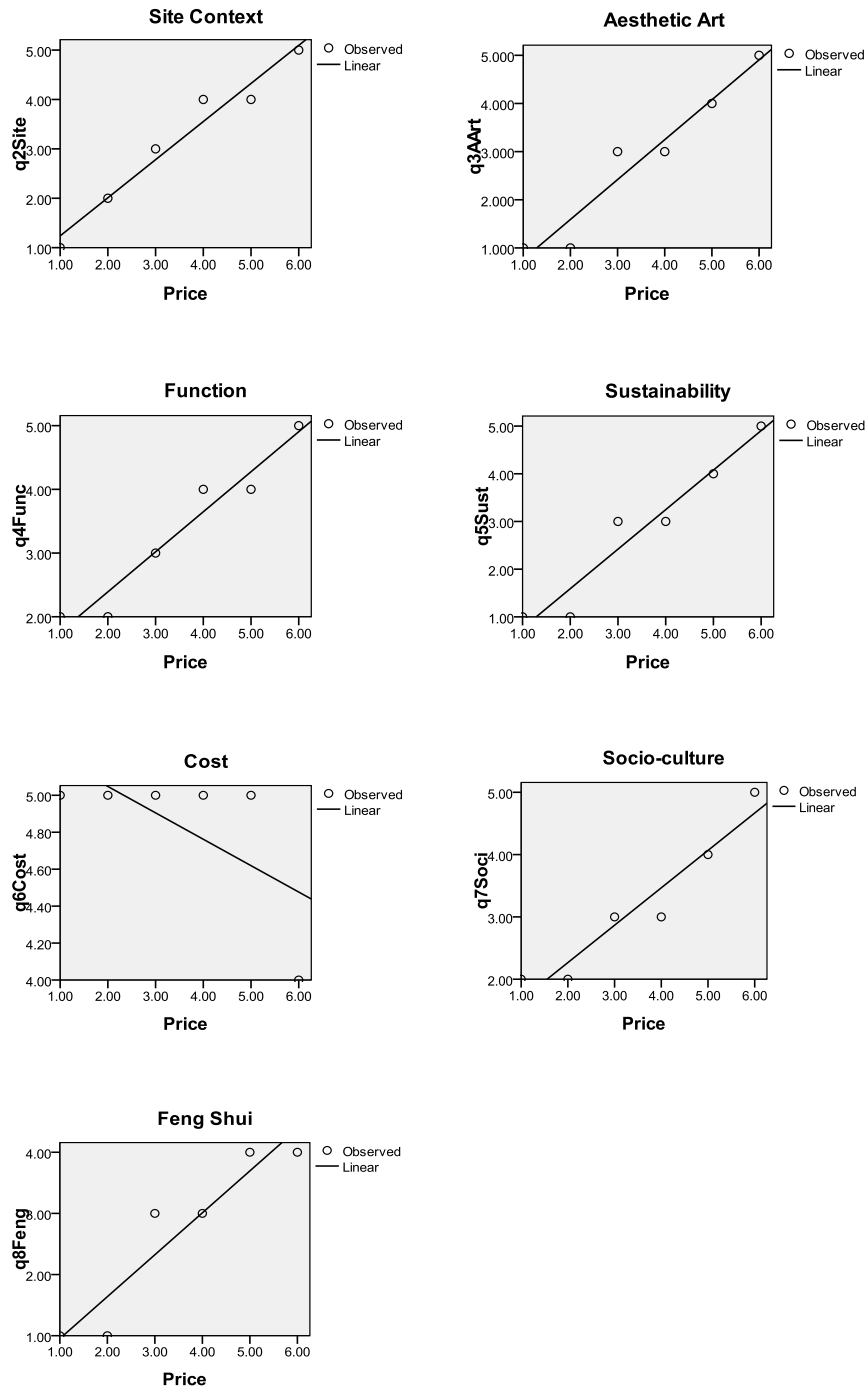
Figure 4.11 Regression Pattern between Design Criteria and Market Price

DV₁ᵣₛₚ - Regression between Price and Site Context

The results of the analysis of regression are shown in Figure 4.12 as follows:

Coefficients

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Price	.771	.077	.980	9.970	.001
(Constant)	.467	.301		1.549	.196
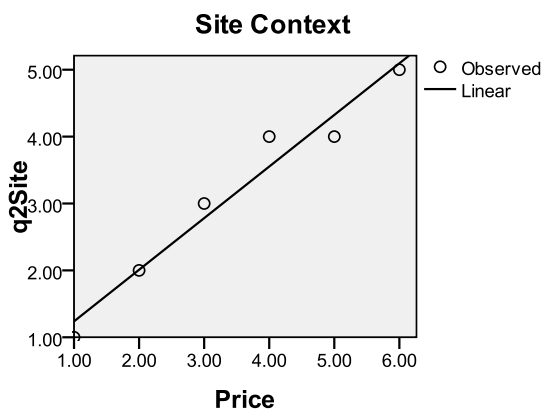
Figure 4.12 Regression Pattern between Market Price and Site Context

The results generally confirm a straight line or simple regression pattern between the two variables in coefficients table and scatter diagram, as presented in Figure 4.12

The scatter diagram indicates a linear relationship between the two variables (price and criterion) by a regression line. This straight line passes through the data points that minimize the sum of squared vertical differences (referred to as 'e' error factor) between the line and the sample points. This linear regression line or $y = \beta x + c + e$ can be used to predict one variable when values of the other are given. This enables to estimate a straight line pattern of the causal relationship between market price and site context, and show that site context (the

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dependent variable) is influenced by market price (the independent variable) as defined in the reflective model.

The coefficients table shows several important computed values of the simple regression for the bivariate relationship. To predict the y-value for given x-values, the regression coefficients of B of unstandardized coefficients are applied to substitute 0.77 for β, and 0.46 for c in the regression line $y = \beta x + c$. The standard coefficients, or Beta values, are useful for reading independent variable as a cause for the variation in the dependent variable. Lastly it is the values of Sig. for the computed level of significance or the p-value. The p-value of this bivariate relationship is 0.00, indicating the relationship is very strong.

DV$_{2R}$ - Regression Analysis between the Market Price and Aesthetics

The results of the analysis of regression are shown in Figure 4.13 as follows:

Coefficients

	Unstandardized Coeffs		Standardized Coeffs			
	B	Std. Error	Beta		t	Sig.
Price	.829	.108	.968		7.660	.002
(Constant)	-.067	.421			-.158	.882

Figure 4.13 Regression Pattern between Market Price and Aesthetics

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The results generally confirm a straight line or simple regression between the two variables in coefficients table and scatter diagram, as presented in Figure 4.13.

The scatter diagram indicates a linear relationship between the two variables (price and criterion) by a regression line. This straight line passes through the data points that minimize the sum of squared vertical differences (referred to as 'e' error factor) between the line and the sample points. This linear regression line or $y = \beta x + c + e$ can be used to predict one variable when values of the other are given. This enables to estimate a straight line pattern of the causal relationship between market price and site context, and show that aesthetics (the dependent variable) is influenced by market price (the independent variable) as defined in the reflective model.

The coefficients table shows several important computed values of the simple regression for the bivariate relationship. To predict the y-value for given x-values, the regression coefficients of B of unstandardized coefficients are applied to substitute 0.82 for β, and -0.06 for c in the regression line $y = \beta x + c$. The standard coefficients, or Beta values, are useful for reading independent variable as a cause for the variation in the dependent variables. Lastly it is the values of Sig. for the computed level of significance or the p-value. The p-value of this bivariate relationship is 0.00, indicating the relationship is strong.

The results of the analysis of regression are shown in Figure 4.14 as follows:

Coefficients

|	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
Price	.629	.077	.971	8.124	.001
(Constant)	1.133	.301		3.761	.020
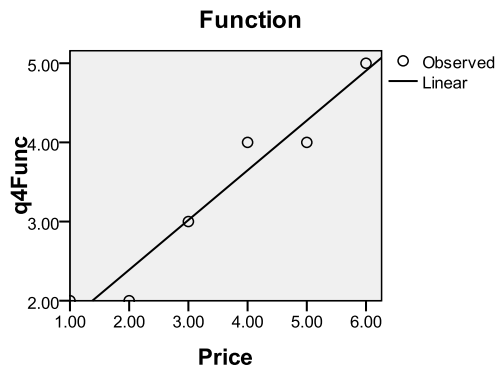
Figure 4.14 Regression Pattern between Market Price and Function

The results generally confirmed a straight line or simple regression between the two variables in coefficients table and scatter diagram, as presented in Figure 4.14.

The scatter diagram indicated a linear relationship between the two variables (price and criterion) by a regression line. This straight line passes through the data points that minimize the sum of squared vertical differences (referred to as 'e' error factor) between the line and the sample points. This linear regression line or $y = \beta x + c + e$ can be used to predict one variable when values of the other are given. This enables to estimate a straight line pattern of the causal relationship between market price and aesthetics, and show that aesthetics (the dependent variable) is influenced by market price (the independent variable) as defined in the reflective model.

The coefficients table shows several important computed values of the simple regression for the bivariate relationship. To predict the y-value for given x-values, the regression coefficients of B of unstandardized coefficients are applied to substitute 0.62 for β, and 1.13for c in the regression line y = βx + c. The standard coefficients, or Betas, are useful for reading independent variables as a cause to explaining the variation in the dependent variables. Lastly it is the values of Sig. for the computed level of significance or the p-value. The p-value of this bivariate relationship is 0.00, indicating the relationship is strong.

DV$_{4R}$- Regression Analysis between the Market Price and Sustainability

The results of the analysis of regression are shown in Figure 4.15 as follows:

Coefficients

	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
Price	.829	.108	.968	7.660	.002
(Constant)	-.067	.421		-.158	.882
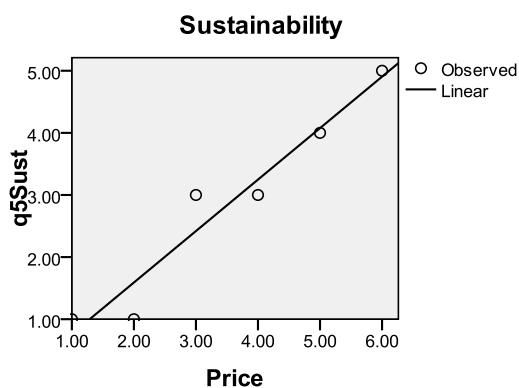
Figure 4.15 Regression between Market Price and Sustainability

The results generally confirm a straight line or simple regression between the two variables in coefficients table and scatter diagram, as presented in Figure 4.15.

The scatter diagram indicates a linear relationship between the two variables (price and criterion) by a regression line. This straight line passes through the data points that minimize the sum of squared vertical differences (referred to as 'e' error factor) between the line and the sample points. This linear regression line or $y = \beta x + c + e$ can be used to predict one variable when values of the other are given. This enables to estimate a straight line pattern of the causal relationship between market price and sustainability, and show that sustainability (the dependent variable) is influenced by market price (the independent variable) as defined in the reflective model.

The coefficients table shows several important computed values of the simple regression for the bivariate relationship. To predict the y-value for given x-values, the regression coefficients of B of unstandardized coefficients are applied to substitute 0.82 for β, and -0.06 for c in the regression line $y = \beta x + c$. The standard coefficients, or Betas, are useful for reading independent variables as a cause for the variation in the dependent variables. Lastly it is the values of Sig. This is the computed level of significance or the p-value. The p-value of this bivariate relationship is 0.00, indicating the relationship is strong.

DV$_{5R}$- Regression Analysis between the Market Price and Cost

The results of the analysis of regression are shown in Figure 4.16 as follows:

Coefficients

	Unstandardized Coefficients		Standardized Coefficients		t	Sig.
	B	Std. Error	Beta			
Price	-.143	.082	-.655		-1.732	.158
(Constant)	5.333	.321			16.604	.000
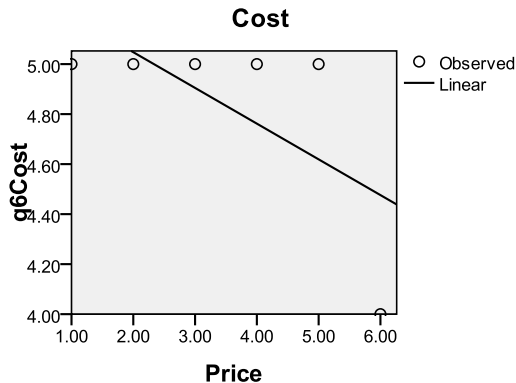
Figure 4.16 Regression between Market Price and Cost

The results generally confirm that there was no scatter diagram of the data points as presented in Figure 4.16. The diagram does not indicate a linear relationship between the two variables (price and criterion) by a regression line. Actually there is no straight line passing through the data points that minimize the sum of squared vertical differences (referred to as 'e' error factor) between the line and the sample points. In this case there was no pattern of straight line causal relationship between market price and cost.

The regression coefficients and standardized coefficients indicate that there is no regression. Lastly it is the values of Sig. for the computed level of significance or the p-value. The p-value of this bivariate relationship is 0.158 higher than 0.05, indicating the relationship is null.

DV$_{6R}$- Regression Analysis between the Market Price and Socio-culture

The results of the analysis of regression are shown in Figure 4.17 as follows:

Coefficients

|	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
Price	.600	.087	.960	6.874	.002
(Constant)	1.067	.340		3.138	.035
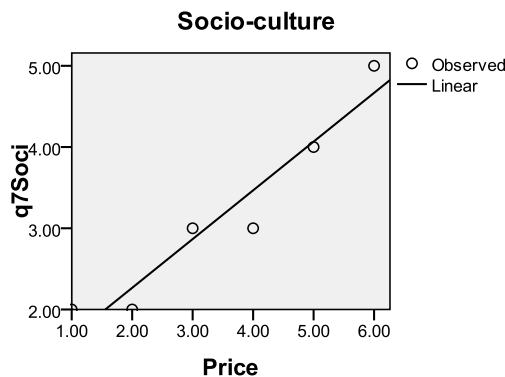
Figure 4.17Regression between Market Price and Socio-culture

The results generally confirm a straight line or simple regression by values in coefficients table and a scatter diagram, as presented in Figure 5.21.

The scatter diagram indicates a linear relationship between the two variables (price and criterion) by a regression line. This straight line passes through the data points that minimize the sum of squared vertical differences (referred to as 'e' error factor) between the line and the sample points. This linear regression line or $y = \beta x + c + e$ can be used to predict one variable when values of the other are given. This enables to estimate a straight line pattern of causal relationship between market price and socio-culture, and show that socio-culture (the dependent variable) is influenced by market price (the independent variable) as defined in the reflective model.

The coefficients table shows several important computed values of the simple regression for the bivariate relationship. To predict the y-value for given x-values, the regression coefficients of B of unstandardized coefficients are applied to substitute 0.60 for β, and 1.06for c in the regression line y = βx + c. The standard coefficients, or Betas, are useful for reading independent variable as a cause for the variation in the dependent variable. Lastly it is the values of Sig. for the computed level of significance or the p-value. The p-value of this bivariate relationship is 0.00, indicating the relationship is strong.

DV$_{7R}$- Regression Analysis between the Market Price and Feng Shui

The results of the analysis of regression are shown in Figure 4.18 as follows:

Coefficients

	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
Price	.686	.126	.939	5.458	.005
(Constant)	.267	.489		.545	.615
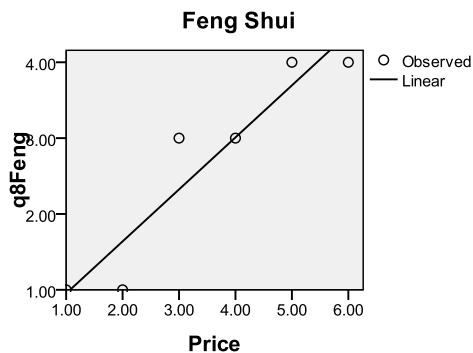
Figure 4.18 Regression between Market Price and Feng Shui

The results generally confirm a straight line or simple regression by values in coefficients table and a scatter diagram, as presented in Figure 4.18.

The scatter diagram indicates a linear relationship between the two variables (price and criterion) by a regression line. This straight line passes through the data points that minimize the sum of squared vertical differences (referred to as 'e' error factor) between the line and the sample points. This linear regression line or $y = \beta x + c + e$ can be used to predict one variable when values of the other are given. This enables to estimate a straight line pattern of the causal relationship between market price and Feng Shui, and show that Feng Shui (the dependent variable) is influenced by market price (the independent variable) as defined in the reflective model for causal measurement.

The coefficients table shows several important computed values of the simple regression for the bivariate relationship. To predict the y-value for given x-values, the regression coefficients of B of unstandardized coefficients are applied to substitute 0.68 for β, and 0.26 for c in the regression line $y = \beta x + c$. The standard coefficients, or Betas, are useful for reading independent variable as a cause for the variation in the dependent variable. Lastly it is the values of Sig. This is the computed level of significance or the p-value. The p-value of this bivariate relationship is 0.00, indicating the relationship is very strong

4.3.3.3 Results of Pattern Study for Design Brief

For study of observed pattern, Q13, Q14, Q15, Q18, Q19, Q20, Q21, Q26, Q27, Q28 and Q29 were analyzed. All eleven questions were referred to except Q13 and Q14 that were analysed and presented in preceding section.

In the analysis, an observed pattern was identified on how design brief was worked out by developer for development in design of multi-storey residential buildings. The developer generally led, worked out the design brief and consulted the architect when required. The

developer directed the architect appointed on what were required for the development and for project design, and in particular the cost plan and business profitability.

Through observations and interview questionnaires, this observed pattern was identified on how the developer led and worked out a design brief. First the developer as client employed architect as agent under the agency agreement from questions Q26 to Q29. The developer directed and led the working team. The architect was obliged to take instructions from the client, to do what the client needed or wanted, and to serve the master who paid them. Second the client ascertained that the design projects by architects should meet the business objectives of the company (Q13, Q14, Q15, Q18 to Q20, and Q26 to Q28). To meet these objectives, the client led the design brief to ensure a good cost plan and profitability from development of the design projects. Besides, the client always aimed for quality, cost and time in all development design projects, and thus the client wanted efficiency and productivity. All these were vital for running the developers' organizations and making branding of the company.

The developer regards design brief for any project as a very important document of their business plans. It covers the scope of design services with feasibility studies in line with their business goals such as profitability, company philosophy etc. The design brief for a project is a written document of requirements that might be from a single page to a few volume set of documents. For any architectural project, the developer wants to lead and work out the design brief among the architect, users and other related professionals. This is contrary to the architect's conviction of how building ought to be designed. Professionally architects are trained for the jobs in design of buildings, and with practice experience they should be given priority to lead and work out design brief. This would be the expected pattern of professional

services. However the pattern is different in practice of the market today as compared with the traditional market.

Before the industrial revolution, architects appointed by patrons were given almost full freedom to lead design of the buildings and the brief. This pattern or way of architectural practice has a long tradition since the first century BC Vitruvius who wrote and abided by three design conditions: delight, commodity and firmness (Wotton, 1624). The practice of architecture in design as delight continued in the times of Ruskin (Circa 1850), and Ecole des Beaux-Arts in Paris, the most celebrated school of architecture in the nineteen century.

The architectural practice of the market today has changed. The role of architect is questionable as sole designer or leader for the total building process and design brief. The clients lead and want design brief to be focus on the requirements and outcomes of the design and the business objectives of the design project. The brief should specify what the design project has to achieve, by what means and within what timeframe. The design brief is required to be developed through a vigorous process among clients, architects, users and other related professionals. The development of the design brief goes through many meetings and discussions. At the end the design brief should first satisfy the business expectations of developers, then users and architects. This can lead to conflict of intention between clients and architects.

4.3.3.4 Results of Pattern Study for Users' Input

For study of pattern, Q13, Q14, Q16, Q18, Q19, Q20, Q21, Q22, Q23, Q24, and Q25 were analyzed. All eleven questions were referred to except Q13 and Q14 that were analysed and presented in preceding section.

In the analysis, an observed pattern was identified on how users' input to design brief was worked out for development and design of multi-storey residential buildings. For the development of multi-storey residential buildings, there was no direct input of users to the design brief. The developers were the main input. Both the case studies of the developers and the architectural firms had confirmed this pattern by the measurement of dichotomous scale, the ranking importance of users in design, and why and how they were not included. The developers generally led and worked out the design brief on what were required for the development and for project design.

The developers did carry out feasibility studies, and performed indirect input of the users but only for the medium cost and high end residential buildings. The developers conducted the input of the users to the design brief through market surveys by own in house or hired marketing professionals. The developers planned and organized feedback meetings with previous users and buyers or special interest groups from the actual market. These two sources of indirect input of users were significant contribution to success of developers.

The developers organised and invited buyers or tenants of the previous residential projects for project sale presentations of the coming development projects. Feng Shui 'masters' were invited to deliver talks on good Feng Shui about the development. Participants were given and asked to fill in questionnaires. The responses were analysed. Certain relevant results were used for the development and design of medium cost and high end multi-storey residential

buildings. The developers labelled the projects such as apartments, condominium and high class luxurious residences. The developers also organized and invited special interest groups from the actual market.

The purpose of the market survey was to have user input and to achieve a feasible and saleable design for potential house buyers or investors. The developer considered this as a vital activity of business development for their own in house property market professionals.

Developers would provide the architect with this useful information as design brief for design of the buildings. Developers were particularly concerned with the high cost luxurious residences, and used different approach. They pitched top best and award winning architects for the jobs. Besides the sales, clients aim for branding of their companies and winning awards of the best properties such as The Eagle Malaysia Top Property Developers Awards, FIABCI Prix d' Excellence Awards, The CNBC International Property Awards 5-Star Best High Rise Residential Asia-Pacific etc.

Developers commented that they did not conduct any market survey or case studies of low cost residential buildings or flats. As developers, they were obliged and assigned by the housing ministry to build and complete a certain number of low cost housing units according to the NEP. They were given with a number of fixed statutory rules for design of flat dwelling units. The rules were given in accordance to housing standards such as: the market price range from \$35,000.00 to \$42,000.00 pending location or states; the schedule of accommodation; the minimum size of each dwelling unit to be 642 square feet; the number of buyers.

Developers commented that they generally lost about fifteen thousand dollars for construction and completion of each dwelling unit. Under such conditions, developers were highly concerned with design-construction cost, and had worked out effective cost plans to minimise

losses. The price had influenced, actually lowered the design quality. To cur sown cost, some more advanced and 'comprehensive' large developers started early to use instead traditional method but alternative construction methods such as industrial building system (IBS). The IBS provided a better quality and faster construction speed such as completion cycle per floor within seven or five days, thus saving time. Time saving is equivalent to cost saving. In contrast, the smaller and medium developers continued to use tradition construction methods. These methods were based on lesser machines, more labour, timber formworks, and generally wet construction. These developers commented that they could not afford for the high initial capital investment of machineries and the cost of maintenance.

This observed pattern contradict to theory of practice. In theory, for design of buildings, the input of users is a key to the users' requirements for subsequent design development. The architect would initially ask and discuss with users or clients for the requirements such as functionality, site matters, aesthetics of internal environment, façade etc. For multi-storey residential buildings or housing, there are other requirements too such as social-culture, cost, sustainability, engineering and perhaps Feng Shui in the local community.

4.3.4 BRDB

For the respective results, Q13 to Q29, and Q34 to Q75 were analyzed.

4.3.4.1 Results of Preliminary Analysis

For the preliminary results, Q13, Q14 and Q17 were anslyzed.

Q13 recorded what vision and mission statements of the company are, while Q14 recorded why the company does multi-storey residential buildings for low cost, medium cost and high cost types. The data provided background information for study of the relationship between two variables.

The results of the analysis for Q17 for relationship between price and design criteria are shown in Figure 4.19.

	Ranking of Importance		
	High Cost	Medium Cost	Low Cost
Aesthetics	3	3	4
Function	2	1	2
Social-culture	4	4	3
Cost	6	6	1
Sustainable	5	5	5
Site context	1	2	7
Feng Shui	7	7	6

Figure 4.19 Relationship between market price and design criteria

4.3.4.2 Results of Correlation and Regression Analyses

The results of correlation and regression analysis for Q34 to Q75 are shown in Table 4.9 and Figure 4.20 for all seven dependent variables (DV_{1-7}).

In comparing the results of the analysis of BRDB with that of SPSETIA, it was found similar observed patterns of correlation and regression between the market price and design criteria

for the multi-storey residential buildings. The correlation is positive and significant except the cost. The scatter diagram of regression shows a straight line of causal relationship except the cost.

In summary, it was found that the results of correlation and regression patterns for the relationship between market price and design criteria replicate among the developers. It was also found that the observed patterns of correlation and regression patterns in the developers match with the predicted patterns of the hypothetical propositions.

Table 4.9Results of Correlation between Market Price and Design Criteria

	Pearson Correlation	Sig. (2-tailed)
Site Context	.98**	.00
Art	.97**	.00
Function	.97**	00
Sustainability	.93**	00
Cost	-.65	.15
Socio-Culture	.97**	00
Feng Shui	-	-
**. Correlation is significant at the 0.01 level (2-tailed).		

Figure 4.20 Results of Regression between Market Price and Design Criteria

The results of the correlation and regression analyses are interpreted as follows:

DV$_{1br}$ - Correlation and Regression Analysis between Price and Site Context

The correlation is positive and significant with r = 0.98 and p < 0.05. The scatter diagram of regression shows a straight line of causal relationship.

DV$_{2br}$ - Correlation and Regression Analysis between Price and Aesthetics

The correlation is positive and significant with r = 0.97 and p < 0.05. The scatter diagram of regression shows a straight line of causal relationship.

DV$_{3br}$ - Correlation and Regression Analysis between Price and Function

The correlation is positive and significant with r = 0.97 and p < 0.05. The scatter diagram of regression shows a straight line of causal relationship.

DV$_{4br}$ - Correlation and Regression Analysis between Price and Sustainability

The correlation is positive and significant with r = 0.93 and p < 0.05. The scatter diagram of regression shows a straight line of causal relationship.

DV$_{5br}$ - Correlation and Regression Analysis between Price and Cost

There is no correlation with r = -0.65 and p = 0.15. The scatter diagram of regression does not show a straight line of causal relationship.

DV$_{6br}$ - Correlation and Regression Analysis between Price and Socio-culture

The correlation is positive and significant with r = 0.97 and p < 0.05. The scatter diagram of regression shows a straight line of causal relationship.

4.3.4.3 Results of Pattern Study for Design Brief

For study of patterns, Q13, Q14, Q15, Q18, Q19, Q20, Q21, Q26, Q27, Q28 and Q29 were analysed as in 4.3.3.3.

In the analysis, an observed pattern was identified on how design brief was worked out by developer for development in design of multi-storey residential buildings. The developer generally led, worked out the design brief and consulted the architect when required. In consultation, the developer directed the architect appointed to provide on what were required for the development and for project design, and in particular the cost plan and business profitability.

4.3.4.4 Results of Pattern Study for Users' Input

For study of user input pattern, Q13, Q14, Q16, Q18, Q19, Q20, Q21, Q22, Q23, Q24, and Q25 were analyzed as in 4.3.3.4. In the analysis, an observed pattern was found on how users input to design brief being worked out. There was no direct input of users to the design brief. The developers were the main input. The developers conducted the indirect input of the users through market surveys by own in house or hired marketing professionals. The developer planned and organized feedback meetings with previous users and buyers or special interest groups from the actual market.

4.3.5 LION

For the respective results, Q13 to Q29, and Q34 to Q75 were analyzed.

4.3.5.1 Results of Preliminary Analysis

For the preliminary results, Q13, Q14 and Q17 were anslyzed.

Q13 recorded what vision and mission statements of the company are, while Q14 recorded why the company does multi-storey residential buildings for low cost, medium cost and high cost types. The data provided background information for study of the relationship between two variables.

The results of the analysis for Q17 for relationship between price and design criteria are shown in Figure 4.21.

	Ranking of Importance		
	High Cost	Medium Cost	Low Cost
Aesthetics	2	3	5
Function	3	2	2
Social-culture	5	4	3
Cost	6	5	1
Sustainable	4	6	4
Site context	1	1	7
Feng Shui	7	7	6

Figure 4.21 Relationship between market price and design criteria

4.3.4.2 Results of Correlation and Regression

The results of correlation and regression analysis for Q34 to Q75 are shown in Table 4.10 and Figure 4.22 for all seven dependent variables (DV_{1-7}).

In comparing the results of the analysis for LION with that of BRDB and SPSETIA, we observed similar patterns of correlation and regression between the market price and design criteria for the multi-storey residential buildings. The correlation is positive and significant except the cost. The scatter diagram of regression shows a straight line of causal relationship except the cost.

In summary, it was found that the results of correlation and regression patterns for the bivariate relationship between market price and design criteria replicate among the developers. It was also found that the observed patterns of correlation and regression analyses in the developers match with the predicted patterns of the hypothetical propositions.

Table 4.10 Correlation Pattern between Design Criteria and Market Price

	Pearson Correlation	Sig. (2-tailed)
Site Context	.95**	.00
Aesthetics/Art	.95**	.00
Function	.97**	00
Sustainability	.96**	00
Cost	-.65	.15
Socio-Culture	.98**	00
Feng Shui	.96**	00

**. Correlation is significant at the 0.01 level (2-tailed).

Figure 4.22 Results of Regression between Market Price and Design Criteria

The results of the correlation and regression analyses are interpreted as follows:DV_{1LI} -

Correlation and Regression Analysis between Price and Site Context

The correlation is positive and significant with r = 0.95 and p < 0.05. The scatter diagram of regression shows a straight line of causal relationship.

DV$_{2LI}$ - Correlation and Regression Analysis between Price and Aesthetics

The correlation is positive and significant with r = 0.95 and p < 0.05. The scatter diagram of regression shows a straight line of causal relationship.

DV$_{3LI}$ - Correlation and Regression Analysis between Price and Function

The correlation is positive and significant with r = 0.97 and p < 0.05. The scatter diagram of regression shows a straight line of causal relationship.

DV$_{4LI}$ - Correlation and Regression Analysis between Price and Sustainability

The correlation is positive and significant with r = 0.96 and p < 0.05. The scatter diagram of regression shows a straight line of causal relationship.

DV$_{5LI}$ - Correlation and Regression Analysis between Price and Cost

The correlation is not significant with r = -0.65 and p = 0.15. The scatter diagram of regression does not show a straight line of causal relationship.

DV$_{6LI}$ - Correlation and Regression Analysis between Price and Socio-culture

The correlation is positive and significant with r = 0.98 and p < 0.05. The scatter diagram of regression shows a straight line of causal relationship.

DV$_{7LI}$ - Correlation and Regression Analysis between Price and Feng Shui

The correlation is positive and significant with r = 0.96 and p < 0.05. The scatter diagram of regression shows a straight line of causal relationship.

4.3.5.3 Results of Pattern Study for Design Brief

In the analysis, similar results of the observed pattern were identified on how design brief was worked out by developer as described in 4.3.3.3.

4.3.5.4 Results of Pattern Study for Users' Input

In the analysis, similar results of the observed pattern were identified on how user input was worked out by developer as described in 4.3.3.4.

4.3.6 YTL

For the respective results, Q13 to Q29, and Q34 to Q75 were analyzed.

4.3.6.1 Results of Preliminary Analysis

For the preliminary results, Q13, Q14 and Q17 were analyzed. Q13 recorded what vision and mission statements of the company are, while Q14 recorded why the company does multi-storey residential buildings for low cost, medium cost and high cost types. The qualitative response data provide background and context for explaining the results of the analysis.

The results of the analysis for Q17 for relationship between price and design criteria are shown in Figure 4.23.

	Ranking of Importance		
	High Cost	Medium Cost	Low Cost
Aesthetics	3	3	4
Function	2	2	2
Social-culture	5	4	3
Cost	6	5	1
Sustainable	4	6	5
Site context	1	1	6
Feng Shui	-	-	-

Figure 4.23 Relationship between Market price and design criteria

4.4.6.2 Results of Correlation and Regression

The results of correlation and regression analyses of the response data from Q34 to Q75 are shown in Table 4.11 and Figure 4.24 for all seven dependent variables (DV).

In comparing the results of the analysis of YTL with that of LION, BRDB and SPSETIA, it was found similar observed patterns of correlation and regression between the market price and design criteria for the multi-storey residential buildings. The correlation is positive and significant except the cost. The scatter diagram of regression shows a straight line of causal relationship except the cost.

In summary, it was found that the results of correlation and regression patterns for the relationship between market price and design criteria replicate among the developers. It was also found that the observed patterns of correlation and regression patterns in the developers match with the predicted patterns of the hypothetical propositions.

Table 4.11 Correlation Pattern between Design Criteria and Market Price

	N	Pearson Correlation	Sig. (2-tailed)
Site Context		.95**	.00
Aesthetics/Art		.93**	.00
Function		.91**	00
Sustainability		.97**	00
Cost		-.62	.18
Socio-Culture		.92**	00
Feng Shui		-	-

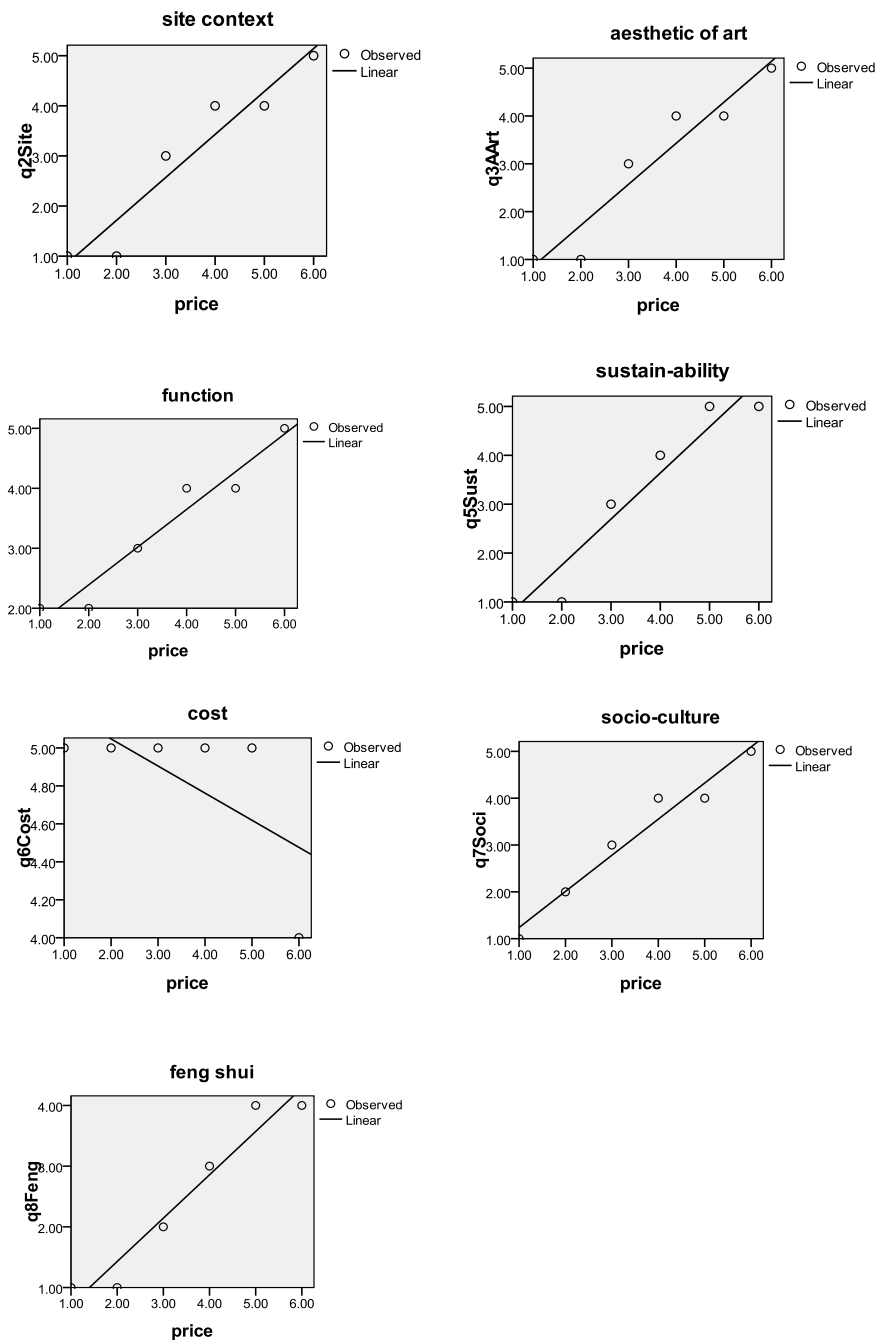**. Correlation is significant at the 0.01 level (2-tailed).

Figure 4.24 Results of Regression between Market Price and Design Criteria

The results of the correlation and regression analyses are interpreted as follows:

DV_{1yt} - *Correlation and Regression Analysis between Price and Site Context*

The correlation is positive and significant with r = 0.95 and p < 0.05. The scatter diagram of regression shows a straight line of causal relationship.

DV$_{2yt}$ - Correlation and Regression Analysis between Price and Aesthetics

The correlation is positive and significant with r = 0.93 and p < 0.05. The scatter diagram of regression shows a straight line of causal relationship.

DV$_{3yt}$ - Correlation and Regression Analysis between Price and Function

The correlation is positive and significant with r = 0.91 and p < 0.05. The scatter diagram of regression shows a straight line of causal relationship.

DV$_{4yt}$ - Correlation and Regression Analysis between Price and Sustainability

The correlation is positive and significant with r = 0.97 and p < 0.05. The scatter diagram of regression shows a straight line of causal relationship.

DV$_{5yt}$ - Correlation and Regression Analysis between Price and Cost

There is no correlation with r = -0.62 and p = 0.18. The scatter diagram of regression does not show a straight line of causal relationship.

DV$_{6yt}$- Correlation and Regression Analysis between Price and Socio-culture

The correlation is positive and significant with r = 0.92 and p < 0.05. The scatter diagram of regression shows a straight line of causal relationship.

4.2.6.3 Results of Pattern Study for Design Brief

In the analysis, similar results of the observed pattern were identified on how design brief was worked out by developer as described in 4.3.3.3.

4.3.6.4 Results of Pattern Study for Users' Input

In the analysis, similar results of the observed pattern were identified on how user input was worked out by developer as described in 4.3.3.4.

4.3.7 PJD

For the respective results, Q13 to Q29, and Q34 to Q75 were analyzed.

4.3.7.1 Results of Preliminary Analysis

For the preliminary results, Q13, Q14 and Q17 were analyzed.

Q13 recorded what vision and mission statements of the company are, while Q14 recorded why the company does multi-storey residential buildings for low cost, medium cost and high cost types. The qualitative response data provide background and context for explaining the results of analysis.

The results of the analysis of Q17 for each bivariate relationship between market price and design criteria are shown in Figure 4.25.

	Ranking of Importance		
	High Cost	Medium Cost	Low Cost
Aesthetics	3	3	4
Function	2	2	2
Social-culture	4	4	3
Cost	5	5	1
Sustainable	6	6	5
Site context	1	1	6
Feng Shui	-	-	-

Figure 4.25 Relationship between Market Price and Design Criteria

4.3.7.2 Results of Correlation and Regression Analyses

The results of the correlation and regression analyses of the response data from Q34 to Q75 are shown in Table 4.12 and Figure 4.26 for all seven dependent variables (DV).

In comparing the results of the analysis for PJD with that of YTL, LION, BRDB and SPSETIA, it was found similar observed patterns of correlation and regression between the

market price and design criteria for the multi-storey residential buildings. The correlation is positive and significant except the cost. The scatter diagram of regression shows a straight line of causal relationship except the cost.

In summary, it was found that the results of correlation and regression patterns for the bivariate relationship between market price and design criteria replicate among the developers. It was also found that the observed patterns of correlation and regression patterns in the developers match with the predicted patterns of the hypothetical propositions.

Table 4.12 Correlation Pattern between Design Criteria and Market Price

	N	Pearson Correlation	Sig. (2-tailed)
Site Context		.98**	.00
Aesthetics/Art		.96**	.00
Function		.97**	00
Sustainability		.96**	00
Cost		-.20	.69
Socio-Culture		.96**	00
Feng Shui		-	-

**. Correlation is significant at the 0.01 level (2-tailed).

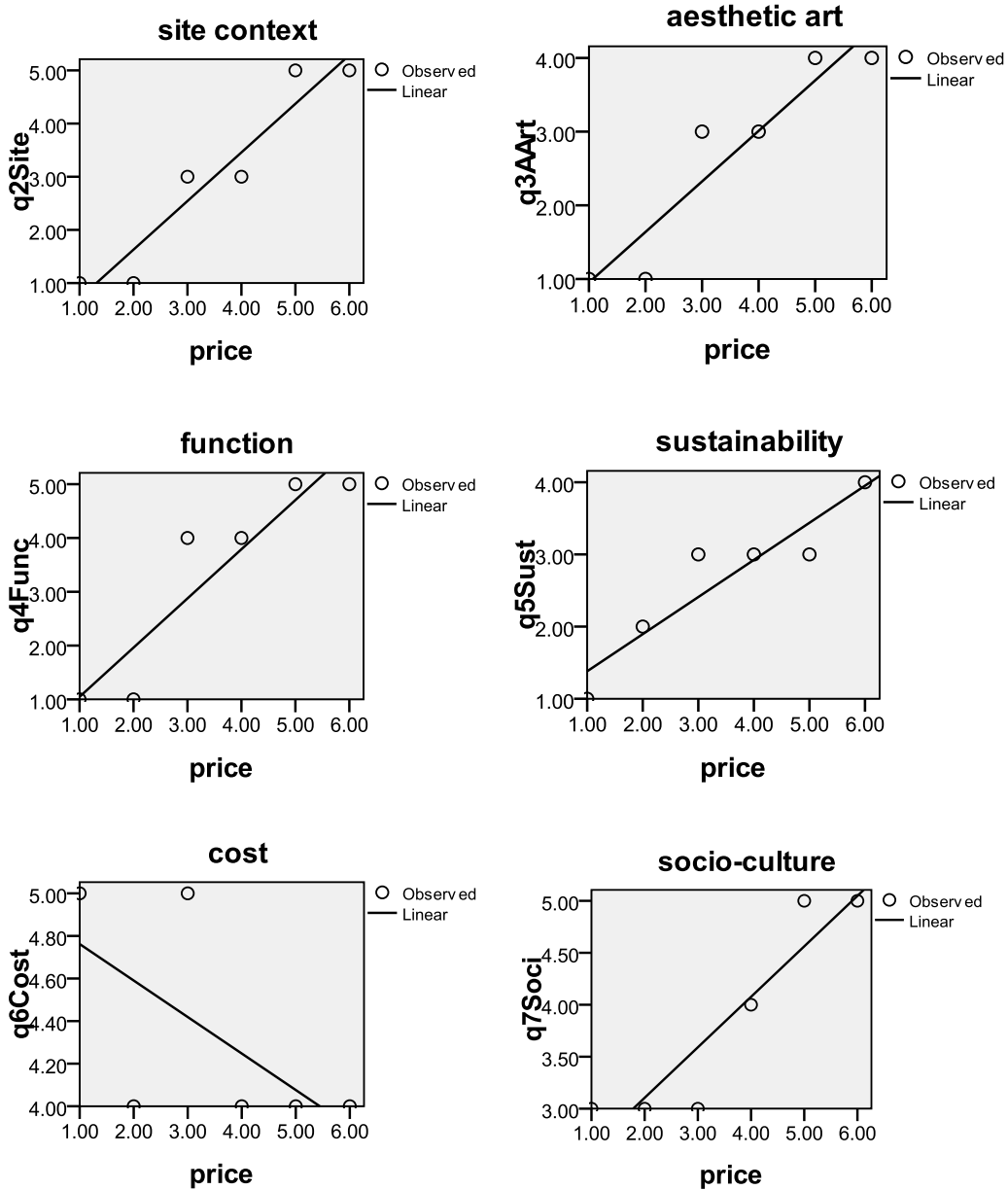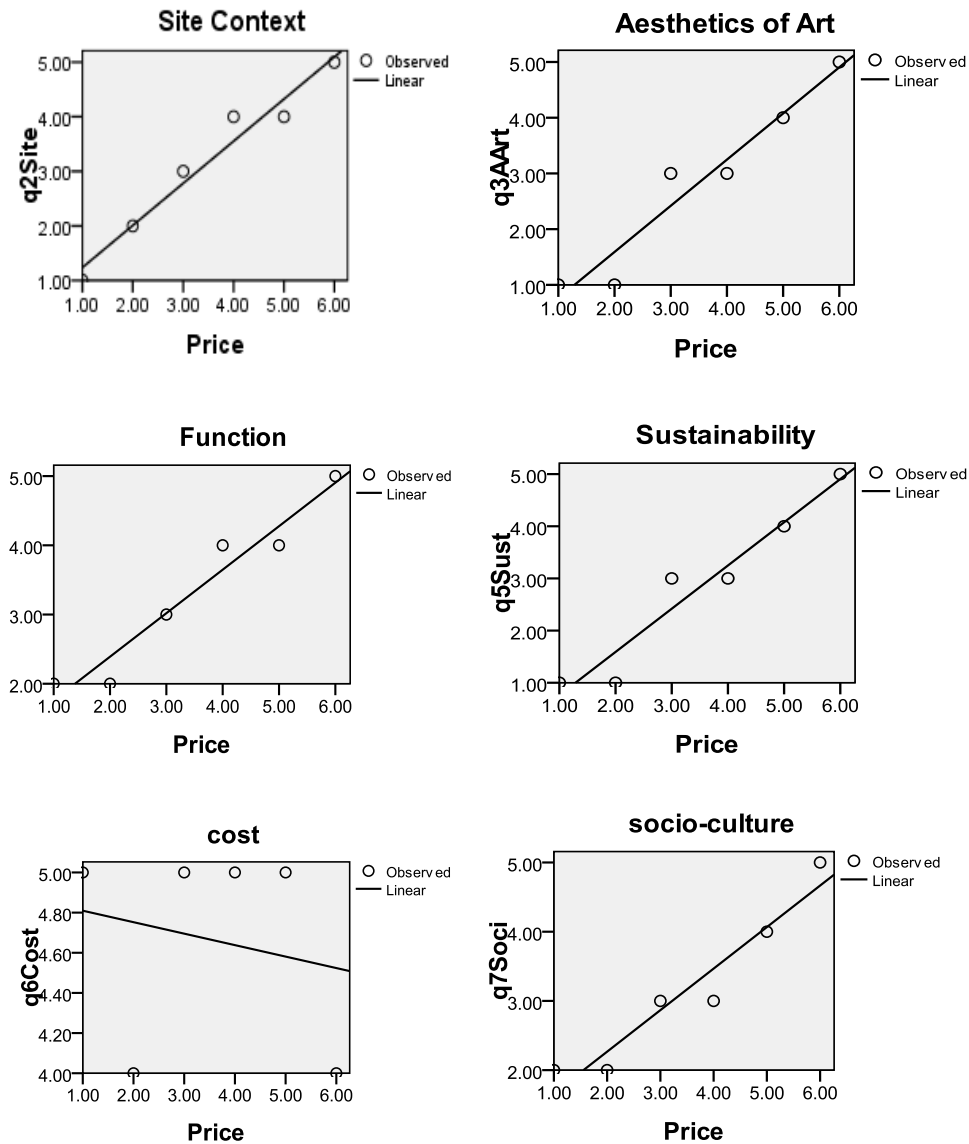**Figure 4.26 Results of Regression between Market Price and Design Criteria**

The results of the analysis are interpreted as follows:

DV$_{1pj}$ - Correlation and Regression Analysis between Price and Site Context

The correlation is positive and significant with r = 0.98 and p < 0.05. The scatter diagram of regression shows a straight line of causal relationship.

DV$_{2pj}$ - Correlation and Regression Analysis between Price and Aesthetics

The correlation is positive and significant but marginal different with r = 0.96 and p < 0.05. The scatter diagram of regression shows a straight line of causal relationship.

.DV$_{3pj}$ - Correlation and Regression Analysis between Price and Function

The correlation is positive and significant with r = 0.97 and p < 0.05. The scatter diagram of regression shows a straight line of causal relationship.

DV$_{4pj}$ - Correlation and Regression Analysis between Price and Sustainability

The correlation between market price and sustainability is positive and significant with r = 0.96 and p < 0.05. The scatter diagram of regression shows a straight line of causal relationship between price and sustainability.

DV$_{5pj}$- Correlation and Regression Analysis between Price and Cost

There is no correlation with r = -0.20 and p = 0.69. The scatter diagram of regression does not show a straight line of causal relationship.

DV$_{6pj}$- Correlation and Regression Analysis between Price and Socio-culture

The correlation is positive and significant with r = 0.96 and p < 0.05. The scatter diagram of regression shows a straight line of causal relationship.

4.3.7.3 Results of Pattern Analysis for Design Brief

In the analysis, similar results of the observed pattern were identified on how design brief was worked out by developer as described in 4.3.3.3.

4.3.7.4 Results of Pattern Analysis for Users' Input

In the analysis, similar results of the observed pattern were identified on how user input was worked out by developer as described in 4.3.3.4.

4.3.8 UOA

For the respective results, Q13 to Q29, and Q34 to Q75 were analyzed.

4.3.8.1 Results of Preliminary Analysis

For the preliminary results, Q13, Q14 and Q17 were anslyzed.

Q13 recorded what vision and mission statements of the company are, while Q14 recorded why the company does multi-storey residential buildings for low cost, medium cost and high cost types. The qualitative response data provide background and context for explaining the results of analysis.

The results of the analysis of Q17 for the relationship between market price and design criteria are shown in Figure 4.27.

	Ranking of Importance		
	High Cost	Medium Cost	Low Cost
Aesthetics	3	3	4
Function	2	1	2
Social-culture	4	4	3
Cost	6	5	1
Sustainable	5	6	5
Site context	1	2	7
Feng Shui	7	7	6

Figure 4.27 Relationship between Market Price and Design Criteria

4.3.8.2 Results of Correlation and Regression Analyses

The results of the correlation and regression analyses for Q34 to Q75 are shown in Table 4.13 and Figure 4.28 for all seven dependent variables (DV).

In comparing the results of the analysis for UOA with that of PJD, YTL, LION, BRDB and SPSETIA, it was found similar observed patterns of correlation and regression between the

market price and design criteria for the multi-storey residential buildings. The correlation is positive and significant except the cost. The scatter diagram of regression shows a straight line of causal relationship except the cost.

In summary, it was found that the results of correlation and regression patterns for the bivariate relationship between market price and design criteria replicate among the developers. It was also found that the observed patterns of correlation and regression analyses in the developers match with the predicted patterns of the hypothetical propositions.

Table 4.13 Results of Correlation between Market Price and Design Criteria

	Pearson Correlation	Sig. (2-tailed)
Site Context	.98**	.00
Aesthetcis/Art	.97**	.00
Function	.97**	00
Sustainability	.93**	00
Cost	-.65	.15
Socio-Culture	.97**	.00
Feng Shui	.94**	.00
**. Correlation is significant at the 0.01 level (2-tailed).		
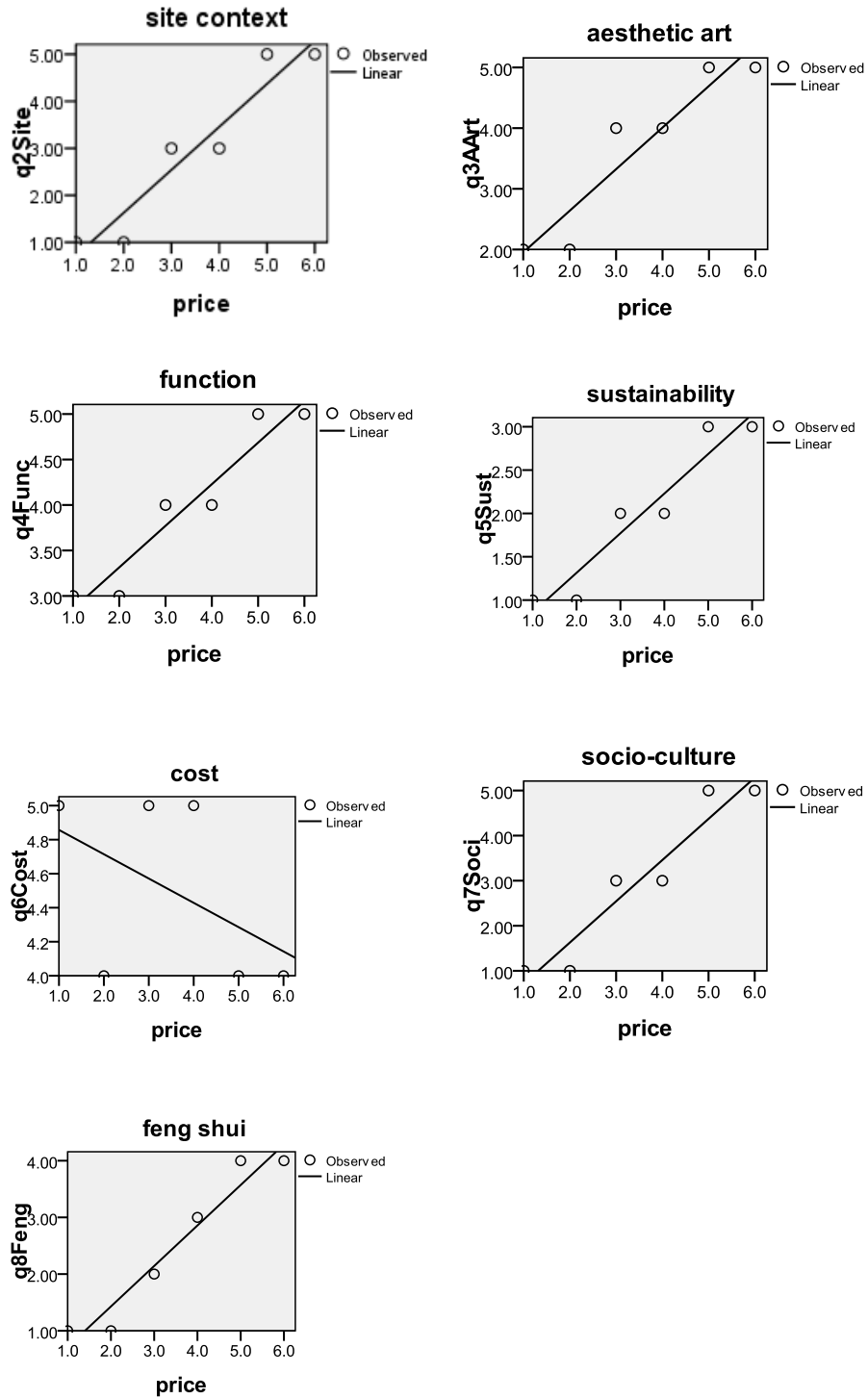
Figure 4.28 Results of Regression between Market Price and Design Criteria

4.3.8.3 Results of Pattern Analysis for Design Brief

In the analysis, similar results of the observed pattern were identified on how design brief was worked out by developer as described in 4.3.3.3.

4.3.8.4 Results of Pattern Analysis for Users' Input

In the analysis, similar results of the observed pattern were identified on how user input was worked out by developer as described in 4.3.3.4.

4.3.9 EW

For the respective results, Q13 to Q29, and Q34 to Q75 were analyzed.

4.3.9.1 Results of Preliminary Analysis

For the preliminary results, Q13, Q14 and Q17 were analyzed. Q13 recorded what vision and mission statements of the company are, while Q14 recorded why the company does multi-storey residential buildings for low cost, medium cost and high cost types. The qualitative response data provide background and context for explaining the results of analysis.

The results of the analysis of Q17 for the relationship between market price and design criteria are shown in Figure 4.29.

	Ranking of Importance		
	High Cost	Medium Cost	Low Cost
Aesthetics	3	3	4
Function	2	2	2
Social-culture	5	4	3
Cost	4	5	1
Sustainable	6	6	5
Site context	1	1	6
Feng Shui	7	7	7

Figure 4.29 Relationship between Market Price and Design Criteria

4.3.9.2 Results of Correlation and Regression Analyses

The results of correlation and regression analysis for Q34 to Q75 are shown in Table 4.14 and Figure 4.30 for all seven dependent variables (DV).

In comparing the results of the analysis for EW with that of UOA, PJD, YTL, LION, BRDB and SPSETIA, it was found similar observed patterns of correlation and regression between the market price and design criteria for the multi-storey residential buildings. The correlation is positive and significant except the cost. The scatter diagram of regression shows a straight line of causal relationship except the cost.

In summary, it was found that the results of correlation and regression patterns for the bivariate relationship between market price and design criteria replicate among the developers. It was also found that the observed patterns of correlation and regression patterns in the developers match with the predicted patterns of the hypothetical propositions.

Table 4.14 Results of Correlation between Market Price and Design Criteria

	N	Pearson Correlation	Sig. (2-tailed)
Site Context		.98**	.00
Aesthetcis/Art		.93**	.00
Function		.96**	00
Sustainability		.93**	00
Cost		-.62	.18
Socio-Culture		.95**	00
Feng Shui		-	00

**. Correlation is significant at the 0.01 level (2-tailed).
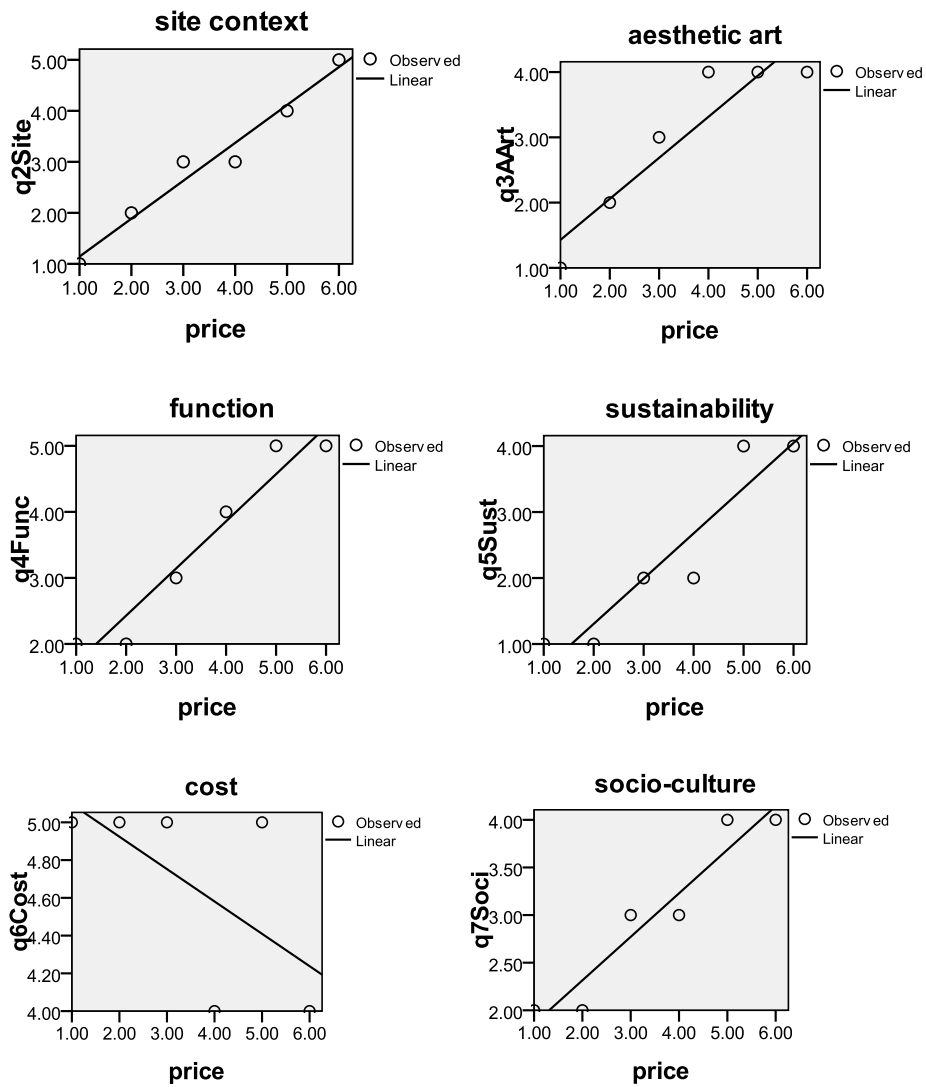
Figure 4.30 Results of Regression between Market Price and Design Criteria

4.3.9.3 Results of Pattern Analysis for Design Brief

In the analysis, similar results of the observed pattern were identified on how design brief was worked out by developer as described in 4.3.3.3.

4.3.9.4 Results of Pattern Analysis for Users' Input

In the analysis, similar results of the observed pattern were identified on how user input was worked out by developer as described in 4.3.3.4.

4.3.10 UNIP

For the respective results, Q13 to Q29, and Q34 to Q75 were analyzed.

4.3.10.1 Results of Preliminary Analysis

For the preliminary results, Q13, Q14 and Q17 were analyzed.

Q13 recorded what vision and mission statements of the company are, while Q14 recorded why the company does multi-storey residential buildings for low cost, medium cost and high cost types. The qualitative response data provide background and context for explaining the results of analysis.

The results of the analysis of Q17 for the relationship between market price and design criteria are shown in Figure 4.31

	Ranking of Importance		
	High Cost	Medium Cost	Low Cost
Aesthetics	3	2	4
Function	1	1	2
Social-culture	5	4	3
Cost	4	5	1
Sustainable	7	7	5
Site context	2	3	7
Feng Shui	6	6	6

Figure 4.31 Relationship between Market Price and Design Criteria

4.3.10.2 Results of Correlation and Regression

The results of the correlation and regression analyses for Q34 to Q75 are shown in Table 4.15 and Figure 4.32 for all seven dependent variables (DV).

In comparing the results of the analysis for UNIP with that of EW, UOA, PJD, YTL, LION, BRDB and SPSETIA, it was found similar observed patterns of correlation and regression between the market price and design criteria for the multi-storey residential buildings. The correlation is positive and significant except the cost. The scatter diagram of regression shows a straight line of causal relationship except the cost.

In summary, it was found that the results of correlation and regression patterns for the bivariate relationship between market price and design criteria replicate among the developers. It was also found that the observed patterns of correlation and regression patterns in the developers match with the predicted patterns of the hypothetical propositions.

Table 4.15 Results of Correlation between Market Price and Design Criteria

|	N	Pearson Correlation	Sig. (2-tailed)
Site Context		.96**	.00
Aesthetics/Art		.91**	.00
Function		.98**	00
Sustainability		.93**	00
Cost		-.65	.15
Socio-Culture		.95**	00
Feng Shui		.96**	00
**. Correlation is significant at the 0.01 level (2-tailed).			
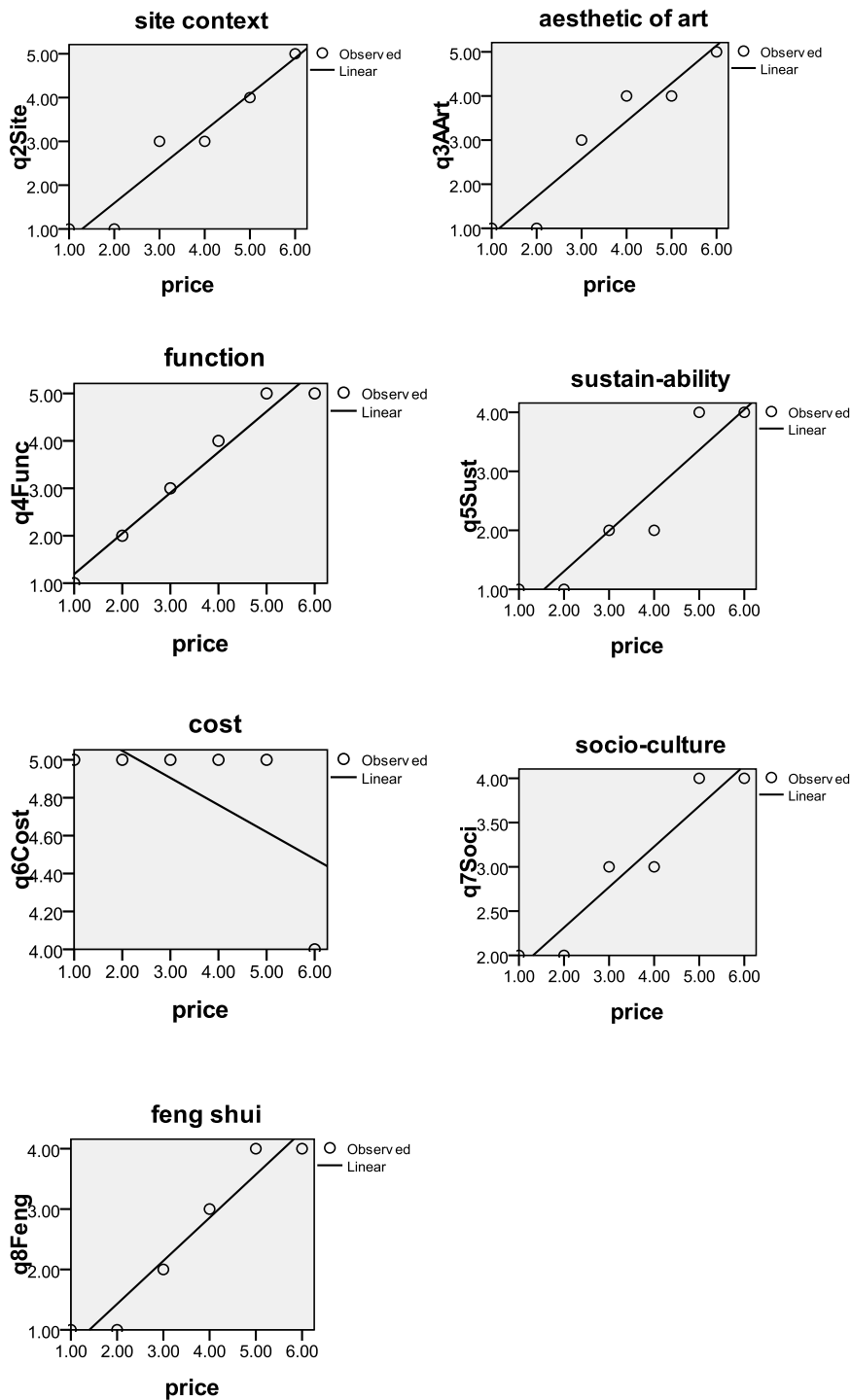
Figure 4.32 Results of Regression between Market Price and Design Criteria

4.3.10.3 Results of Pattern Analysis for Design Brief

In the analysis, similar results of the observed pattern were identified on how design brief was

worked out by developer as described in 4.3.3.3.

4.3.10.4 Results of Pattern Analysis for Users' Input

In the analysis, similar results of the observed pattern were identified on how user input was worked out by developer as described in 4.3.3.4.

4.4 Analysis and Results of Case Study II of Architectural Firms

4.4.1 Introduction

This data analysis was based on the Case Study II of seven architectural firms including GDP, V-TAC (VERITAS and TAC), YTL, ATELIER, AKIPRAKTIS, and AKIPANEL. Response data were recorded in the Case Study II questionnaires Q1 to Q75 as per Appendix D1, while data input in variable view and data view (blank) of SPSS Data Editor as per Appendix D2.

4.4.2 Methods of Analysis

The analytical methods included correlation, regression, replication, and pattern matching that have been described in Chapter 3.6.

4.4.2.1 Peculiarities to the Analysis

The data analysis was not apparent at the first round of interviews with the architectural firms that were conducted before the two surveys. This is referred to as pre-survey interview. The pre-survey refers to the two surveys of the multi-storey residential buildings conducted in 2009/2010 and 2010/2011 by two groups of respondents. After the two surveys a second round of interviews was conducted with the same architectural firms. This is referred to as post-survey interview. Two different sets of response data were collected. The results of the analyses showed that the pre-survey data were different from that of the post-survey.

The results of the analysis of pre-survey interview data showed that there was no relationship between the two variables. However the results of the analysis of the post-survey interview data showed that there was certain relationship between the two variables. In the pre-survey interview, the respondents generally ranked importance of all criteria for the design of all types of multi-storey residential buildings. In the post-survey interview, the respondents generally ranked importance of criteria for the design of multi-storey residential buildings according to the design brief given by clients.

4.4.3 GDP

For the respective results, Q13 to Q29, and Q34 to Q75 as per Appendix D were analyzed.

4.4.3.1 Results of Preliminary Analysis

For the preliminary results, Q13, Q14 and Q17 were analyzed. Q13 recorded what vision and mission statements of the company are, while Q14 recorded why the company does multi-storey residential buildings for low cost, medium cost and high cost types. The data provided background information for study of the relationship between two variables.

The results of the analysis for Q17 for relationship between price and design criteria are shown in Figure 4.33.

	Ranking of Importance		
	High Cost	Medium Cost	Low Cost
Aesthetics	2	2	4
Function	1	1	1
Social-culture	5	3	3
Cost	6	6	2
Sustainable	4	5	5
Site context	3	4	6
Feng Shui	-	-	-

Figure 4.33 Simple Relationship between Market Price and Design Criteria

4.4.3.2 Results of Correlation and Regression Analyses

The results of the correlation and regression analyses for Q34 to Q75 are shown in Table 4.16 and Figure 4.34 for all seven dependent variables (DV_{1-7}).

In comparing the results of the analysis for GDP with that of the eight developers, it was found similar observed patterns of correlation and regression between the market price and design criteria for the multi-storey residential buildings. The correlation is positive and significant except the cost. The scatter diagram of regression shows a straight line of causal relationship except the cost.

In summary, it was found that the results of correlation and regression pattern for the relationship between market price and design criteria replicate among the developers. It was also found that the observed patterns of correlation and regression patterns in the developers match with the predicted patterns of the hypothetical propositions.

Table 4.16 Results of Correlation between Market Price and Design Criteria

Gdp	N	Pearson Correlation	Sig. (2-tailed)
Site Context		.87*	.00
Aesthetics/Art		.87*	.00
Function		.92**	00
Sustainability		.91**	00
Cost		-.62	.18
Socio-Culture		.95**	00
Feng Shui		-	-

**. Correlation is significant at the 0.01 level (2-tailed).
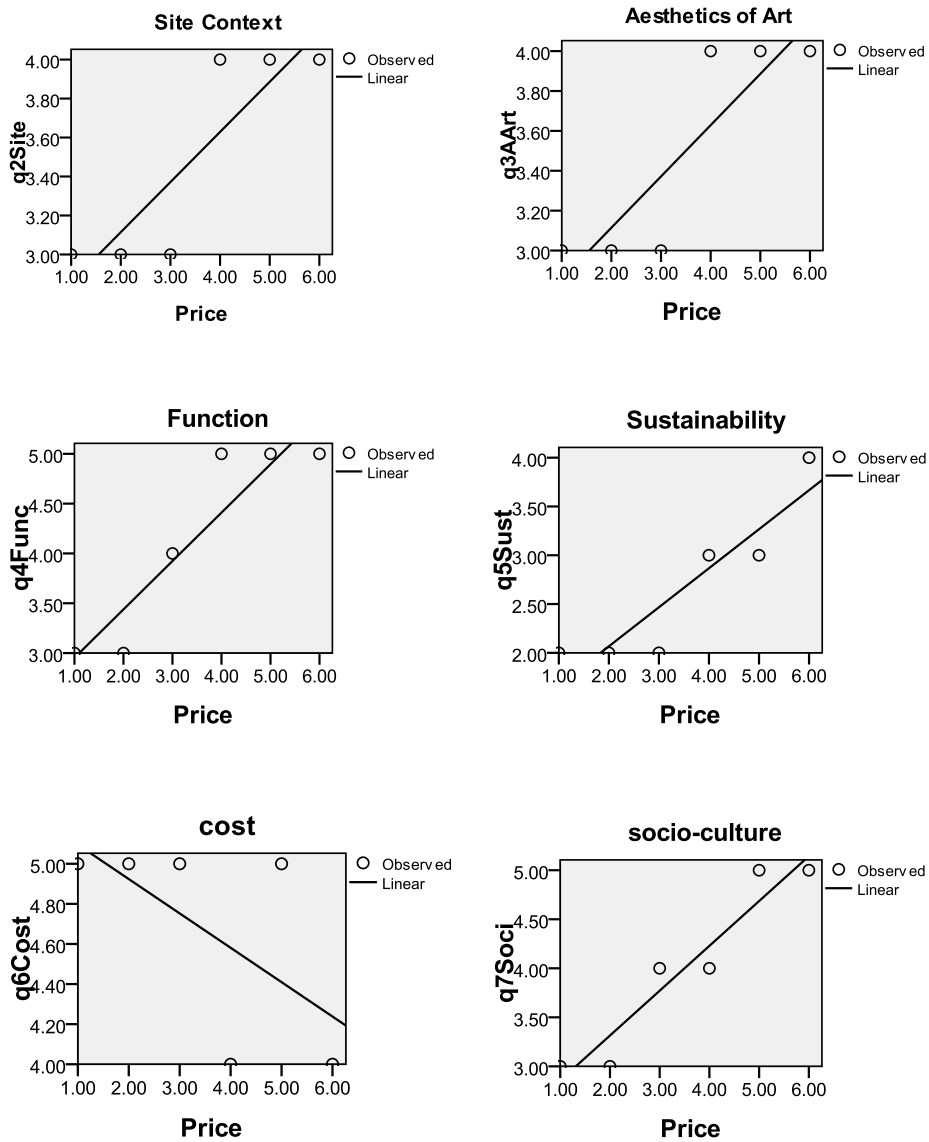
Figure 4.34 Results of Regression between Market Price and Design Criteria

DV_{1gd} - *Correlation and Regression Analysis between Price and Site Context*

The correlation is positive and significant with r = 87 and p < 0.05. The scatter diagram of regression shows a straight line of causal relationship.

DV_{2gd} - *Correlation and Regression Analysis between Price and Aesthetics*

The correlation is positive and significant with r = 0.87 and p < 0.05. The scatter diagram of regression shows a straight line of causal relationship.

DV$_{3gd}$ - Correlation and Regression Analysis between Price and Function

The correlation is positive and significant with r = 0.92 and p < 0.05. The scatter diagram of regression shows a straight line of causal relationship.

DV$_{4gd}$ - Correlation and Regression Analysis between Price and Sustainability

The correlation is positive and significant with r = 0.91 and p < 0.05. The scatter diagram of regression shows a straight line of causal relationship.

DV$_{5gd}$ - Correlation and Regression Analysis between Price and Cost

There is no correlation with r = -0.62 and p = 0.18 that is larger than p < 0.05. The scatter diagram of regression does not show a straight line of causal relationship.

DV$_{6gd}$ - Correlation and Regression Analysis between Price and Socio-culture

The correlation is positive and significant with r = 0.95 and p < 0.05. The scatter diagram of regression shows a straight line of causal relationship.

4.4.3.3 Results of Pattern Study for Design Brief

For study of patterns, Q13, Q14, Q15, Q18, Q19, Q20, Q21, Q26, Q27, Q28 and Q29 were analysed as in 4.3.3.3.

In the analysis, an observed pattern was identified on how design brief was worked out by developer for development in design of multi-storey residential buildings. The developer generally led, worked out the design brief and consulted the architect when required. In

consultation, the developer directed the architect appointed to provide on what were required for the development and for project design, and in particular the cost plan and business profitability.

4.4.3.4 Results of Pattern Study for User Input

For study of user input pattern, Q13, Q14, Q16, Q18, Q19, Q20, Q21, Q22, Q23, Q24, and Q25 were analyzed as in 4.3.3.4.

In the analysis, an observed pattern was found on how users input to design brief being worked out. There was no direct input of users to the design brief. The developers were the main input. The architects relied on developers for the input of the users if any. In consultation, the developers discussed with architects and occasionally invited their own in house or hired marketing professionals to join for the discussion. The developers would pass on to architects useful feedbacks of user needs from previous users and buyers or special interest groups from the actual market. They informed the architects that the bottom line of the design is to create something nice, attractive, functional and cost effective apartments for potential buyers.

4.4.4 V-Tac

For the respective results, Q13 to Q29, and Q34 to Q75 were analyzed.

4.4.4.1 Results of Preliminary Analysis

For the preliminary results, Q13, Q14 and Q17 were analyzed.

Q13 recorded what vision and mission statements of the company are, while Q14 recorded why the company does multi-storey residential buildings for low cost, medium cost and high cost types. The data provided background information for study of the relationship between two variables.

The results of the analysis for Q17 for relationship between price and design criteria are shown in Figure 4.35.

	Ranking of Importance		
	High Cost	Medium Cost	Low Cost
Aesthetics	3	2	4
Function	1	1	2
Social-culture	4	4	3
Cost	6	5	1
Sustainable	5	6	6
Site context	2	3	5
Feng Shui	7	7	7

Figure 4.35 Simple Relationship between Market Price and Design Criteria

4.4.4.2 Results of Correlation and Regression Analyses

The results of the correlation and regression analyses for Q34 to Q75 are shown in Table 4.17 and Figure 4.36 for all seven dependent variables (DV_{1-7}).

In comparing the results of the analysis for V-Tac with that of GDP and the eight developers, it was found similar observed patterns of correlation and regression between the market price

and design criteria for the multi-storey residential buildings. The correlation is positive and significant except the cost. The scatter diagram of regression shows a straight line of causal relationship except the cost.

In summary, it was found that the results of correlation and regression patterns for the bivariate relationship between market price and design criteria replicate among the developers. It was also found that the observed patterns of correlation and regression patterns in the developers and architects' firms match with the predicted patterns of the hypothetical propositions.

Table 4.17 Results of Correlation between Market Price and Design Criteria

V-Tac	N	Pearson Correlation	Sig. (2-tailed)
Site Context		0.83[*]	.00
Aesthetics/Art		0.93*	.00
Function		0.93**	00
Sustainability		0.92**	00
Cost		-0.65	.15
Socio-Culture		0.92**	00
Feng Shui		0.92	00

**. Correlation is significant at the 0.01 level (2-tailed).
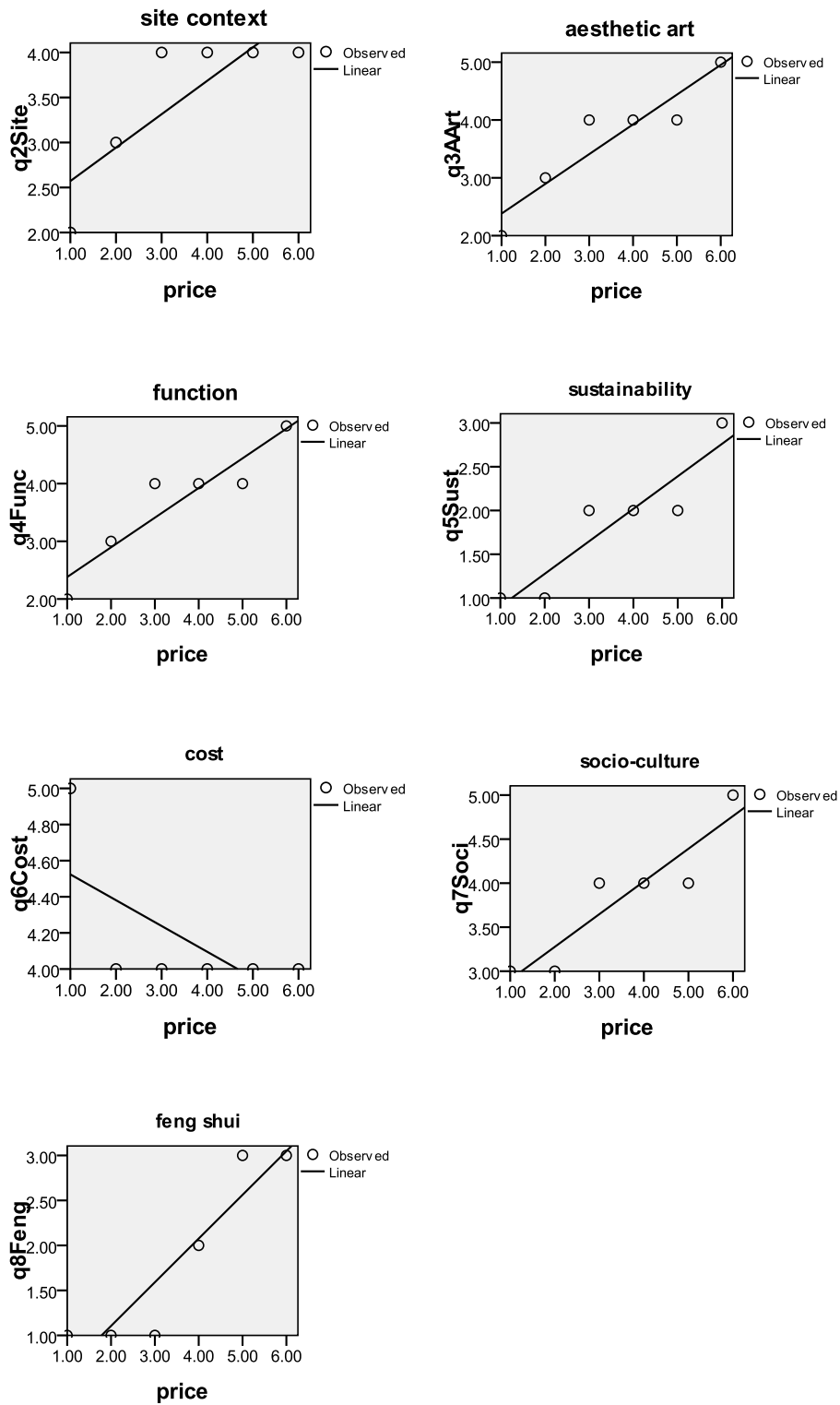
Figure 4.36 Results of Regression between Market Price and Design Criteria

DV$_{1vt}$ -- Correlation and Regression Analysis between Price and Site Context

The correlation is positive and significant with r = 0.83 and p < 0.05. The scatter diagram of regression shows a straight line of causal relationship..

DV$_{2vt}$ - Correlation and Regression Analysis between Price and Aesthetics

The correlation is positive and significant with r = 0.93 and p < 0.05. The scatter diagram of regression shows a straight line of causal relationship.

DV$_{3vt}$ -- Correlation and Regression Analysis between Price and Function

The correlation is positive and significant with r = 0.93 and p < 0.05. The scatter diagram of regression shows a straight line of causal relationship.

DV$_{4vt}$ - Correlation and Regression Analysis between Price and Sustainability

The correlation is positive and significant with r = 0.92 and p < 0.05. The scatter diagram of regression shows a straight line of causal relationship.

DV$_{5vt}$ - Correlation and Regression Analysis between Price and Cost

There is no correlation with r = -0.65 and p = 0.15. The scatter diagram of regression does not show a straight line of causal relationship.

DV$_{6vt}$ - Correlation and Regression Analysis between Price and Socio-culture

The correlation is positive and significant with r = 0.92 and p < 0.05. The scatter diagram of regression shows a straight line of causal relationship.

DV$_{7vt}$ - Correlation and Regression Analysis between Price and Feng Shui

The correlation is positive and significant with r = 0.26 and p < 0.05. The scatter diagram of regression shows a straight line of causal relationship.

4.4.4.3 Results of Pattern Study for Design Brief

For study of patterns, we analysed Q13, Q14, Q15, Q18, Q19, Q20, Q21, Q26, Q27, Q28 and Q29 were analysed as in 4.4.3.3 and 4.3.3.3.

In the analysis, an observed pattern was identified on how design brief was worked out by developer for development in design of multi-storey residential buildings. The developer generally led, worked out the design brief and consulted the architect when required. In consultation, the developer directed the architect appointed to provide on what were required for the development and for project design, and in particular the cost plan and business profitability.

4.4.4.4 Results of Pattern Study for Users' Input

For study of patterns, Q13, Q14, Q16, Q18, Q19, Q20, Q21, Q22, Q23, Q24, and Q25 were analysed as in 4.4.3.4 and 4.3.3.4.

In the analysis, an observed pattern was found on how users input to design brief being worked out. There was no direct input of users to the design brief. The developers were the main input. The architects relied on developers for the input of the users if any. In consultation, the developers discussed with architects and occasionally invited their own in house or hired marketing professionals to join for the discussion. The developers would pass on to architects useful feedbacks of user needs from previous users and buyers or special interest groups from the actual market. They informed the architects that the bottom line of the design is to create something nice, attractive, functional and cost effective apartments for potential buyers.

4.4.5 ATELIER

For the respective results, Q13 to Q29, and Q34 to Q75 were analyzed.

4.4.5.1 Results of Preliminary Analysis

For the preliminary results, Q13, Q14 and Q17 were analyzed.

Q13 recorded what vision and mission statements of the company are, while Q14 recorded why the company does multi-storey residential buildings for low cost, medium cost and high cost types. The data provided background information for study of the relationship between two variables.

The results of the analysis for Q17 for relationship between price and design criteria are shown in Figure 4.37.

	Ranking of Importance		
	High Cost	Medium Cost	Low Cost
Aesthetics	2	2	4
Function	1	1	2
Social-culture	4	3	3
Cost	6	6	1
Sustainable	5	5	5
Site context	3	4	6
Feng Shui	7	7	7

Figure 4.37 Simple Relationship between Market Price and Design Criteria

4.4.5.2 Results of Correlation and Regression Analysis

The results of the correlation and regression analyses for Q34 to Q75 are shown in Table 4.18 and Figure 4.38 for all seven dependent variables (DV_{1-7}).

In comparing the results of the analysis for Atelier with that of V-Tac, GDP and the eight developers, it was found similar observed patterns of correlation and regression between the market price and design criteria for the multi-storey residential buildings. The correlation is positive and significant except the cost. The scatter diagram of regression shows a straight line of causal relationship except the cost.

In summary, it was found that the results of correlation and regression patterns for the bivariate relationship between market price and design criteria replicate among the developers. It was also found that the observed patterns of correlation and regression patterns in the developers and architects' firms match with the predicted patterns of the hypothetical propositions.

Table 4.18 Results of Correlation between Market Price and Design Criteria

Ate	N	Pearson Correlation	Sig. (2-tailed)
Site Context		0.96^*	.00
Aesthetics/Art		0.96*	.00
Function		0.91**	00
Sustainability		0.92**	00
Cost		-0.65	.15
Socio-Culture		0.92**	00
Feng Shui		0.91	00

**. Correlation is significant at the 0.01 level (2-tailed).
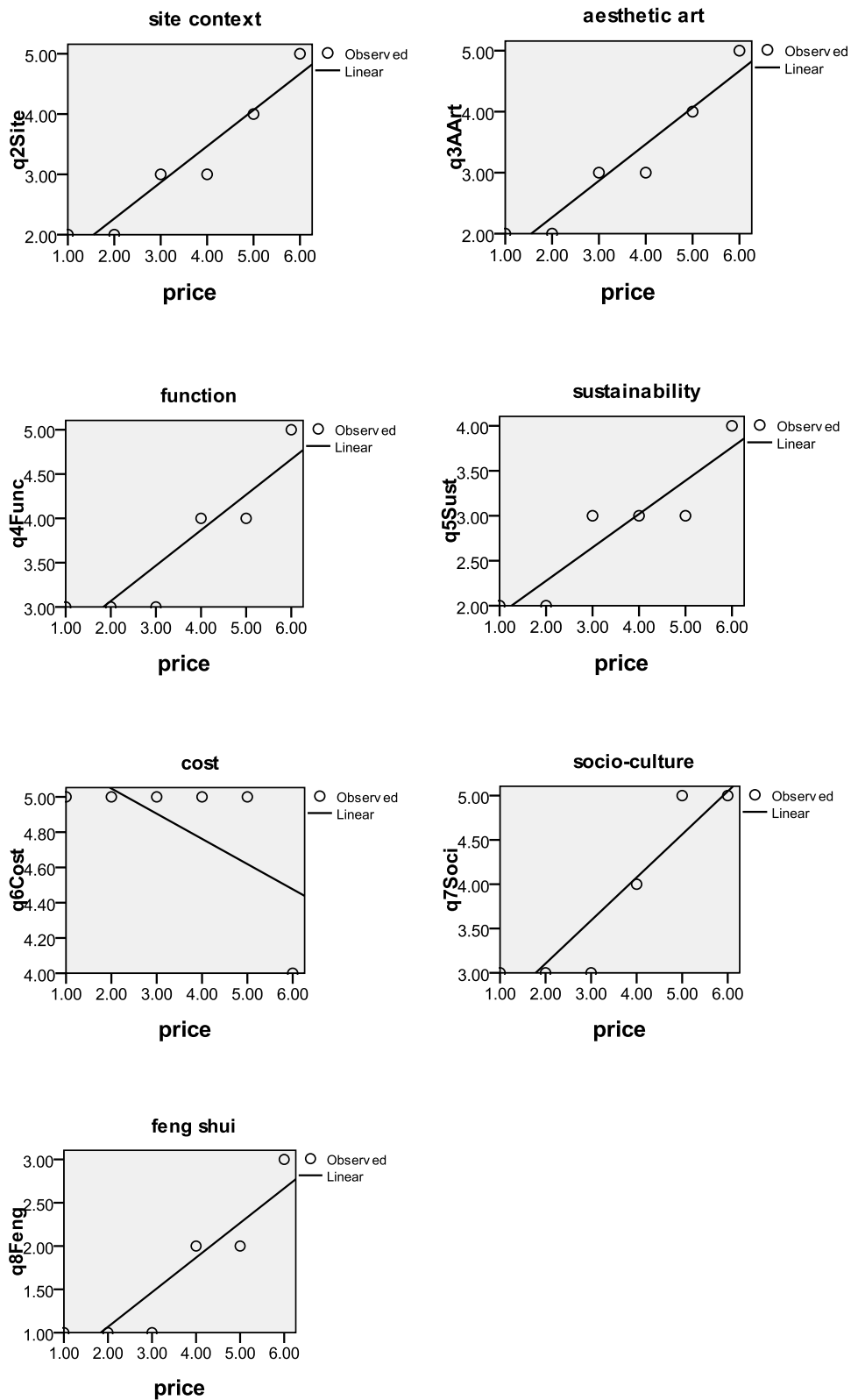
Figure 4.38 Results of Regression between Market Price and Design Criteria

DV_{1at}- Correlation and Regression Analysis between Price and Site Context

The correlation is positive and significant with r = 0.96 and p < 0.05. The scatter diagram of regression shows a straight line of causal relationship.

DV_{2at} - Correlation and Regression Analysis between Price and Aesthetics

The correlation is positive and significant with r = 0.96 and p < 0.05. The scatter diagram of regression shows a straight line of causal relationship.

DV_{3at}- Correlation and Regression Analysis between Price and Function

The correlation is positive and significant with r = 0.91 and p < 0.05. The scatter diagram of regression shows a straight line of causal relationship.

DV_{4at} - Correlation and Regression Analysis between Price and Sustainability

The correlation is positive and significant with r = 0.92 and p < 0.05. The scatter diagram of regression shows a straight line of causal relationship.

DV_{5at}- Correlation and Regression Analysis between Price and Cost

There is no correlation with r = -0.65 and p = 0.15 that is larger than p < 0.05. The scatter diagram of regression does not show a straight line of causal relationship.

DV_{6at} - Correlation and Regression Analysis between Price and Socio-culture

The correlation is positive and significant with r = 0.92 and p < 0.05. The scatter diagram of regression shows a straight line of causal relationship.

DV_{7at} - Correlation and Regression Analysis between Price and Feng Shui

The correlation is positive and significant with r = 0.91 and p < 0.05. The scatter diagram of regression shows a straight line of causal relationship.

DV$_{1at}$- Correlation and Regression Analysis between Price and Site Context

The correlation is positive and significant with r = 0.96 and $p < 0.05$. The scatter diagram of regression shows a straight line of causal relationship.

DV$_{2at}$ - Correlation and Regression Analysis between Price and Aesthetics

The correlation is positive and significant with r = 0.96 and $p < 0.05$. The scatter diagram of regression shows a straight line of causal relationship.

DV$_{3at}$- Correlation and Regression Analysis between Price and Function

The correlation is positive and significant with r = 0.91 and $p < 0.05$. The scatter diagram of regression shows a straight line of causal relationship.

DV$_{4at}$ - Correlation and Regression Analysis between Price and Sustainability

The correlation is positive and significant with r = 0.92 and $p < 0.05$. The scatter diagram of regression shows a straight line of causal relationship.

DV$_{5at}$- Correlation and Regression Analysis between Price and Cost

There is no correlation with r = -0.65 and p = 0.15 that is larger than $p < 0.05$. The scatter diagram of regression does not show a straight line of causal relationship.

DV$_{6at}$ - Correlation and Regression Analysis between Price and Socio-culture

The correlation is positive and significant with r = 0.92 and $p < 0.05$. The scatter diagram of regression shows a straight line of causal relationship.

DV$_{7at}$ - Correlation and Regression Analysis between Price and Feng Shui

The correlation is positive and significant with r = 0.91 and $p < 0.05$. The scatter diagram of regression shows a straight line of causal relationship.

4.4.5.3 Results of Pattern Study for Design Brief

For study of patterns, Q13, Q14, Q15, Q18, Q19, Q20, Q21, Q26, Q27, Q28 and Q29 were analysed as in 4.3.3.3.

In the analysis, an observed pattern was identified on how design brief was worked out by developer for development in design of multi-storey residential buildings. The developer generally led, worked out the design brief and consulted the architect when required. In consultation, the developer directed the architect appointed to provide on what were required for the development and for project design, and in particular the cost plan and business profitability.

4.4.5.4 Results of Pattern Study for Users' Input

For study of user input pattern, Q13, Q14, Q16, Q18, Q19, Q20, Q21, Q22, Q23, Q24, and Q25 were analyzed as in 4.3.3.4.

In the analysis, an observed pattern was found on how users input to design brief being worked out. There was no direct input of users to the design brief. The developers were the main input. The architects relied on developers for the input of the users if any. In consultation, the developers discussed with architects and occasionally invited their own in house or hired marketing professionals to join for the discussion. The developers would pass on to architects useful feedbacks of user needs from previous users and buyers or special interest groups from the actual market. They informed the architects that the bottom line of the design is to create something nice, attractive, functional and cost effective apartments for potential buyers.

4.4.6 YTL DESIGN

For the respective results, Q13 to Q29, and Q34 to Q75 were analyzed.

4.4.6.1 Results of Preliminary Analysis

For the preliminary results, Q13, Q14 and Q17 were analyzed.

Q13 recorded what vision and mission statements of the company are, while Q14 recorded why the company does multi-storey residential buildings for low cost, medium cost and high cost types. The data provided background information for study of the relationship between two variables.

The results of the analysis for Q17 for relationship between price and design criteria are shown in Figure 4.39.

	Ranking of Importance		
	High Cost	Medium Cost	Low Cost
Aesthetics	3	3	4
Function	2	2	2
Social-culture	5	4	3
Cost	6	5	1
Sustainable	4	6	5
Site context	1	1	6
Feng Shui	-	-	-

Figure 4.39 Simple Relationship between Market Price and Design Criteria

4.4.6.2 Results of Correlation and Regression Analysis

The results of the correlation and regression analyses for Q34 to Q75 are shown in Table 4.19 and Figure 4.40 for all seven dependent variables (DV_{1-7}).

In comparing the results of the analysis for YTL with that of Atelier, V-Tac, GDP and the eight developers, it was found similar observed patterns of correlation and regression between

the market price and design criteria for the multi-storey residential buildings. The correlation is positive and significant except the cost. The scatter diagram of regression shows a straight line of causal relationship except the cost.

In summary, it was found that the results of correlation and regression patterns for the bivariate relationship between market price and design criteria replicate among the developers. It was also found that the observed patterns of correlation and regression patterns in the developers and architects' firms match with the predicted patterns of the hypothetical propositions.

Table 4.19 Results of Correlation between Market Price and Design Criteria

ytl	N	Pearson Correlation	Sig. (2-tailed)
Site Context		0.91**	.00
Aesthetics/Art		0.83**	.00
Function		0.91**	00
Sustainability		0.97**	00
Cost		-0.20	.69
Socio-Culture		0.90**	00
Feng Shui		0.92**	00

**. Correlation is significant at the 0.01 level (2-tailed).
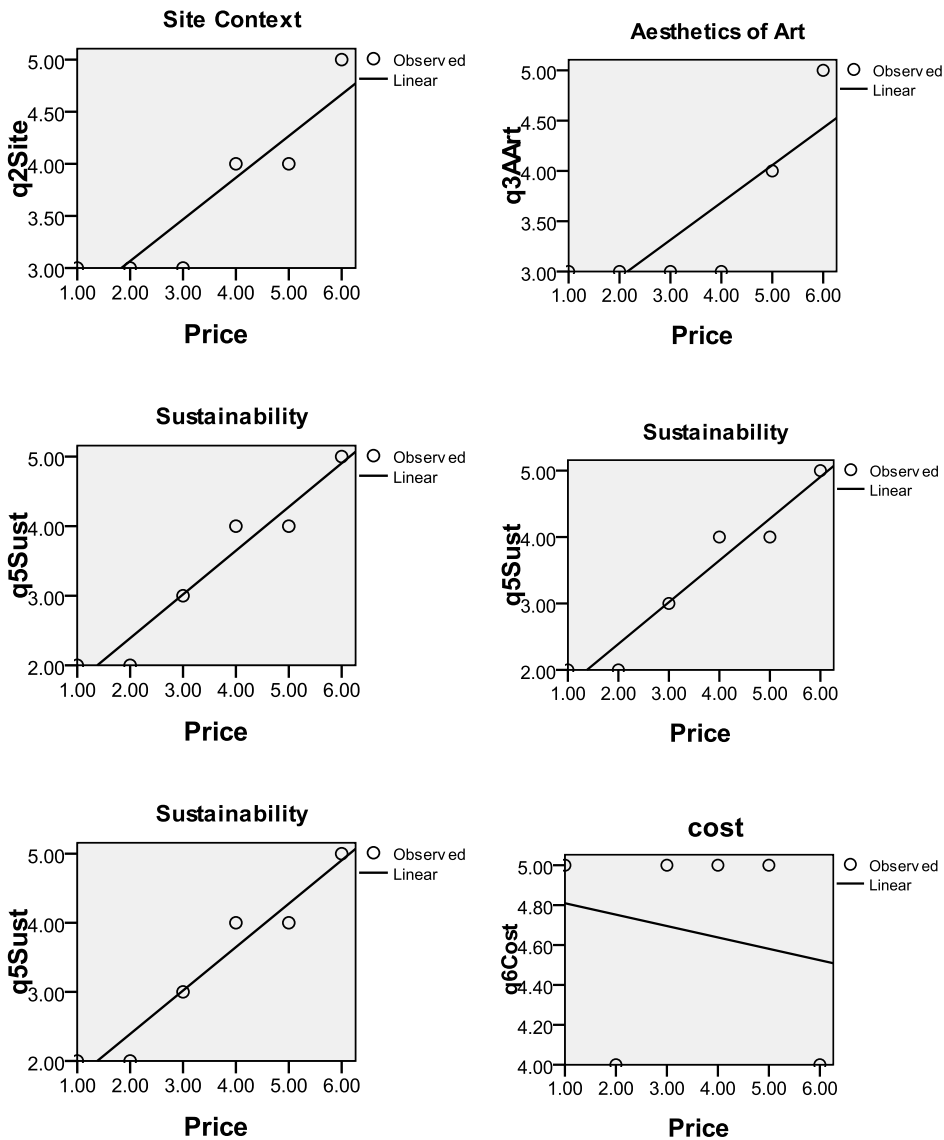
Figure 4.40 Results of Regression between Market Price and Design Criteria

DV$_{1yt}$ - Correlation and Regression Analysis between Price and Site Context

The correlation is positive and significant with r = 0.91 and p < 0.05. The scatter diagram of regression shows a straight line of causal relationship.

DV$_{2yt}$ - Correlation and Regression Analysis between Price and Aesthetics

The correlation is positive and significant with r = 0.83 and p < 0.05. The scatter diagram of regression shows a straight line of causal relationship.

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DV$_{3yt}$ -- Correlation and Regression Analysis between Price and Function

The correlation is positive and significant with r = 0.91 and p < 0.05. The scatter diagram of regression shows a straight line of causal relationship.

DV$_{4yt}$ - Correlation and Regression Analysis between Price and Sustainability

The correlation is positive and significant with r = 0.97 and p < 0.05. The scatter diagram of regression shows a straight line of causal relationship.

DV$_{5yt}$ - Correlation and Regression Analysis between Price and Cost

There is no correlation with r = -0.20 and p = 0.15 that is larger than p < 0.05. The scatter diagram of regression does not show a straight line of causal relationship.

DV$_{6yt}$ - Correlation and Regression Analysis between Price and Socio-culture

The correlation is positive and significant with r = 0.90 and p < 0.05. The scatter diagram of regression shows a straight line of causal relationship.

4.4.6.3 Results of Pattern Study for Design Brief

For study of patterns, Q13, Q14, Q15, Q18, Q19, Q20, Q21, Q26, Q27, Q28 and Q29 were analysed as in 4.4.3.3 and 4.3.3.3.

4.4.6.4 Results of Pattern Study for Users' Input

For study of user input pattern, Q13, Q14, Q16, Q18, Q19, Q20, Q21, Q22, Q23, Q24, and Q25 were analyzed as in 4.4.4.4 and 4.3.3.4.

4.4.7 AKIPRAKTIS

For the respective results, Q13 to Q29, and Q34 to Q75 were analyzed.

4.4.7.1 Results of Preliminary Analysis

For the preliminary results, Q13, Q14 and Q17 were analyzed.

Q13 recorded what vision and mission statements of the company are, while Q14 recorded why the company does multi-storey residential buildings for low cost, medium cost and high cost types. The data provided background information for study of the relationship between two variables.

The results of the analysis for Q17 for relationship between price and design criteria are shown in Figure 4.41

	Ranking of Importance		
	High Cost	Medium Cost	Low Cost
Aesthetics	3	2	6
Function	1	1	2
Social-culture	5	3	3
Cost	6	6	1
Sustainable	4	5	4
Site context	2	4	5
Feng Shui	7	7	7

Figure 4.41 Simple Relationship between Market Price and Design Criteria

4.4.7.2 Results of Correlation and Regression Analysis

The results of the correlation and regression analyses for Q34 to Q75 are shown in Table 4.20 and Figure 4.42 for all seven dependent variables (DV_{1-7}).

In comparing the results of the analysis for Akipratis with that of YTL, Atelier, V-Tac, GDP and the eight developers, it was found similar observed patterns of correlation and regression between the market price and design criteria for the multi-storey residential buildings. The

correlation is positive and significant except the cost. The scatter diagram of regression shows a straight line of causal relationship except the cost.

In summary, it was found that the results of correlation and regression patterns for the bivariate relationship between market price and design criteria replicate among the developers. It was also found that the observed patterns of correlation and regression patterns in the developers and architects' firms match with the predicted patterns of the hypothetical propositions.

Table 4.20 Results of Correlation between Market Price and Design Criteria

Pra	N	Pearson Correlation	Sig. (2-tailed)
Site Context		0.95^{*}	.00
Aesthetics/Art		0.92*	.00
Function		0.92**	00
Sustainability		0.96**	00
Cost		-0.65	.15
Socio-Culture		0.93**	00
Feng Shui		0.92	00

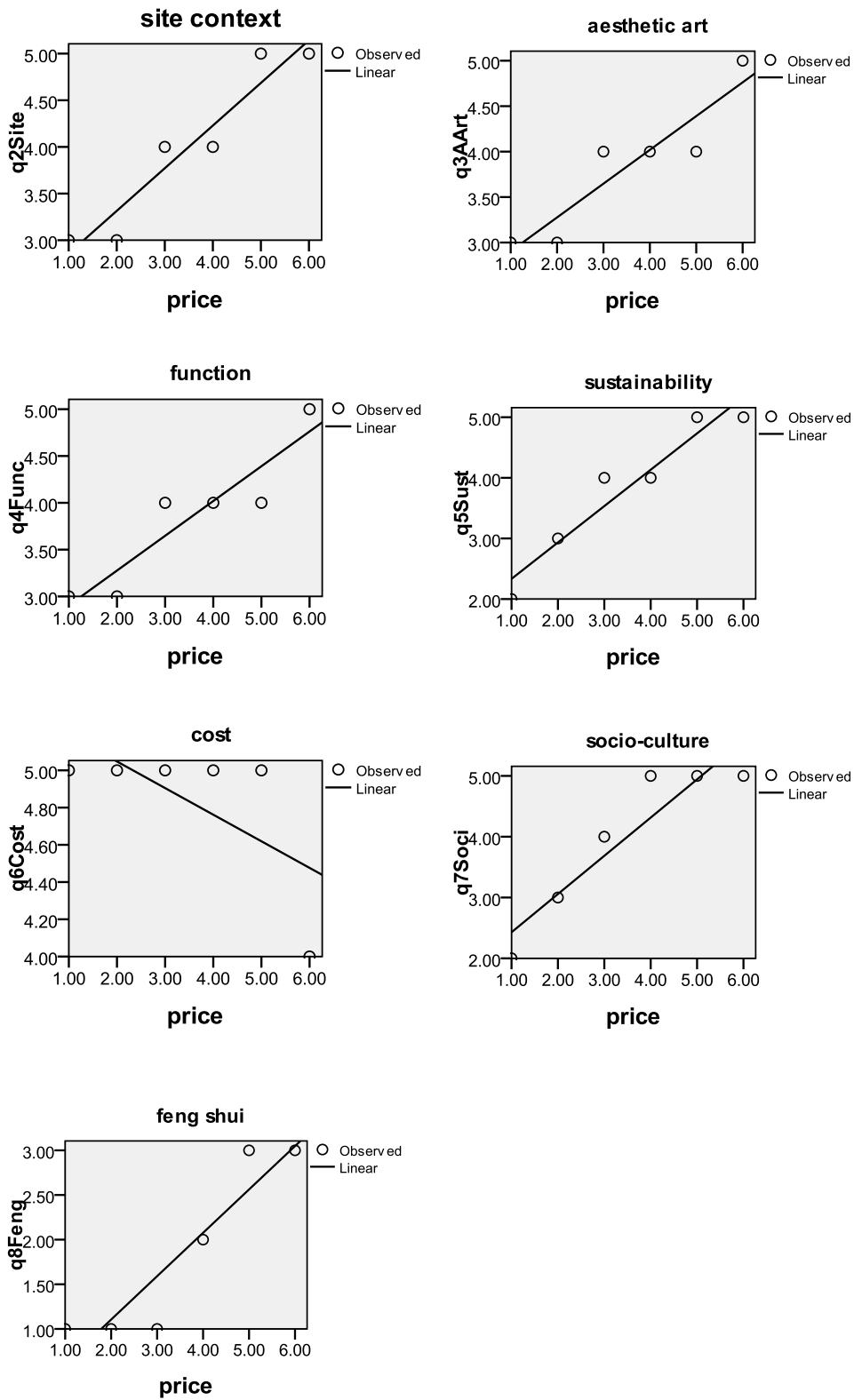**. Correlation is significant at the 0.01 level (2-tailed).

Figure 4.42 Results of Regression between Market Price and Design Criteria

4.4.7.3 Results of Pattern Study for Design Brief

For study of patterns, Q13, Q14, Q15, Q18, Q19, Q20, Q21, Q26, Q27, Q28 and Q29 were analysed and the results were similar as in 4.4.3.3 and 4.3.3.3.

4.4. 7.4 Results of Pattern Study for Users' Input

For study of user input pattern, Q13, Q14, Q16, Q18, Q19, Q20, Q21, Q22, Q23, Q24, and Q25 were analysed and the results were similar as in 4.4.4.4 and 4.3.3.4.5.6.8.

4.4.8 AKIPANEL

For the respective results, Q13 to Q29, and Q34 to Q75 were analyzed.

4.4.8.1 Results of Preliminary Analysis

For the preliminary results, Q13, Q14 and Q17 were analyzed. Q13 recorded what vision and mission statements of the company are, while Q14 recorded why the company does multi-storey residential buildings for low cost, medium cost and high cost types. The data provided background information for study of the relationship between two variables.

The results of the analysis of Q17 for relationship between price and design criteria are shown in Figure 4.43.

	Ranking of Importance		
	High Cost	Medium Cost	Low Cost
Aesthetics	2	2	5
Function	1	1	2
Social-culture	4	3	3
Cost	5	4	1
Sustainable	6	6	4
Site context	3	5	6
Feng Shui	7	7	7

Figure 4.43 Simple Relationship between Market Price and Design Criteria

4.4.8.2 Results of Correlation and Regression Analysis

The results of correlation and regression analysis for Q34 to Q75 are shown in Table 4.21 and Figure 4.44 for all seven dependent variables (DV_{1-7}).

In comparing the results of the analysis for Akipanel with that of Akipratis YTL, Atelier, V-Tac, GDP and the eight developers, it was found similar observed patterns of correlation and regression between the market price and design criteria for the multi-storey residential buildings. The correlation is positive and significant except the cost. The scatter diagram of regression shows a straight line of causal relationship except the cost.

In summary, it was found that the results of correlation and regression patterns for the bivariate relationship between market price and design criteria replicate among the developers. It was also found that the observed patterns of correlation and regression patterns in the developers and architects' firms match with the predicted patterns of the hypothetical propositions.

Table 4.21 Results of Correlation between Market Price and Design Criteria

aki	N	Pearson Correlation	Sig. (2-tailed)
Site Context		0.97**	.00
Aesthetics		0.96**	.00
Function		0.96**	00
Sustainability		0.96**	00
Cost		-0.65	.15
Socio-Culture		0.90**	00
Feng Shui		0.92**	00

**. Correlation is significant at the 0.01 level (2-tailed).
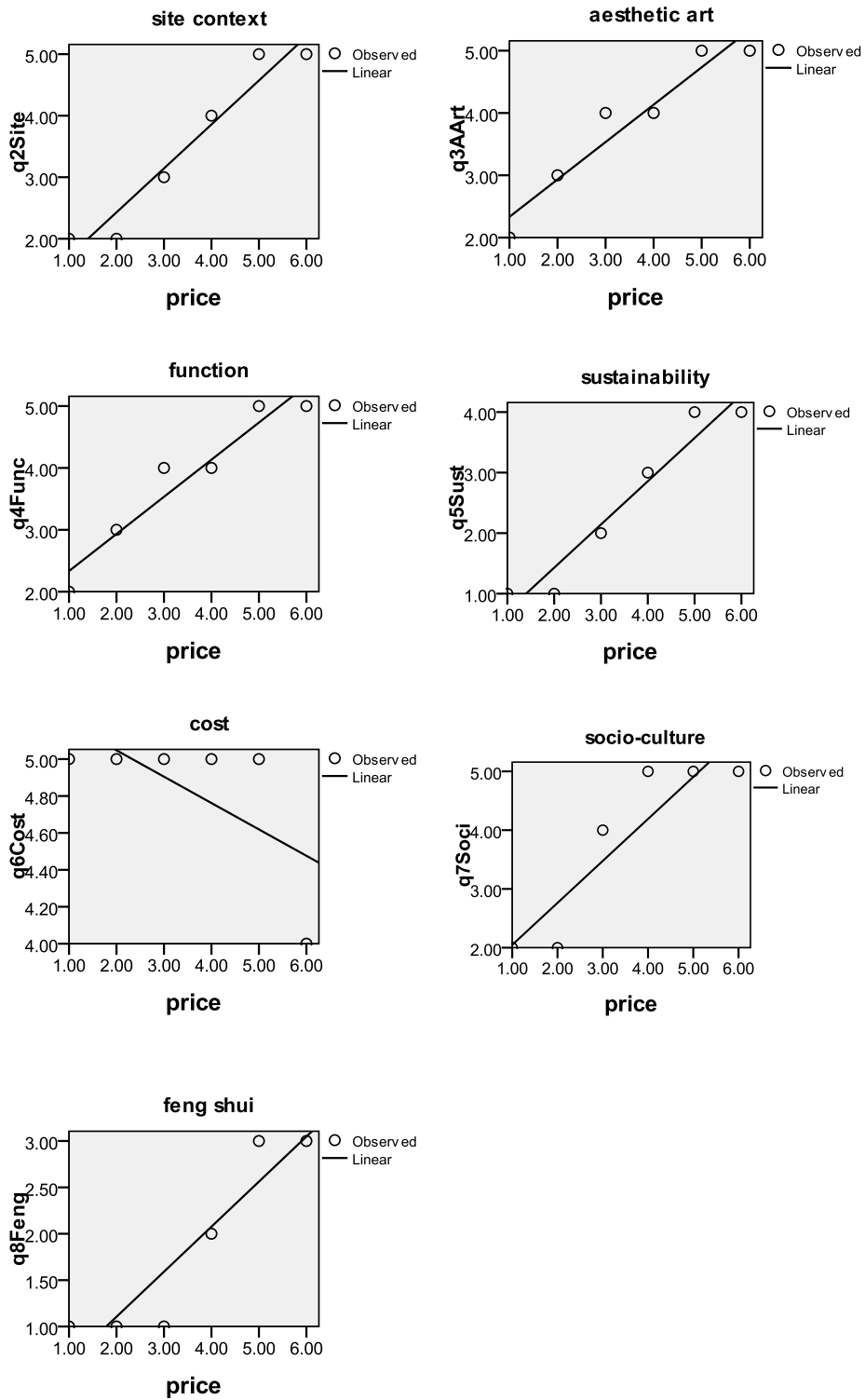
Figure 4.44 Results of Regression between Market Price and Design Criteria

4.4.8.3 Results of Pattern Analysis for Design Brief.

For study of patterns, Q13, Q14, Q15, Q18, Q19, Q20, Q21, Q26, Q27, Q28 and Q29 were analysed and the results were similar as in 4.4.3.3 and 4.3.3.3.

4.4.8.4 Results of Pattern Analysis for Users' Input

For study of user input pattern, Q13, Q14, Q16, Q18, Q19, Q20, Q21, Q22, Q23, Q24, and Q25 were analysed and the results were similar as in 4.4.4.4 and 4.3.3.4.5.6.8

4.5 Analysis and Results of Survey I and Survey II of Buildings and Plans

4.5.1 Intorduction

This data analysis was based on two surveys of multi-storey residential buildings and plans. Response data were recorded in the Survey I questionnaires Q1 to Q10 as per Appendix E1 and the Survey II questionnaires Q1 to Q10 as per Appendix F1,while data input in variable view and data view (data not inserted) of SPSS Data Editor as per Appendix E2 and Appendix F2 respectively .

4.5.2 Methods of Analysis

The analytical methods included correlation, regression, replication logic, and pattern matching logic. These methods had been described in Chapter 3.6.

4.5.2.1 Survey I and Survey II Questionnaires and Data Validity Check

For the inferential statistical analysis, the validity of the two datasets of first Survey I and second Survey II was checked for skew-ness and kurtosis. The acceptable range of values for a distribution is as follows:

$-1.9 <$ Skewness $< +1.9$
$-1.9 <$ Kurtosis $< +1.9$

The computed values of skew-ness and kurtosis for both the datasets tested are found to be within satisfactory range as shown in Table 4.22 and Table 4.23 below.

Table 4.22 Skewness and Kurtosis for the first surveyI

36	N	Skew-ness	Kurtosis
Site Context	36	-.07	-.67
Aesthetics/Art	36	-.04	-.91
Function	36	-.10	-.72
Sustainability	*36*	*-.10*	*-.81*
Cost	36	-.39	-.29
Socio-Culture	36	.18	-.35
Feng Shui	36	-.05	-.50

Table 4.23 Skewness and Kurtosis for the second survey II

	N	Skew-ness	Kurtosis
Site Context	49	.11	-1.1
Aesthetics/Art	49	.03	-1.27
Function	49	-.34	-.70
Sustainability	49	.30	-1.15
Cost	49	-.19	-.70
Socio-Culture	49	-.05	-.88
Feng Shui	49	.21	-1.12

4.5.3 Survey I of Thirty Six Buildings

For the correlation and regression results, Q7, Q8, Q9 and Q10 of the Survey I questionnaires were analysed as per Appendix E1 with the data input as per Appendix E2

4.5.3.1 Results of Correlation and Regression Analysis

The results of correlation and regression analysis are shown in Table 4.24 and Figure 4.45.

Table 4.24 Results of Correlation between Market Price and Design Criteria

	N	Pearson Correlation	Sig. (2-tailed)
Site Context	36	.82**	.00
Aesthetcis/Art	36	.83**	.00
Function	36	.79**	.00
Sustainability	36	.81**	.00
Cost	36	.43**	.00
Socio-Culture	36	.65**	.00
Feng Shui	36	.68**	.00

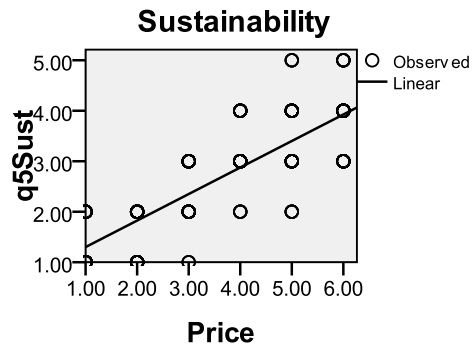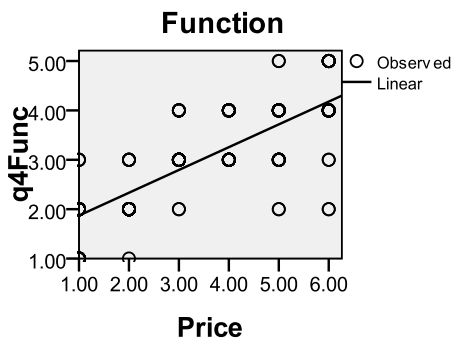**. Correlation is significant at the 0.01 level (2-tailed).
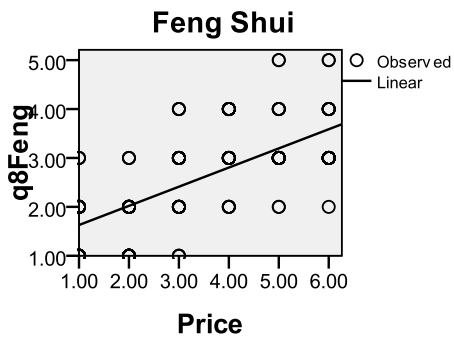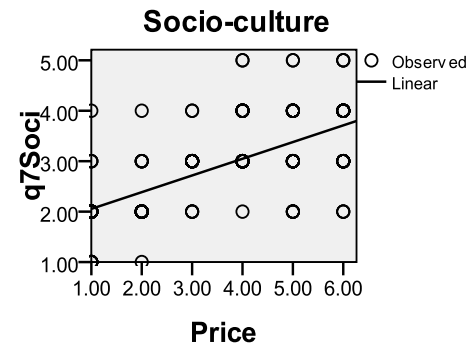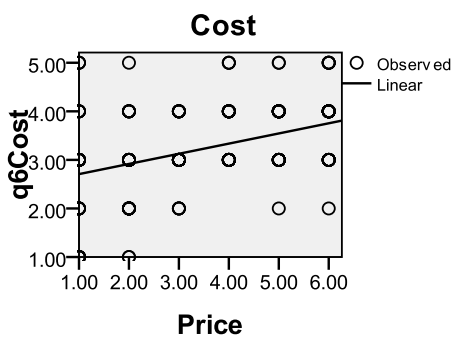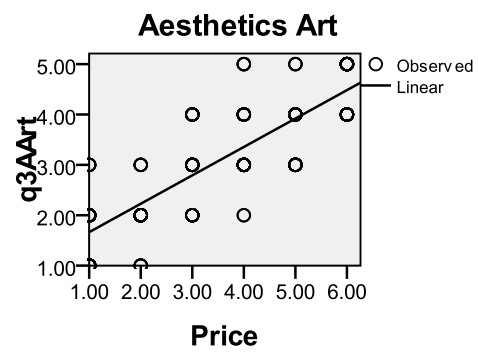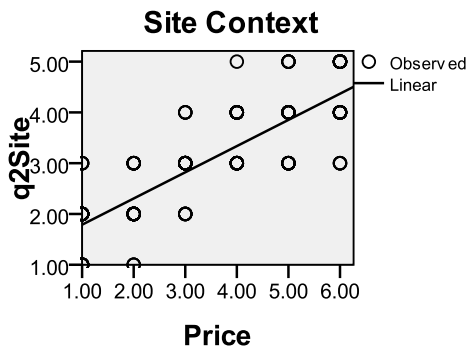
Figure 4.45 Results of Regression between Market Price and Design Criteria

The results of the analysis are interpreted as follows:

DV$_{1/36}$ - Correlation and Regression Analysis between Price and Site Context

The correlation is positive and significant but some different with r = 0.82 and p < 0.05. The scatter diagram of regression shows a straight line of causal relationship.

DV$_{2/36}$ - Correlation and Regression Analysis between Price and Aesthetics

The correlation is positive and significant but marginal different with r = 0.83 and p < 0.05. The scatter diagram of regression shows a straight line of causal relationship

DV$_{3/36}$- Correlation and Regression Analysis between Price and Function

The correlation is positive and significant but marginal different with r = 0.79 and p < 0.05. The scatter diagram of regression shows a straight line of causal relationship.

DV$_{4/36}$- Correlation and Regression Analysis between Price and Sustainability

The correlation is positive and significant but marginal different with r = 0.81 and p < 0.05. The scatter diagram of regression shows a straight line of causal relationship.

DV$_{5/36}$- Correlation and Regression Analysis between Price and Cost

There is correlation with r = 0.43 and is less than p < 0.05. The scatter diagram of regression also shows a straight line of causal relationship.

DV6/36 - Correlation & Regression Analysis between Price & Socio-culture

The correlation is positive and significant with r = 0.65 and p < 0.05. The scatter diagram of regression shows a straight line of causal relationship.

DV$_{7/36}$- Correlation and Regression Analysis between Price and Feng Shui

The correlation is positive and significant with r = 0.68 and p < 0.05. The scatter diagram of regression shows a straight line of causal relationship. In comparing the results of the analysis of the 1st survey with the seven architectural firms and the eight developers, it was found that similar observed patterns for the correlation and regression between the market price and design criteria for the multi-storey residential buildings except the cost.

It was further found that the similar results of correlation and regression replicate among the case studies and survey. It was also found that the observed patterns of correlation and regression in the survey were matched with the predicted patterns of the study hypothesis.

4.5.4 Survey II of Forty Five Buildings

For the correlation and regression results, Q7, Q8, Q9 and Q10 of the Survey II questionnaires were analysed as per Appendix F1 with the data input as per Appendix F2

4.5.4.1 Results of Correlation and Regression Analyses

The results of correlation and regression analyses are shown in Table 4.25 and Figure 4.46.

Table 4.25 Results of Correlation between Market Price and Design Criteria

	N	Pearson Correlation	Sig. (2-tailed)
Site Context	49	.90**	.00
Aesthetics/Art	49	.90**	.00
Function	49	.83**	00
Sustainability	49	.83**	00
Cost	49	.61**	.00
Socio-Culture	49	.79**	00
Feng Shui	49	.81	00

**. Correlation is significant at the 0.01 level (2-tailed).
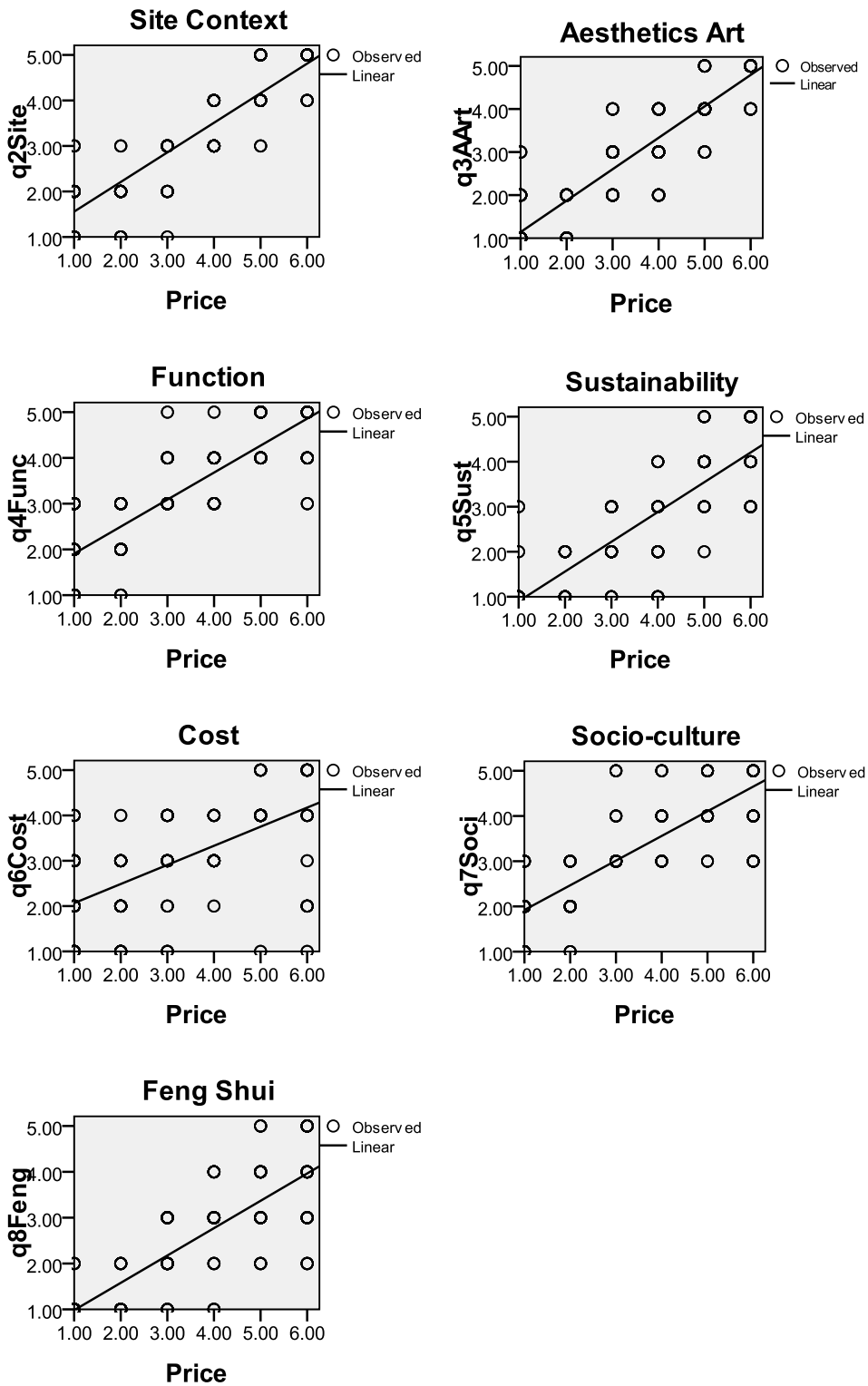
Figure 4.46 Results of Regression between Market Price and Design Criteria

The results of the correlation and regression analyses are interpreted as follows:

DV1/49- Correlation and Regression Analysis between Price and Site Context

The correlation is positive and significant but some different with r = 0.90 and p < 0.05. The scatter diagram of regression shows a straight line of causal relationship.

DV$_{2/49}$ - Correlation and Regression Analysis between Price and Aesthetics

The correlation is positive and significant but marginal different with r = 0.90 and p < 0.05. The scatter diagram of regression shows a straight line of causal relationship.

DV$_{3/49}$- Correlation and Regression Analysis between Price and Function

The correlation is positive and significant but marginal different with r = 0.83 and p < 0.05. The scatter diagram of regression shows a straight line of causal relationship.

DV$_{4/49}$- Correlation and Regression Analysis between Price and Sustainability

The correlation is positive and significant but marginal different with r = 0.83 and p < 0.05. The scatter diagram of regression shows a straight line of causal relationship.

DV$_{5/49}$- Correlation and Regression Analysis between Price and Cost

There is correlation with r = 0.61 and is less than p < 0.05. The scatter diagram of regression also shows a straight line of causal relationship.

DV$_{6/49}$- Correlation & Regression Analysis between Price & Socio-culture

The correlation is positive and significant with r = 0.79 and p < 0.05. The scatter diagram of regression shows a straight line of causal relationship.

DV$_{7/49}$- Correlation and Regression Analysis between Price and Feng Shui

The correlation is positive and significant with r = 0.81 and p < 0.05. The scatter diagram of regression shows a straight line of causal relationship.

4.6 Summary

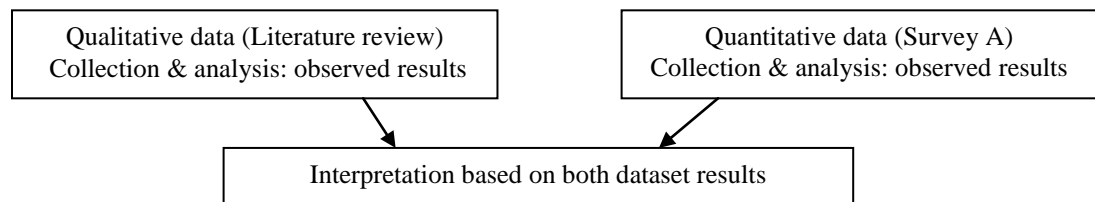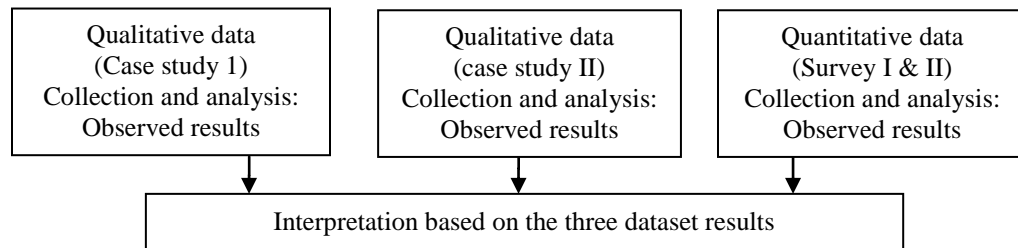Apart from determining design criteria, establishing bivariate relationships, the analysis of the four empirical evidences shows several other important results including triangulation, replication, pattern matching etc. The replication and pattern matching are discussed and explained in Chapter 5 and 5.8 and the triangulation is as follows:
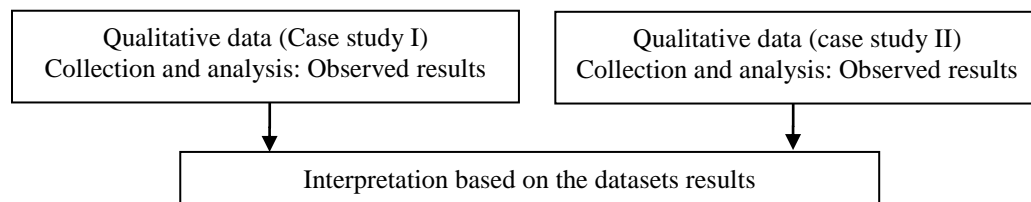
4.6.1 Triangulation

a. The first triangulation is found in determining a set of seven architectural design criteria. It is the convergence of the similar observed results of qualitative data from literature review and quantitative data from survey A as shown below:

```
┌─────────────────────────────────────┐   ┌─────────────────────────────────────┐
│  Qualitative data (Literature review)│   │  Quantitative data (Survey A)        │
│  Collection & analysis: observed      │   │  Collection & analysis: observed     │
│  results                              │   │  results                             │
└─────────────────────────────────────┘   └─────────────────────────────────────┘
              │                                         │
              ▼                                         ▼
        ┌─────────────────────────────────────────────────┐
        │  Interpretation based on both dataset results     │
        └─────────────────────────────────────────────────┘
```

b. The second triangulation is found in establishing the relationships between the market price and architectural design quality criteria. It is the convergence of the similar results of correlation and regression of the bivariate relationships from case study I of developers, case study II of architectural firms, survey I and II as shown below:

```
┌──────────────────┐  ┌──────────────────┐  ┌──────────────────┐
│ Qualitative data │  │ Qualitative data │  │ Quantitative data│
│  (Case study 1)  │  │  (case study II) │  │  (Survey I & II) │
│ Collection and   │  │ Collection and   │  │ Collection and   │
│ analysis:        │  │ analysis:        │  │ analysis:        │
│ Observed results │  │ Observed results │  │ Observed results │
└──────────────────┘  └──────────────────┘  └──────────────────┘
         │                     │                     │
         ▼                     ▼                     ▼
   ┌───────────────────────────────────────────────────┐
   │  Interpretation based on the three dataset results  │
   └───────────────────────────────────────────────────┘
```

c. The third triangulation is found in validating the RH2 and RH3 research hypotheses. It is the convergence of the similar results of the observed patterns of client-architect works in making design decisions from case studies of developers and case studies of architectural firms as shown below:

```
┌─────────────────────────────────────┐   ┌─────────────────────────────────────┐
│  Qualitative data (Case study I)     │   │  Qualitative data (case study II)    │
│  Collection and analysis: Observed    │   │  Collection and analysis: Observed   │
│  results                              │   │  results                             │
└─────────────────────────────────────┘   └─────────────────────────────────────┘
              │                                         │
              ▼                                         ▼
        ┌─────────────────────────────────────────────────┐
        │  Interpretation based on the datasets results     │
        └─────────────────────────────────────────────────┘
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CHAPTER 5 DISCUSSION OF THE RESULTS

5.1 Backgorund Information of Literature Review to the Research Aims

Studies of residential satisfaction and quality in Malaysia have noted the importance of design quality of buildings to people and the environment. Studies of architectural practice overseas have similarly noted the importance of design quality of buildings to people and the environment.

In reviewing the literature, limited data was found on a set of architectural design criteria and the association between the market price and design quality of multi-storey residential buildings in Malaysia. Very little was found in the literature on the first research question RQ1 that is why certain multi-storey residential buildings lack architectural design quality, and the second research questions RQ2 that is how the practice of architecture contributed to this phenomenon.

This study was designed to determine a set of architectural design criteria for MSRB by literature and survey. The determined criteria were then applied to establish the effect of market price on design quality. This application was conducted through the case studies of eight developers, the case studies of seven architectural firms and the two surveys of low, medium and high cost multi-storey residential buildings. In addition, this study was designed to test a research hypothesis i.e. architectural design quality for MSRB decreases as market price decreases (RH1), and to validate two other research hypotheses: i.e. clients are more dominant than architects in making design decisions (RH2); and, there is a lack of congruence in design quality of the buildings between the users to whom the architects are ethically responsible and clients to whom the architects are accountable (RH3).

5.2 Statements of the Results

The results of this study were derived from four empirical evidences. They show several interesting and important findings. The first empirical results of the survey show positively a set of seven architectural design criteria for multi-storey residential buildings that were reviewed by literature. There are exceptions to the results of the Feng Shui criterion. The subsequent three empirical results show contradiction between the business goals of the clients and the design ideas of architects' convictions. The contradiction caused issues of design quality in the conception of architectural design except for the cost criterion. In addition, the market price was also found to cause similar design quality issues. Contrary to expectations, this study did not find a significant change in cost criterion with market price. However this finding does not imply that the cost criterion is not important. In contrast to the other six design criteria, this study found that the cost criterion is very important to all developers for the low, medium and high cost multi-storey residential buildings. Interestingly developers were more flexible to costing of the high cost projects than the medium and low cost projects for business profitability and company branding and culture. These three factors of the business are prevalent in most top developers with strong company vision and mission. For the low cost projects, developers were very firm on the cost for development comprising the design, construction, materials and quality. Besides, these developers explored new building systems or technologies to save time and cost.

This study produced results which generally collaborate with the findings of the previous works in this field. The findings of the current study are consistent with those of Blau, (1987), Gutman, (1988), Cuff, (1992) and Pressman, (2005) who found design quality issues being affected by contradiction in architectural practice. Similarly the findings of the current study

are consistent with those of Tan (1980), Husna and Nurijan (1987), Goh, (2007), Salleh (2008) and Mohit (2010) who found design quality issues in multi-storey residential buildings in Malaysia. The findings of this current study for the seven design criteria are in general consistent with those of the literature except for the Feng Shui.

One very important finding is that this study does not show user participation in the conception of architectural design through case studies of eight developers and seven architectural firms. Users are an essential social group in housing but developers and architects generally have neglected their participation. The social importance of architecture will be discussed more in 5.6.

Both expected and unexpected results with its limitations are discussed in the following four empirical evidences: a survey of professionals; a case study of eight developers; a case study of seven architectural firms, and; two surveys of multi-storey residential buildings of the low, medium, and high cost. Prior to this is a brief discussion of arguments for measurement of the eccentricity of design quality in architecture.

5.3 Measurement of Eccentricity of Design Quality in Architecture

This thesis is centered on design quality issue in architectural practice which has been argued over the measurement of quality. The argument between the traditional and current approach has extreme positions. M. Cook (2007) comments the architecture and design quality is seldom without controversy, as it is perceived as subjective. Cuff (1992) comments the debate of design quality as a controversial issue. The issue lies on the philosophical question of whether design quality can be absolutely determined. According to Cuff, design quality can

be defined as a phenomenological entity perceived by individuals, not just as an inherent quality of the object or building. Blau (1987) comments criteria for evaluation were in disarray as there were differences in the architectural community during the mid-1970s. The differences were caused by the polarity of convictions among architects and the waffling of critics as to what the directions of architecture are. Paradoxically professional organisations or their members tend to agree about quality. They may argue about ideas, approach and style, and at the end they produce reasonable judgments for quality which is good and useful (Becker, 1982; RIBA, 2010).

Geertz (1993) has said that we do not know how design quality is achieved: '...We do know very little about what it is like, these days…creative activity.' Salaman (1974) has identified architects who believe the good design quality but disagree as to its definition.

Design quality and creativity in architecture is historically, and still predominantly, sought in the special nature of the individual. This is found in studies of the works of arts (Cary, 1958; Deinhard, 1970) and the character of the individual genius in architecture: their passions (Pevsner & Todd, 2005), intentions (Norberg-Schulz, 1968), minds (Summerson, 1963), intensity (Schuyler, 1964). Watkin (2001) states the history of architecture is built on genius who are 'the creative, mysterious and unpredictable', and rejects the explanation by sociological findings. This notion of individual genius by interpretation analysis is contended by results of sociological studies (Boyle, 1977; Saint, 1983; Stevens, 2002). The interpretation is mainly to communicate the true measure and significance of feeling and ideas. In contrast, sociological study (Blau, 1987) is to show how social conditions in which architectural design develop and influence the nature of this development, assuming creativity is necessary. The sociological study considers creative products and examines the conditions

in the firm or practice rather than just creative individuals and the characteristics of designers in the interpretation analysis. This approach opens up options in measurement of architectural design quality.

From a sociological aspect, there is considerable support for some sort of recognition of the measurement of architectural design quality. M. Cook (2007) has developed an objective evaluation matrix with five defined levels of design quality. The matrix can be applied to measure the quality by three sources of data comprising a visual survey, professional judgment and then by scientific measurement. Cuff (1992) evaluates excellent building quality as one that perceived by three parties comprising the consumers or the public at large, the participants in the design process, and the architectural profession. Blau (1987) measures design quality in architecture by questionnaire survey from three sources of collegial evaluations including: the faculty teaching members in each of the five New York City schools of architecture; the number of times the work of a firm had been reviewed in professional journals during the preceding five year period; and the combined number of awards received and competitions won during the preceding five year period.

In this study, measurement of architectural design quality is based on four empirical fields: the professional judgment of the architectural design criteria; developers' decision on the design criteria in development and design process; architects' decision on the design criteria in design process, and; survey of buildings of the low, medium and high cost at site for the relationships between the market price and design criteria. These multiple sources of measurement support the assumption that standards are generally shared and that the different sources of evaluation yield the same results. It shows that no measure is inherently better than others but is based on methodological ground in a social context.

5.4 Survey A Results of the Ninety Five Professionals

The results of this study show several interesting and important findings. The most important finding is a set of seven architectural design criteria comprising site context, aesthetics, function, sustainability, cost, socio-culture, and Feng Shui that applied by certain communities. Another important finding is that the results of the descriptive statistics are consistent with the inferential statistics. The results were in general consistent with the design criteria that reviewed by the literature (Adorno, 1979; Mak & So, 2009; Morgan, 2005; RIBA, 2010; Teather & Chow, 2000; Williams, 2007). An interesting finding is a preliminary ranking of the set of design criteria by frequency scores. The most interesting finding was the highest variability of Feng Shui that could be applied as a design criterion for certain local business and education communities. Other interesting finding was the one sample t-test for a hypothesized population and the two independent sample t-tests for comparing the mean differences of majority opinion between the practitioners and academicians, and the male and females. These findings with its limitations are discussed in the following descriptive and inferential statistical results.

5.4.1 Frequency Results of the Criteria

The results of this frequency statistics showed that 90% and above majority opinion with agree to site context, aesthetics, function, sustainability, cost, socio-culture except for the Feng Shui. These results in a descending order are presented in Table 5.1, and in general concur with the review of literature.

Table 5.1 Frequencies' Percentage for Each Design Criteria

Criteria	N	Strongly disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly agree 5	Agree & Strongly agree 4 & 5
Function	95	0.0	0.0	0.0	17.9	82.1	100
Socio-Culture	95	0.0	0.0	1.1	44.2	54.7	99.9
Site Context	95	0.0	0.0	1.1	22.1	76.8	98.9
Cost	95	0.0	0.0	2.1	58.9	38.9	97.8
Aesthetics/Art	95	0.0	0.0	6.3	44.2	49.5	93.7
Sustainability	95	0.0	0.0	10.5	51.6	37.9	89.5
Feng Shui	95	1.1	12.6	36.8	43.2	6.3	49.5

The histograms in Figure 5.1 show some interesting and important results. The results of six design criteria show a hump towards the right end, creating a right-skewed case, while the seventh criterion Feng Shui has a fairly normal distribution. In contrast to function, the results of the Feng Shui in Table 5.1 accounted for the highest variability values of the standard deviation as shown in Table 5.2. The right-skewed humps of the six criteria explain that the majority opinion on agree with '4' and '5', while the centre hump of Feng Shui explains that the majority opinion on agree '4' and neutral '3', tailing out to both ends of strongly agree with '5' and of strongly disagreed with '1'.

The results of Feng Shui criterion in Table 5.1 show certain significant relationships between the two variables. These results concur with the findings of Bond (Garcia Ferrari et al., 2008). Feng Shui is applicable for certain local business and educational communities though not taught in architectural schools. Indeed it has been an attention and interest of certain professionals and business communities.

The public today are quite receptive to 'Feng Shui design' for certain types of buildings. It has become a topic in newspapers, journals (Mak & Ng, 2008; Teather & Chow, 2000), books (Thompson, 1998), sale presentations of properties, and talks in public or PAM. The subject is also an interest of some architectural students who pursue as a dissertation. The interest of the subject has recently grown among the public, business and professional communities in residential and commercial buildings (Lip, 1990, 1992; Tong, 2004; Q. Wang, 1992).

In practice, the author encountered certain clients who wanted 'Feng Shui design' for residential buildings. These clients first consulted Feng Shui masters. In one project the building plan approval was granted but the Feng Shui master said that date for certain good Feng Shui has passed, and the projected had to be immediately aborted. In another project the final architectural design was completed, but the Feng Shui master advised that the south side of the building must not had water zone such as bath rooms, toilets, kitchen or swimming pool, and the design had to be changed accordingly. Feng Shui plays a significant role of design for certain communities!

5.4.2 Criteria Ranking by Frequency Results

The results of the frequency statistics show a preliminary ranking of the seven architectural design criteria in descending order as follows:

1) Function –   100%
2) Socio-Culture –   99.9%
3) Site Context –   98.9%
4) Cost –   97.8%
5) Aesthetics/Art – 93.7%
6) Sustainability – 89.5%
7) Feng Shui –   49.3% (36.8% Neutral or do not know enough)

5.4.3 Results of the Mean, the Mode and the Median

The results of the mean, the median, the mode in Table 5.2 also showed that 90% and above of the majority opinions of the respondents with agree to design criteria except for the Feng Shui. These results are consistent with that of the frequencies.

The function criterion showed the highest scores among the mean, median, mode and standard deviation in Table 5.2. However Feng Shui showed the lowest scores but the mean of 3.41 (above the mean 3) and the mode of 4 (above the mean 3).

Table 5.2 Ranking Results of the Mean with the Median, Mode and S.D

	N	Mean	Median	Mode	Std. Dev. (S.D)
Design Criteria					
Function	95	4.82	5.00	5.00	.38
Site Context	95	4.75	5.00	5.00	.45
Socio-Culture	95	4.53	5.00	5.00	.52
Aesthetics/Art	95	4.43	4.00	5.00	.61
Cost	95	4.36	4.00	4.00	.52
Sustainability	95	4.27	4.00	4.00	.64
Feng Shui	95	3.41	3.00	4.00	.83

Looking at the Feng Shui criterion in Table 5.2, the mean of 3.41 is significantly lying between "neutral" and "agree", accompanied by a slightly higher standard deviation of 0.83, showing higher variability within the survey participants. However the mode of this class is at 4.0, showing that "agree" was still the most popular choice. This implies that respondents were in the neutral/agree zone, but with a higher variability reflecting a diverse and varying opinion on the importance of Feng Shui as a design criterion as shown in Figure 5.1. In contrast, function showed the lowest variability reflecting a close consensus opinions on the importance as a design criterion as shown by the distribution in Figure 5.1.

The two histograms in Figure 5.1 show results of extreme variability by standard deviation. Function shows the lowest variability while Feng Shui the highest.
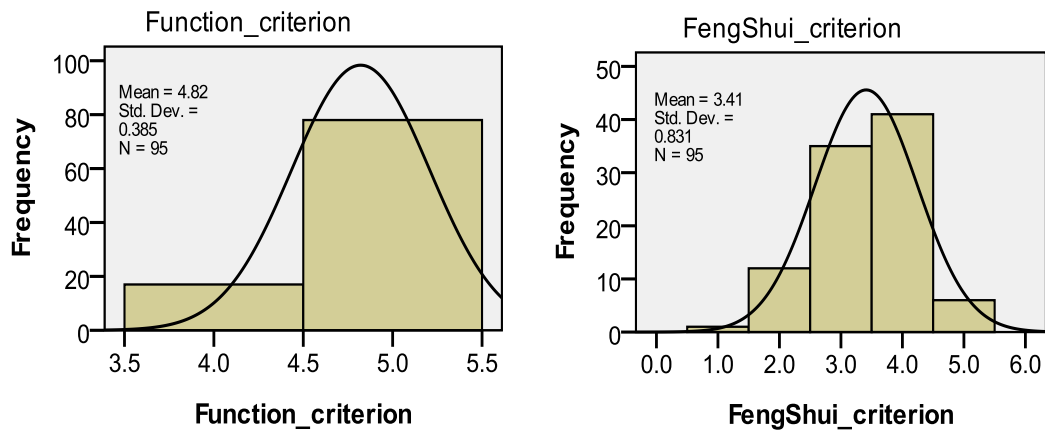
Figure 5.1 Frequency Histograms with Distribution Curves

5.4.4 Consistent Results of Single Sample T-test

The results of this t-test for comparing sample mean with population mean further showed the set of design criteria by majority opinions. The results in a descending order of the means are shown in Table 5.3.

This t-test conducted the null hypothesis testing for the two groups on the two variables, hence provided more distinct and varied findings for a given sample size in a population.

Table 5.3 Results of One-Sample T-test

	N	Mean	Std. Deviation	Std. Error Mean	Test Value = 4		
					t	df	Sig. (2-tailed) $P < .05$
Function	95	4.82	.38534	.03954	20.768	94	.00
Site Context	95	4.75	.45466	.04665	16.247	94	.00
Socio-culture	95	4.53	.52208	.05356	10.022	94	.00
Aesthetics/Art	95	4.43	.61285	.06288	6.864	94	.00
Cost	95	4.36	.52699	.05407	6.814	94	.00
Sustainability	95	4.27	.64317	.06599	4.148	94	.00
Feng Shui	95	3.41	.83149	.08531	-6.910	94	.00

5.4.5 Results of T-test for Practitioners & Academicians

For testing of the variability and consistency, practitioners and academicians were treated as separate groups that are in general independent and mutually exclusive. The independent two sample t-test compared the mean difference of opinions between these two groups. The positive results of this t-test further concluded the set of design criteria except for the marginal differences of the aesthetics. These results in a descending order of the means are shown in Table 5.4. Aesthetics is viewed as a value of subjective perception since the industrial revolution though historically rooted in architecture.

Table 5.4 Independent Sample T-test for Academicians and Practitioners

			Descriptive Statistics			Inferential Statistics		
		N	Mean	Std. Deviation	Std. Error Mean	Test Value = 4		
						t	df	Sig.(2tailed) P < .05
Function	academic	33	4.7273	.45227	.07873	-1.74	93	.08
	practicing	62	4.8710	.33797	.04292			
Site Context	academic	33	4.6970	.52944	.09216	-.95	93	.34
	practicing	62	4.7903	.41040	.05212			
Socio-culture	academic	33	4.5758	.50189	.08737	.52	93	.59
	practicing	62	4.5161	.53537	.06799			
Aesthetics/Art	academic	33	4.1515	.66714	.11613	-3.43	93	.00
	practicing	62	4.5806	.52941	.06724			
Cost	academic	33	4.3333	.59512	.10360	-.47	93	.63
	practicing	62	4.3871	.49106	.06236			
Sustainability	academic	33	4.2121	.64988	.11313	-.67	93	.49
	practicing	62	4.3065	.64245	.08159			
Feng Shui	academic	33	3.4545	.75378	.13122	.37	93	.70
	practicing	62	3.3871	.87506	.11113			

5.4.6 Results of T-test for Female and Male

This study of female and male was initiated because of its limited studies on female in the profession and practice of architecture. For further testing of the variability and consistency, male and females were treated as separate groups that are in general independent and mutually exclusive. The independent two sample t-test compared the mean difference of opinions between them. The positive results of this t-test further concluded the set of design criteria except for the marginal differences of the cost. The results on a descending order of the means are shown in Table 5.5.

Table 5.5 Independent Samples T-test for Comparing the Female with Male

		N	Mean	Std. Deviation	Std. Error Mean	Test Value = 4		
						T	df	Sig.(2tailed) P <.05
Function	Male	76	4.8026	.40066	.04596	-.93	93	.354
	Female	19	4.8947	.31530	.07234			
Site Context	Male	76	4.7237	.47885	.05493	-1.47	93	.143
	Female	19	4.8947	.31530	.07234			
Socio-culture	Male	76	4.4868	.52898	.06068	-1.89	93	.062
	Female	19	4.7368	.45241	.10379			
Aesthetics/Art	Male	76	4.4605	.59868	.06867	.92	93	.360
	Female	19	4.3158	.67104	.15395			
Cost	Male	76	4.4342	.49895	.05723	2.50	93	.014
	Female	19	4.1053	.56713	.13011			
Sustainability	Male	76	4.2763	.66531	.07632	.07	93	.937
	Female	19	4.2632	.56195	.12892			
Feng Shui	Male	76	3.3553	.85952	.09859	-1.30	93	.197
	Female	19	3.6316	.68399	.15692			

This t-test shows three important findings: firstly the number of the females (19) is lesser than that of the males (76); secondly the number of females employed in academic is higher than the males; thirdly the number of females employed on salaried basis is more than males.

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Historically females have been restricted or 'prejudiced' by social norms to enter into this profession until the last half centuries. This study showed that only 19 out of the 95 are female matured registered professional architects. Cuff (1998) comments that data about women architects is slim like much data about the architectural profession. The American Institute of Architects (1983) has conducted a study of Membership Survey on the Status of Women in the Profession'. In this study it shows the effects of sex discrimination on advancement in career because of lesser number and higher mean age for women as compared with that for men. Larson (1977) writes "only sons were sent aboard for training in the 1700s". Wright (1953) mentions Julia Morgan the first woman was sent abroad for study at the Ecole des Beaux Arts, and obtained her certificate in 1901.

5.4.7 Threats to Research Validity

The results of this survey study were subject to some threats to research validity. The threats included the constructs, internal validity, external validity and reliability. However, most statistical analytical models have taken consideration of error factors into the derivation of the mathematical models. The threats occurred among the stratified purposeful sampling, structured interviews, predetermined survey questionnaires, and characteristics of persons under studied. These threats that caused elements of bias are discussed in the following.

For better stratification, it took longer time, effort and funds to work out the detail number of the cross section of architectural professionals for the population frame. The sampling frame based on the stratification was useful in providing a listing of each element in the population. However the list may not always be current and updated information in reality. For a limited time and effort given, and as an individual researcher, complete randomization cannot be

achieved easily. This short coming was but mitigated with selected sample of some stratification and sample size of the respondents applied.

For the structured interview and predetermined survey questionnaires, the bias elements were brought into the collected response data and the analytical tools. Firstly there was the predetermination of elements with the weighted questions. Secondly there was the restricted opportunity for the interviewee to provide further information beyond the predetermined questions. However this approach was deemed as necessary and used effectively to compare the differences in the interviewees' responses in showing real differences in what was being measured.

Thirdly there was the preconditioning of interviewers to ensure that each interviewee would answer the same questions and that opinions were captured for specific enquiry. Lastly there was the variability of individual human factors such as behavior, attitude and experience among the interviewers or interviewees that could also significantly color the surveys.

5.5 Case Study I Results of Developers

The results of this study show several interesting and important findings. The first important finding was the correlation ($p \leq 0.05$) that is the relationships between the market price and design criteria were positive and significant except for the cost criterion. The second important finding was the regression that is the relationships between the market price and design criteria were linear and causal except for the cost criterion. The third important finding was the replication that is the similar correlation and regression outcome patterns of the relationships between the two variables were replicated across the eight cases. The fourth

important finding was the pattern-matching that is the empirical observed patterns were matched with the predicted patterns of the hypothesis RH1 except the cost criterion. The fifth important finding was the positive hypothesis testing of RH1.architectural design quality for multi-storey residential buildings generally decreases as market price decreases. Lastly the sixth and seventh findings were the two other hypotheses: RH2.clients are more dominant than architects in making design decisions, and; RH3.there is a lack of congruence of the design quality of the buildings between the users to whom the architects are responsible to and clients to whom the architects are accountable.

An interesting finding is that this study did not find any correlation between the market price and the cost. However this finding implies some important reasons for explaining the design quality issues. The issues are related to the government aids, developers' business profitability, consultant's fees and the ethical role of architects as a profession. In contrast to the other six criteria, the developers placed the cost almost equally important for the low, medium and high cost units. The developers explained that the costing was most important for the low cost units than the medium and high cost units. For the low cost, developers commented that the development cost for each completed low cost unit did not meet the sum of allocated financial aids and the sale. As a result, there were insufficient funds for developers, architects, consultants and contractors to do the projects with better design quality for people and the environment. For the medium high and high cost units, developers commented that there were substantial inputs to design quality of projects such as iconic image, sustainable features, signature etc. The developers pitched world renowned architects and award winning architects for projects. In addition, developers used design competitions for design quality.

Another interesting finding is that there was no user participation in the conception of architectural design. These evidences were obtained from responses in the case study questionnaires of user studies Q15, Q16, Q22, Q23, Q24 and Q25 as shown in Appendix C1, C2 and C3. The answers to these questions of why and how reveal some important findings. Developers conducted indirect user participation by focus groups and surveys of users of the previous apartments or condominiums. Developers sourced from the market or employed in-house real estate marketing professionals for these jobs. The aim is to sell.

Not unexpectedly this study did not get all developers to respond to the questionnaires on the relationships between the market price and Feng Shui criterion. There were five out of the eight developers participated. The reason for not responding was mainly due to the convictions of the owners of the company.

5.5.1 Threats to Research Validity

In contrast to survey, the case study results were subject to more serious threats to research validity. The threats were the constructs, internal validity, external validity and reliability. Case studies do not rely on randomisation. In an ideal world, experiment would be used for all research evaluations because they are the strongest in internal validity due to random assignment. However, randomization was not always possible for investigation in this real world. This lack of control in case studies was led to the use of quasi-experiment's non-equivalent group dependent variables (NEDV). The non-equivalent group is subject to several threats to research validity such as history, maturation, instrumentation and regression. To minimise such threats, developers were carefully selected for representation and generalisability of the subject.

This study selected eight developers. At least four developers were among the Top 30 and two developers were among the Top 10 of all developers in the country. The first developer S P Setia is today Top 1 winner for the EDGE Malaysia Top 30 Property Developers Awards 2011. This company has been one of the Top Ten Property Developers in Malaysia consecutively from 2008 to 2011. In addition, this company has been ranked as Aon Hewitt's 2011 (Malaysia) Best Overall Employer, and Asia Pacific 2011. The second developer Bandar Raya Developments Berhad (BRDB) has been voted as one of the Top 10 Property Developers in Malaysia for seven years consecutively from 2003 to 2009 by The Edge Malaysia. The other two developers YTL and PJD have also been voted as one of the Top 30 Property Developers for last several years consecutively by The Edge Malaysia.

One of the major threats to the case study research is the use of limited cases. Every case is significant and considered as a case 'experiment'. In an extreme case study research, even a single case can be considered fit and relevant for the investigation. For example: a single unique case study of an extraordinary and exclusive thing or person such as a president. The case study considers this as fit and fair as there is no replicate. This uniqueness of case study research in a real world can outdo what a survey or experiment would not do.

Another threat is the measurement of interval scale that assumed to be 'true' but not in the real sense. These exceptions are accounted for by Miles and Shevlin (2007) who suggest a more liberal approach to psychological or social research for assuming 1, 2, 3, 4 and 5 ranking order to be the interval scale. Robert, Brain and Uma (2001) suggest also a convention to applied business research for assuming 1, 2, 3, 4 and 5 ranking order to be interval scale.

Despite several threats, case study research can play a vital role in the natural sciences as well as social sciences. Many scientific fields, such as human biology, geology, and astronomy, do not always apply scientific investigation. The theory of evolution by Darwin, for example was based largely on case study research.

The case study research satisfies the characteristics of complexity science by analysing case materials in a holistic approach. Unlike quantitative analysis, the case study does not break, control and randomize wholes into variables and relationships to be studied separately. Complexity science views the whole as the sum of its parts, and not the whole in its parts. This important view is commensurate with a qualitative case study strategy which treats social entities as a whole. Social entities are complex, adaptive and dynamic systems whose evolving patterns must be understood as a whole rather than broken into piecemeal quantitative relationships. Anderson, Crabtree, Steele, & McDaniel (2005: 673-680; 681) write, "Complexity theory is a useful companion to case study, because it simultaneously fosters an attitude of attention to emerging patterns, dynamism, and comprehensiveness while focusing attention on defined system properties." They have described several principles for case study data collection in complexity science. Briefly these principles entail understanding the historical background of the entity under study, focusing on the gap between ideals and practice; the unexpected outcomes; the interdependencies among actors; the multidimensionality of relationships among actors; the sense-making among actors; the self-organization, adaptation, and emergence; and not solely on the foreground at the expense of the background, but instead looking to see the relation of major outcomes to small events and seemingly minor relationships among actors.

To minimise further threats, this study includes a case study of architectural firms and two surveys of buildings. This inclusive approach provides triangulation for multiple sources or cases of evidences into a converging single line of enquiry, and hence enhances research validity.

5.6 Case Study II Results of Architectural Firms

The results of this study show several interesting and important findings.

Firstly there are two sets of results that are based on the pre-survey and post-survey interviews. The pre-survey results did not show any relationships between the market price and design criteria. The post-survey results show quite similar to those of the developers but are found to be different in nature and peculiarity of the architects as a profession. Secondly there are like the developers, the similar important findings including the positive and significant correlation ($p \leq 0.05$), linear and causal regression, case replication, predicted and observed pattern matching, positive testing of the hypothesis RH1, and investigation of the hypotheses RH2 and RH3 to be true. Thirdly is an interesting finding that this study did not find any correlation between the market price and the cost. The discussions are similar to that of the developers as described in preceding sections. Fourthly is an important finding that there was no user participation in the conception of architectural design. Lastly this study did not get all architectural firms to respond to the questionnaires on the relationships between the market price and Feng Shui criterion. There were five out of the seven architectural firms that had participated. The reasons for not responding are the firms not knowing enough of the subject or they are neutral or they have their own convictions. The different nature and peculiarity of the architects as a profession are discussed in the following section.

5.6.1 Different Nature and Pecularityof the Same Results

The results of pre-survey interviews show no relationships between the market price and design criteria but some important findings. In these pre-survey interviews, the respondents generally ranked importance of seven design criteria for design of the low, medium and high cost residential buildings. These results imply that architects do consider the design criteria are important for design of the residential buildings. However they were restrained by clients, the market and their perception of architecture in practice.

In contrast, the results of the post-survey interviews show certain relationships between the two variables. In these post-survey interviews, the respondents generally ranked importance of design criteria for design of multi-storey residential buildings according to the client's design brief. These findings were obtained from case study questionnaires of relationship study Q15, Q16, Q22 to Q25, and Q34 to Q75 as shown in Appendix D1, D2 and D3.

Another important finding from these interviews is that there was no user participation in the conception of architectural design. These evidences were obtained from responses in the case study questionnaires of user studies Q15, Q16, Q22, Q23, Q24 and Q25 as shown in Appendix D1, D2 and D3. The answers to these dichotomous scale questions of why and how reveal some important findings. The results show that architects did not carry out social engagement with users that underline the social importance of architecture. This isolated position of architects has been commented by several architectural researchers (Andaya; Saint, 1983). Users are an essential social group in housing who actually live, eat and play there every day. They should play a role of social participation (Garcia Ferrari et al., 2008) in the architectural design process. Paul Jenkins (Forsyth, 2009) highlights the role of wider social participation in the architectural process among users, developers, architects etc. for

the good of society. There is a need to bridge this design gap between architecture and society for people and the environment. This design gap can be bridged through an understanding and applying 'architecture as a social art' (Cuff, 1992; Forsyth, 2009) in the design process. These are pending issues and challenges to architects and the profession.

These findings account for the RH2 - there is a lack of congruence in the design quality of the buildings between the users to whom the architects are ethically responsible and clients to whom the architects are accountable. These also explain the RH3 - developers are more dominant than architects in making design decision.

An interesting finding is an observed dichotomy of words and deeds by architects. What the architects said, they justified by their actions. They were applying what is called espoused theory. In a study of professional effectiveness, Argyris and Schon (1992) find that practitioners use proverbial contrast between what they say or believe and what they do. They speak in espoused theory to explain and justify their deeds, but revert to a theory in use to actually guide their deeds. They want us to hear more about beliefs and ideas than about the principles or theory in use that guide their actions. This study showed in architect practitioners a contradiction between espoused theory and theory in use. This conflict reduces professional effectiveness in the conception of architectural design.

5.6.2 Threats to Research Validity

Like developers, the case study results of the architectural firms were subject to more serious threats to research validity than survey. The threats included also the constructs, internal validity, external validity and reliability. These case studies did not rely on randomisation. The similar use of the quasi-experimental non-equivalent group dependent variable design is subject to several threats such as history, maturation, instrumentation and regression. The

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threats occurred among the purposeful structured interviews, predetermined survey questionnaires, and characteristics of persons under studies. These threats that caused elements of bias are similar to that of the developers as discussed in the preceding sections.

This study used seven pre-selected architectural firms that were appointed separately by the eight developers under study. Though the pre-selection is a threat to research validity, it enhances the investigation of the conception of architectural design process in practice. It provides the flow and opportunity of the whole process. There are three architectural firms that have been winners for the PAM architectural awards for the past several years. They were GDP, VERITAS and YTL Design Group.

5.7 Survey I and Survey II Results of Buildings and Plans

The results of survey I and survey II show similar findings to that of the developers and architectural firms. There are several interesting and important findings.

The first important finding was the correlation ($p \leq 0.05$) that is the relationships between the market price and design criteria were positive and significant. The second important finding was the regression that is the relationships between the market price and design criteria were linear and causal. The third important finding was the replication that is the similar correlation and regression outcome patterns of the relationships between the two variables were replicated across the two surveys. The fourth important finding was the pattern-matching that is the observed patterns of the relationships between the two variables of the empirical data were matched with the predicted patterns of the hypothesis RH1. The fifth important finding was the testing of the hypothesis RH1 that is architectural design quality for multi-storey residential buildings decreases as market price decreases. The sixth important survey finding is the triangulation for the multiple sources of case study evidence into a converging single line of enquiry for research validity.

However, these survey I and survey II findings show that there is relationship between the cost criterion and market price (low, medium and high cost). These are different from findings of that of the case studies of the developers and architectural firms. The reasons are: firstly the participants were final third year architectural students who have no practice but little working experience in design with cost; secondly the subject of design cost plan has not been generally taught much for studio projects; thirdly the six other criteria are taught except the Feng Shui being learned informally.

5.7.1 Threats to Research Validity

In contrast to the case study I and II, the survey I and II results were in general subject to lesser threats to research validity including construct, internal, external and reliability.

As the survey results were based on random selection of the buildings, the threats included were bias to the data collection rather than the analytical techniques. Most statistical analyses have already taken much error factors into mathematical models such as correlation and regression models. The threats occurred among the purposeful sampling of participants, and predetermined survey questionnaires.

For the purposeful sampling of participants and predetermined survey questionnaires, the bias elements were brought into the collected response data. First was the predetermination of elements of the questions that would be bias. Second was the restricted opportunity for the interviewee to provide further information than the predetermined questions. However this approach was deemed as necessary as used effectively to compare the differences in the interviewees' responses as showing real differences in what was being measured. Third was the preconditioning of interviewers to ensure that each interviewee would answer the same questions and that opinions were captured for specific enquiry. Lastly were the variability, individuality and uncertainty of the human factors such as behavior, attitude and relevant experience among interviewees.

For research validity, the survey I and II have provided the case study I and II triangulation for the multiple sources of evidences into a converging line of enquiry. The triangulation was explained and presented in Chapter 4. 4.6.

5.8 Summary

The case study and survey results are subject to some threats to research validity such as the constructs, internal validity, external validity and reliability. The threats occurred among the stratified purposeful sampling, structured interviews, predetermined questionnaires, and characteristics of persons under studied.

However, these results show several interesting and important findings that linked to the research problem, questions and objectives. Apart from determining design criteria, establishing bivariate relationships and testing RH1, the results of the four empirical evidences shows several other important findings including triangulation, replication, pattern matching etc. The triangulation was explained in Chapter 4 and 4.6. The replication and pattern matching are explained as follows:

5.8.1 Replication

a. The first replication is found in the Case Study I of eight (8) developers. In comparison, the similar results of the first individual case replicate in the other seven individual cases. These similar results are the significant and positive correlation and the linear regression of the bivariate relationship. These eight cases of Case Study I demonstrate literal replication for an analytical generalisation.

b. The second replication is found in the Case Study II of seven (7) architectural firms. Similarly in comparison, the similar results of the first individual case replicate in the other six individual cases. The similar results are the significant and positive correlation and the linear regression.

   In addition, in comparison the similar results of the Case Study I replicate in the Case Study II, providing cross studies replication.

c. The third replication is found in the Survey I and the Survey II. Similarly in comparison, the similar results of the Survey I replicate in the Survey II. The similar results are the significant and positive correlation and the linear regression of the bivariate relationship. In addition, the similar results of the Case Study I and the Case Study II replicate in the Survey I and the Survey II, providing further cross studies replication. In addition these results provide statistical generalisation.

5.8.2 Pattern Matching

The pattern matching is found in the testing of the RH1 research hypothesis. The observed patterns of the correlation and regression of the bivariate relationship in the case studies of developers, the case studies of architectural firms, the survey I and the survey II were matched with the predicted patterns of the RH1. This is illustrated as follows:

Predicted pattern   Observed pattern

N	O_{RH1-7}	X	O_{DV1-7}
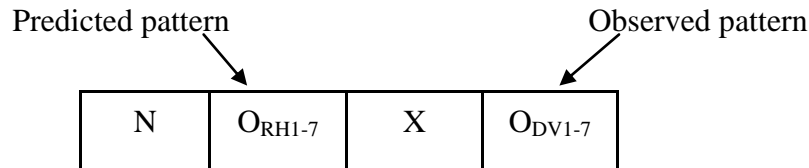
- O_{RH1-7} are theoretical predicted patterns of the RH1 of the bivariate relationships and used as a template.

- O_{DV1-7} are observed patterns of the architectural design criteria under influences of the market price under investigation:

    O_{DV1}=site context, O_{DV2}=aesthetics, O_{DV3}=function, O_{DV4}=sustainability,

    O_{DV5}=cost, O_{DV6}=socio-culture, O_{DV7}=Feng Shui.

- The observed patterns of the bivariate relationship of RH1 were established:

    Correlation: Positive and significant relationship except for the cost;

    Regression: Linear and causal relationship except for the cost.

- Research findings show that the theoretical predicted patterns O_{RH1-7} and observed patterns O_{DV1-7} were matched by the following conditions:

    Two and more cases and studies provided the similar results;

    Literal replication was found and claimed to strengthen its validity;

    Two kinds of generalisations were achieved;

        Case studies provide analytical generalisation, and

        Surveys provide statistical generalization for research validity.

CHAPTER 6 CONCLUSION

6.1 A Theoretical, Methodological and Empirical Framework

This thesis has given an account of together with the reasons for developing a theoretical, methodological and empirical framework to measurement of design quality. A theoretical framework was developed which then guided a mixed methods research including case studies and surveys. These methods underline non-equivalent dependable variables design, pattern-matching, replication, descriptive and inferential statistics.

This study was designed to determine a set of architectural design criteria for multi-storey residential buildings (MSRB) by literature review and the Survey A of professionals. The determined criteria were then applied to establish the effect of market price on design quality. This application was conducted through the Case Study I of eight developers, the Case Study II of seven architectural firms, and the Survey I and Survey II of low, medium and high cost MSRB. In addition, the research was designed to test the research hypothesis RH1 and to validate the other two research hypotheses RH2 and RH3.

With the findings, it is now possible to state the three research hypotheses (RH) i.e. architectural design quality for MSRB decreases as market price decreases (RH1); clients are more dominant than architects in making design decisions (RH2); and, there is a lack of congruence in the design quality of buildings between the users to whom the architects are ethically responsible and clients to whom the architects are accountable (RH3). These findings explain the two research questions (RQ) i.e. why do certain multi-storey residential buildings lack architectural design quality (RQ1), and how does the practice of architecture contribute to this phenomenon (RQ2). The research findings are summarised as follows:

6.2 Summary of Research Findings:

➢ **Research Objective (RO1)**

The literature and Survey A have determined and ranked the first ever set of seven architectural design criteria for multi-storey residential buildings in Klang Valley as follows:

1. Function –   100%
2. Socio-Culture –   99.9%
3. Site Context –   98.9%
4. Cost –   97.8%
5. Aesthetics/Art –   93.7%
6. Sustainability –   89.5%
7. Feng Shui –   49.3% (36.8% Neutral or do not know enough)

➢ **Research Objective (RO2)**

The Case Study I of eight developers and the Case Study II of seven architectural firms have concluded the relationships between the established design criteria and market price of multi-storey residential buildings. The important findings are:

i.   Correlation ($p \leq 0.05$): The relationships between the two variables are positive and significant except for the cost.

ii. Regression: The relationships between the two variables are linear and causal except for the cost.

iii. Replication: The similar correlation and regression outcome patterns of the relationships between the two variables are replicated across the eight cases.

iv. Pattern-matching: The observed patterns of the relationships between the two variables of empirical data are matched with the predicted patterns of the hypothesis RH1 except for the cost.

v.   Hypothesis Testing: The hypothesis RH1 was in general tested to be true except for the cost.

➤ **Research Objective (RO3)**

The Survey I of the thirty six buildings and the Survey II of forty five buildings have concluded the evaluation of the application of architectural design criteria on the selected low, medium and high cost multi-storey residential buildings. These findings have provided a triangulation for the multiple sources of evidences from the case study I of the eight developers and the case study II of seven architectural firms with the important findings as follows:

    i.   Correlation ($p \leq 0.05$): The relationships between the two variables are positive and significant except for the cost.

   ii.   Regression: The relationships between the two variables are linear and causal except for the cost.

  iii.   Replication: The similar correlation and regression outcome patterns of the relationships between the two variables are replicated across the eight cases.

  iv.   Pattern-matching: The observed patterns of the relationships between the two variables of empirical data are matched with the predicted patterns of the hypothesis RH1 except for the cost.

   v.   Hypothesis Testing: The hypothesis RH1 was in general tested to be true except for the cost.

➤ **Research Objective (RO4)**

The investigation of the Case Study I and Case Study II, and the evaluation of the Survey I and Survey II of the buildings have established the relationships between the architectural design criteria and market price of multi-storey residential buildings for the low, medium and high cost types. The established relationship is based on analytical and statistical generalizations from the following important findings:

    i.   Correlation ($p \leq 0.05$): The relationships between the two variables are positive and significant except for the cost.

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ii. Regression: The relationships between the two variables are linear and causal except for the cost.

iii. Replication: The similar correlation and regression outcome patterns of the relationships between the two variables are replicated across the eight cases.

iv. Pattern-matching: The observed patterns of the relationships between the two variables of empirical data are matched with the predicted patterns of the hypothesis RH1 except for the cost.

➢ **Research Objective (RO5)**

With NEDV and pattern-matching logic, the research has generally tested the research hypothesis RH1 to be true except for the cost: architectural design quality for multi-storey residential buildings decreases as market price decreases. This is expressed as follows:

i. Architectural design quality (site context) decreases as market price decreases

ii. Architectural design quality (aesthetics) decreases as market price decreases.

iii. Architectural design quality (function) decreases as market price decreases.

iv. Architectural design quality (sustainability) decreases as market price decreases.

v. Architectural design quality (cost) does not decrease as market price decreases.

vi. Architectural design quality (socio-culture) decreases as market price decreases

vii. Architectural design quality (Feng Shui) decreases as market price decreases.

➢ **Research Objective (RO6)**

The findings of the qualitative analysis and interpretation show that the following two research hypotheses (RH) to be true:

i. RH2 - clients are more dominant than architects in making design decisions.

ii. RH3 - there is a lack of congruence of the design quality of the buildings between the users to whom the architects are ethically responsible and clients to whom the architects are accountable.

6.3 Implications

The finding of the seven architectural design criteria has several implications:

Firstly this finding is important as the first ever set of seven architectural design criteria in Malaysia. Secondly the criteria are appropriate and relevant for design quality evaluation. Thirdly the criteria are practical for developers, built environment students or professionals and related public. During case study interviews, developers could respond to the dichotomous questions of why and how on these criteria, and in surveys participants could respond to questions on these criteria.

This design research through practice shows several important issues of the measurement of design quality and architecture:

Firstly, the case study is a quasi-experiment without randomisation. Thus, the investigation of the single group such as developer or architectural firm is subject to threats to research validity. The potential threats are history, maturation, instrumentation and regression.

Secondly, it is the type of measurement scale. Unlike ratio scale, the use of interval scale measurement is subject to threats to research validity. These potential threats are the constructs, data collection and questionnaires.

Thirdly, it is the uncertainty and characteristics of the subject being human individual or group.

The combined findings from the four empirical investigations with the theoretical framework suggest a strong case for developing method of measuring architectural design quality.

6.4 Contributions to The Body of Knowledge

The research findings add to the body of knowledge in architecture, the profession and practices for design of multi-story residential buildings.

Firstly, it is the first ever set of seven architectural design criteria for multi-storey residential buildings and their ranking in Malaysia.

Secondly, it is the establishment of the significant correlation and linear regression for the relationship between the architectural design quality and market price. These findings therefore assist in an understanding of the role of architects and the clients in architectural practice.

Thirdly, it is the demonstration in the testing of the RH1 research hypothesis to be true i.e. architectural design quality for multi-storey residential buildings decreases as market price decreases. These findings enhance the understanding of why certain multi-storey residential buildings lack architectural design quality in Malaysia, and how the professional practice of architecture contributes to this phenomenon.

Fourthly, it is the validation of the RH2 research hypothesis i.e. clients are more dominant than architects in making design decision and the RH3 research hypothesis.

Fifthly, it is the absence of user participation in architectural design process, thus lacking in social importance

Sixthly, it is the development of a theoretical, methodological and empirical framework for analysing architectural design quality. This reinforces the new understanding of measurement of architectural design quality.

Lastly, it is this design research through practice that adds substantially to an understanding of the architectural design quality issues that have been influenced by architects, clients and the market. Architectural design has life-long effects on people and the environment. Therefore architects are required to understand clients, and work in collaboration for successful outcomes. In addition, the architects need to bridge the isolated position from society by including wider social participation in architectural design process. Research units for user studies are highly recommended.

6.5 Recommendations for Practices, Research and Policy Making

These research findings suggest some recommendations to how various related parties can contribute in architectural practice for excellent multi-storey residential buildings for people and the environment. These parties include the following:

- Ministry of Housing and Local Councils

- Developers or/and users

- The architectural profession, organization and practicing architects

- Architectural schools

- The public and the Press

Firstly, the government can play a vital role. In Malaysia, low-cost housing has been part of a social-economical service of the government for the nation since the independence in 1957. Unless the current government adopts to revise policies, and the market price or adequate funding, the architectural design quality of these low cost buildings for people and the environment will continue to remain lacking. The Ministry can set up research units of user studies and architectural design criteria. In addition the Ministry advises local councils of planning and building on implementation of the design criteria and the policy of social participation including in particular the building users and the public at large. All local councils need to exhibit all multi-storey housing projects for public viewing. The councils invite building users, professions, developers, architectural schools, and the public to participate, comment and give feedbacks on user requirements and the built environment. The

current or/and potential users can share their experiences that would be useful for design review and improvement.

Secondly, developers can play a significant role. Developers are important parties to ensure the architectural design criteria and social participation of all parties in design development. They have developed and constructed these low cost building projects that are based on a very tight given funding, working with architects, consultants, contractors and other building specialists. Developers are agencies who can advise the government to resolve as a team pending issues such as design, construction and adequate funding for the projects etc. This study show that some developers are equipping themselves with the time, cost and quality approach, and have set up total construction methods and management in-house comprising turn-key contractor, building material manufacturers, planners, architects, engineers, estate managers, and property marketers. These developers search for new rational and industrial building systems and technology.

Thirdly, architectural profession and organisations can play a direct role. The architectural profession can promote the architectural design criteria together with a role of social participation in design process to practicing architects for the important relationships between architecture and society. The professional organisations such the PAM and LAM who are agents of change can promote this to the professional recognition, the design studio of architectural schools, professional practice and management courses, internship periods and continuing profession development (CPD).

Fourthly, architectural schools can play a formative role in the training, education and research. The ethos and convictions of architectural profession is derived from schools in which design studios are accredited on the architectural design criteria of the RIBA. The schools as institutions for implementing change can train architects the importance of social engagement with building users in the early formative learning years. Recommendations could be suggested to existing research and teaching of studio by including attention to the integration of design with business and management issues and the role of social participation in design process. For the professional studies and practice courses, the schools can add in the complexities of everyday architectural design work, referencing to or doing case studies and design-business solution.

Lastly, the press can play a publicity role. The press together with PAM, LAM, other related professions and bodies publish the writings and works of architects, architectural schools and developers in architectural journals, periodicals and newspapers. This information would raise the level of awareness among all related parties and the public at large.

6.6 Suggestions for Future Work

With the limited study of architectural practice locally, future studies on the current and related topics can include:

- Architectural design criteria to include users, interior design, value engineering, Feng Shui etc.

- Issues of the relationship between architectural design and market price for other types of buildings such as low-rise residential, industrial, office, commercial, shop houses etc.

- Issues of the integration of design with business and management in current practice.

- Issues of user participation in the architectural design process for multi-storey residential or housing buildings.

- Using more than one independent variable other than market price in which architectural design quality may be affected.

6.7 Summary

With the findings and recommendations of this design research, it is hoped that it can serve to design sustainable built environment for fulfilling human needs and goals, protecting people and the environment and creating a more liveable world now and tomorrow.

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