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Best-value in Korean Public Building Construction

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ABSTRACT

BEST VALUE IN KOREAN PUBLIC BUILDING CONSTRUCTION

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Although the low-bid system has played a major role in public building construction sector for a long time, this system has arguably delivered work of low quality, an continued and rising number of claims within the industry. With these challenges in mind, the Korean government has sought to examine and possibly adopt best-value procurement as an alternative approach to delivering public building construction projects within Korea. The reality however is that although delivering arguably a number of advantages, best-value does present the government with its own peculiar challenges because of a lack of a precise understanding of what 'best-value' means. Hence, in this study, the author seeks to examine the concept of best-value and its application to Korean public building construction. To achieve the stated objectives, the author draws upon extant literature in 'value' procurement to critically examine the impact of 'best-value' concepts in Korean public building procurement. Data is obtained from a survey of 180 managers involved in the procurement and management of public buildings in Korea. Utilising 'best-value' criteria drawn from literature, the author employs Analytic Hierarchy Process (AHP) to weight 'best-value' criteria identified through the survey. Based on the results of the AHP exercise, the following are found; (i) value depends on the state of each individual building which can be defined from a 'need' perspective, (ii) the primary criteria for 'best-value' in Korea public construction projects were 'serviceability', 'safety', 'comfort' 'environmental friendliness', 'economical feasibility' and 'artistry' and finally that (iii) the importance of each primary criteria was dependent on the building type.

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Chapter 1 Introduction

1.1 Background

Procurement system has become a glamorousissue with industry practitioners and researchers. It decides the overall framework of responsibilities and authorities for participants within the construction process. It is a key factor related to client satisfaction and project success. Appropriate procurement system is important issue for both clients and project stakeholders (Love, Skitmore et al. 1998).

The low-bid system[1] has played a major role in the public construction sector for a long time; however, this system cannot guarantee the best performance in terms of public construction. It has resulted in a low quality of work, and a high incidence of order changes, claims, litigation and increased project management costs(Kashiwagi and Byfield 2002). In today's construction projects, public sector owners work under immense pressure to improve project performance, complete projects faster, and reduce the cost of administering their construction programmes. To ease these pressures and the challenges of the low bid system, many governments have tried alternative procurement methods, such as best-value procurement, which is aimed at improving the quality of the buildings and of the performance of projects(Scott, Molenaar et al. 2006).

In Korea, the government has also tried to adopt the best-value procurement method as a better procurement system based on the problemsuch as low quality (refer to chapter 2.1) of the existing low-bid system in the public construction sector. The government institutionalised best-value procurement in October 2007. However, the best-value procurement has not been used because elements of the system such as the contractor selecting criteria and processesare not robust (Yeo 2010). This slow progress of using best-value procurement is a result of the obscurity surroundingsthe concept of best-value. While low price gives an objective and definite meaning, the concept of value is subjective and vague. Some people try to find the concept of best-value through the cases of other countries such as the UK, the USA, and others (Lee 2006a). This ambiguity, however, also exists worldwide, including in western countries. In general, even though the best-value procurement system signifies a key selection process, that incorporates factors other than just price to effectuate better performance or achieve other specific project goals, the concept of best-value is still vague and ambiguous (Scott et al., 2006). It makes the application of the western system of best-value to Korea difficult. Without clear understanding of best-value, it is impossible to achieve success in using best-value. Therefore, it is critical to make clear the concept of best-value for its successful application.

[1]Contracts shall be awarded only on the basis of the lowest responsive bidsubmitted by a bidder meeting establis hed criteria ofresponsibility (US Code, Section 112: Letting of contracts, 2011).

On the other hand, the design quality of buildings is a pre-occupation of humankind stretching back to ancient times. Some developed countries have promoted national architecture plans for the development of quality of life and to further the competiveness of cities since the 1990s. In particular, countries like the UK and Finland have realised that public building and architecture plays a leading role in the overall improvement of national architecture standards, and have emphasised its importance (Kim 2009). In Korea, the quality of building has also grown in importance and is conceived as one of the main issues of modern times. Because the income of the people has increased remarkably, the desire to live in a good building for a better quality of life is growing. Furthermore, while the GDP of Korea ranks 15th among 179 countries, the value of its national brand lies in 31st place and the tourism sector which includes architectural properties only ranked 43th(The Anholt-GFK Roper Nation Brands Index 2008).

Especially, public architecture is considered as the foundation facilities which form the basis of people's lives and the core of a nation's architecture policy in many countries(Seo, Cho et al. 2008). The Korean government has tried to increase the overall quality of building and the value of national brand through the improvement of the quality of public building. However, it is difficult to reach a consensus about what makes a good building because of diverse opinions of several stakeholders. For example, many local governments have undertaken the construction of various public buildings for culture, welfare, and display; however, the buildings do not meet the requirements of the citizens who are the end users because of their uniformity and duplication of style. Furthermore, many local governments have been criticised for unnecessary extravagance, enormity of scale and inefficient energy effectiveness of new public office buildings which does not consider the needs and demands of users including citizen (Kim 2009). This conflict comes from a lack of consensus on what is needed for public office buildings in Korea. Therefore it is important to identify what would be the best-value building in theKorean public sector.

1.2 Research Objective and Questions

This study can be divided into two parts; the first aims at defining the general concept of value and best-value, and the second investigates how these concepts can be applied to Korean public building construction to achieve best-value. That is, this research tries to define the best-value concept and apply this concept to public building procurement in Korea in order to suggest a decision model for achieving best-value. For this, it is necessary to investigate the features required in building that has value. Although the features of valued buildingsmay be different according to the kind of building and conditions, common factors will be gathered. After deriving the general features from the survey, the research will examine the priority of features by pair-wise comparison, and then compare the difference between the kind of buildings. Each owner can use this research as a reference when they set evaluation criteria and priority of these criteria for the best-valueprocurement. This application can

also be used as a guide for best-value selection in many decisions.

Value is important in construction and best-value is a primary concern in many industries, particularly in the construction industry(CIRC 2001).Although numerous studies on value and best-value have been conducted, however, the concept of value and best-value is still not clear. Therefore the following chapters will fill this gap by defining value and best-value; in addition efforts will be made to identify the best-value method in Korean public building construction projects using the definition. Based on this, research questions are proposed.

1) What is the best-value in building construction?
   (i) What is value?
   (ii) What is best-value?

2) How can best-value be achieved in Korean public building construction?
   (i) What are the important factors in the Korean public buildings?
   (ii) What arethe most important of these factors ?
(iii) What are the differencesin the selectionof these factors among the demographic categories suchas gender, age, and profession in Korea?
   (iv) What is the difference between the way how the factors are weighted among different types of building ?

1.3. Scope of the Research

With the service sector becoming the prime focus of the present-day industrial set up, building occupies the central role as the most important workplace within the cities.However, since the building is a broad concept and the kinds of the building is exceedingly diverse such as library, museum, post office, school, hospital, and so on, it is difficult to elicit common factors that the those buildings should have in other to be good building. It is necessary to concentrate research target to increase the concretness and practicality of the results. In addition, the importance of public office building is also considered by reflecting budget, role, etc, as provided in chapter two. Thus, the scope of research in this study is confined to the public office building.

On the other hand, the stages of in the building life cycle(refer to figure 1) are important in this study. Construction consists of several processes such as project planning, designing, contractor selection, constructing, maintainance and so on. The specific stage that a building is at in its life cycle has a significant influence on the relevant type of evaluation technique deployed(Cooper, Kagioglou et al. 1998).

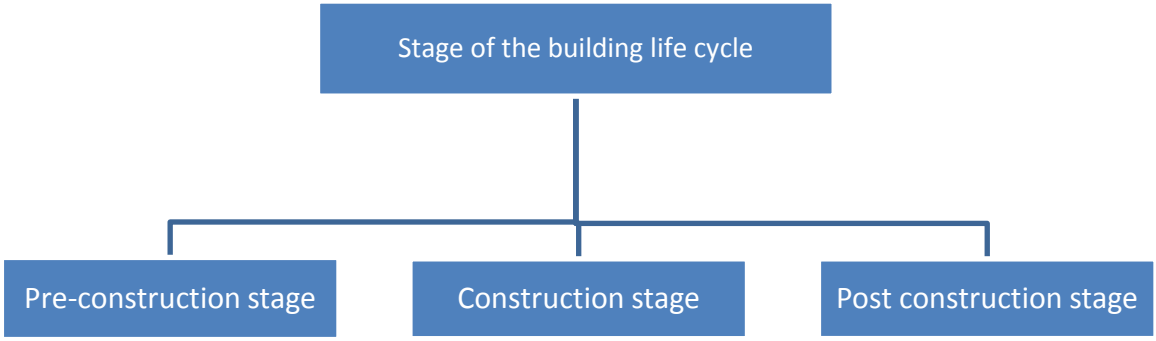


Figure 1. Stages of building life cycle (Cooper et al., 1998)

The factors considered important differ according to the stage of building. In each process, the focus on different goals will shift. For example, while the client's need isthe main goalin the project planning and design stage, the quality of the contractor is the core factor in the contractor selection stage. Later, maintenance can be an important factor. Cooper et al. (1998)claimed that the client's needs are progressively defined and developed into an appropriate design throughout the pre-construction phases;however, this stage of a project is given little consideration compared to the latter stages. The construction phase is related with the fulfillment of the design. In the post-construction phase, the aim is to continually monitor and maintain the constructed facility.

Best-value in construction is related to several factors such as contractor selection, cost, meet-time, structure, and so on. Despite of these factors, the core of the construction lies in the structure itself. The other factors exist to help the achieving of good structure. Zhang et al.(2009)define supplier selection and evaluation as the process of finding suppliers compatible with the buyer's need for quality products and/or services at a price affordable to them, in the desired quantities and at the right time.Therefore in this study, the focus is on the best-value structure itself and the design phase.

The design of a construction project will need to revolve around the needs of the user. The Office of Government Commerce of UK (OGC) (2002)claimed that this is even more important in the design of a building where needs and priorities can be found through the design process itself prior to the formal tender. Zimmerman (2001)claimed that in the conventional scheme of things most decisions made in the design stage are taken on the basis of the needs of the organisation or people who use the building.Johnson(1990) also claimed thatmost strategic,important decisions are made very early on the design stage of the building.

1.4. Outline of the Thesis

Chapter 1 presents the background to the research pertaining to the best-value concept and also highlights the needfor applying the best-value concept to the Korean public building construction sector. The issues of the construction procurement system and public building construction in

Koreaare also discussed. The objectives of this research and scope of the study are also articulated in this chapter. Following this, the structure of this thesis is presented.Chapter 2 consist of four sections; the problem of the low bid system, a critique of the best-value system in Korea, the importance of public building, and the problems of Korean public building.

In Chapter 3, an extensive literature review was carried out which included the definitions of best-value and value. The new concepts of value and best-value are presented by logical observation and interpretation on the practical use of value term and this concept was justified through comparing with the results of previous researches. In addition, the needs/criteria of a valuable building were also studied based on variousbuilding evaluation methods. An overview of the various existing building assessment systems adopted around the world are given and compared. Six main criteria and 34 sub-criteria were adopted in this chapter. Justification for the adoption of the criteria is also presented. Chapter 4 elaborates on the research methodology adopted in this research study. This includes the structure and design of the questionnaire, data collection approach, sample size and responses. In addition, the data analysis methods are presented in this chapter. This study can be divided into two parts; one that attempts to define the concept of best-value, and the second that applies the best-value concept to Korean public buildings construction. The best-value concept is developed by logical observation and interpretation of practicaql language usage. The second part consist of two steps; one to identify the importantcriteria of a valuable public building, and the other to weight these criteria in the case of best-valued Korean public office buildings. Two research methods are applied: a general survey and the Analytic Hierarchy Process (AHP) survey.

Chapter 5provides a comprehensive presentation of the results and discussion of the general survey data from each section of the questionnaire in detail, supported by graphs, tables and statistics. In addition, important criteria relating to a valuable building was selected and the differentiation in criteria selection among the various demographic groups is also compared.Chapter 6 presents the results of the AHP survey. The weights of the six main criteria and their corresponding sub-criteria are computed based on the AHP survey results. Three representative public buildings were used in this survey. These are the National Assembly Building, the Sungnam City Hall, and the Central Police Office Building. The dominant criteria of each building are suggested and compared.

Finally, Chapter 7 concludes the study with a review of the achievement of the objectives and summarises the contributions as well as the limitations of the study. Recommendations for improvement of the study undertaken are also presented.

Chapter 2 A critique of Korean public building construction

2.1 The problem of the low-bid system

The Korean construction industry occupies a high position in the national economy. It accounts for 6.3% of the GDP in 2009, with the size of public construction procurement worth $56billionin the same year[2].

The selectionof the most suitable procurement method is critical for both clients and project stakeholders,and has been an important issue within the building industry. Procurement systems have become various and flexible. One of main issues within the construction industry is connected with what clients want in order to be satisfied with theirbuildings and the methods by which those buildingshave been procured. Consequently, it is important to identify the clients' criteria, their importance and then evaluate performance to match the criteria. All clientsrequire their buildings to be finished withinbudget, on time, and to be of the highest quality. There are various derivatives to eachprocurement method since the criteria that each client emphasis are differnt. The most popular procurement methods are presented in Fig 2. (Love, Skitmore et al. 1998).

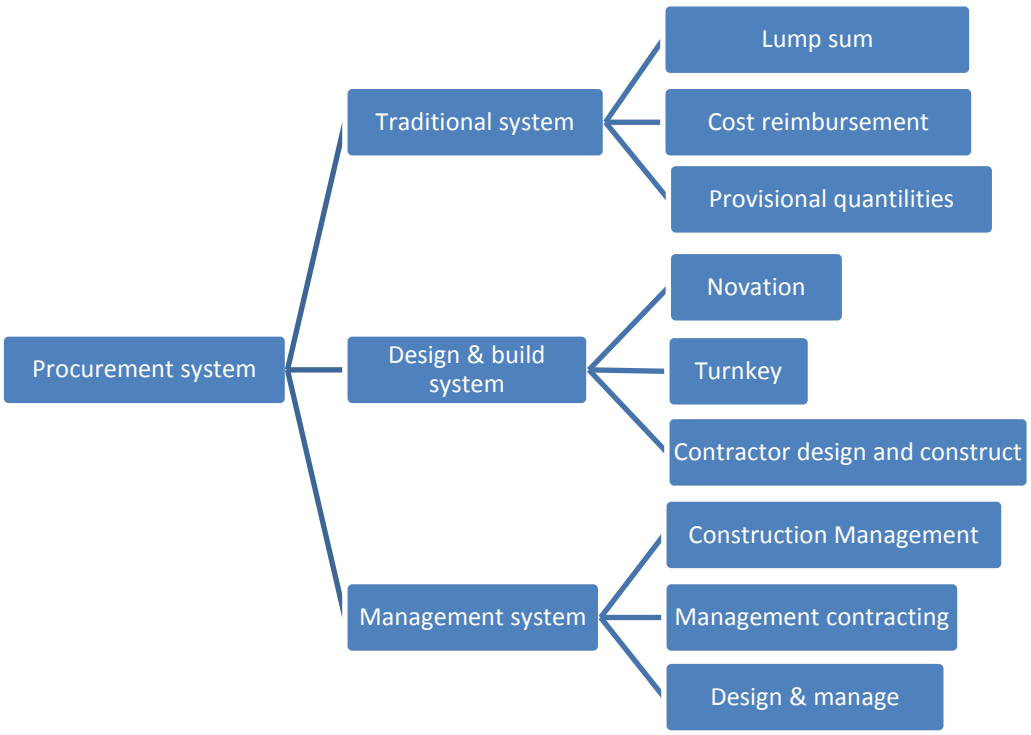


Figure 2. Construction procurement system (adepted from Love et al., 1998)

Korean public construction procurement systems are mainly classified as qualification evaluation

[2] 2010 Statistical Yearbook of MLTM (Ministry of Land, Transport and Maritime of Korea)

system, low-bid system and design-build system. While the rate of the qualification evaluation system gradually fell from 62.3% to 29.3%, the rates of low-bid and design-build increased to 40.1% and 24.9% respectively, in 2008. The low-bid system increased rapidly due to the expansion of the scope of application. The low-bid system has been the main system in Korean public procurement system since it became mandatory in 2006 for all projects over $ 30 million to adopt this system(Choi et al., 2011). The ratio of each procurement method is presented in figure 2.

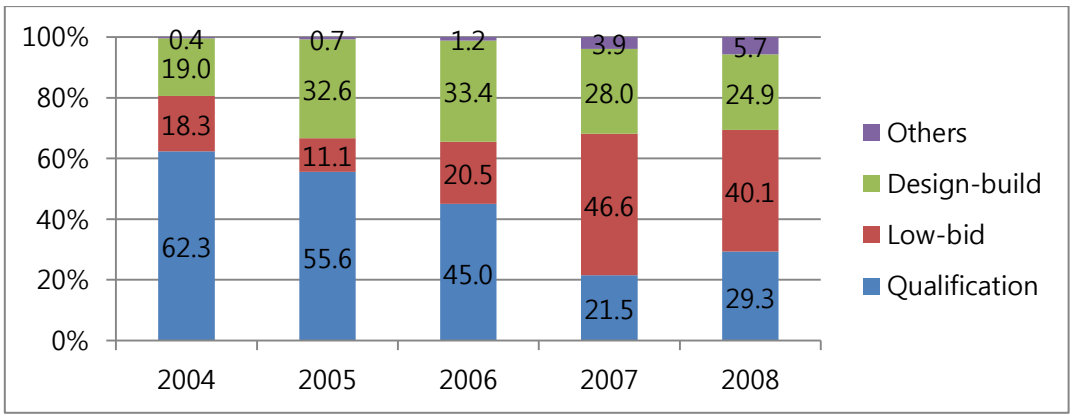


Figure3. The ratio of each procurement methodby Korea Construction Industry Institute (2009)

While the low bid system is transparent and easytouse, there are some problems which have persistently occurred with the system such as excessive low bids that do not meet real construction costs, thus resulting in poor construction quality and performance(Lee 2006a). Kashiwagi and Byfield(2002)opined that in the last two decades the competitive low-bid procurement process has been the primary procurement process in the field of construction;however, this system (the low-bid process) has not impressed the facility owners by providing the desired results. It has produced sub-standard work, non-conducive working conditions, a high incidence of contractor-generated change orders, claims, litigation and increased project management costs. Constructors also have lower profit margins which bring higher risks and reduce the quality. A combination of factors such as the price pressures, low level of craftsperson skill, and minimum standards has reduced the low-bid system to becomeultimately a ‘lose-lose’ situation.

Xia and Wu(2007)suggested that many manufacturers clearly are aware that suppliers offering the lowest unit prices do not always provide the best quality or ultimate service performance. They pointed out that supplier assessment was capable of identifying multi-objective decisionsrelating to the lowest cost, best quality and service performance. The National Audit Office of UK (NAO)(2001) on the other hand stated that empirically, the low-bid system could not provide value for money in the life cycle and resulted in poor performance. This is why the relationship between the government and

construction industry has become one of conflict and mistrust.

The main problems of the low-bid system in Korea are as follows. First, Korea Government expanded the application range of the low-bid system to $30million in 2006 from $ 100 millionin 2001 (except for design-build projects)(Choi, Shim et al. 2011). The low-bid system has been applied to huge, high-technology projects based on project cost not the characteristics of the project. As a result, the winning bidder, even in highly technical, high-quality projects such as nuclear power plant construction, is determined by cost only (Lee 2006b).

Second, it is argued that the winning bidder in the Korean low-bid system is not decided just by bid price because only those companies which have passed pre-qualification (PQ) screening can join the bid process. In other countries, the number of companies which have passed PQ screening is typically just 3-5 and they are considered to have enough ability to perform the project. In other words, PQ screening is 'short listing'process to screen for those companies which have the ability to fulfill the project. However, it is difficult to confirm that the company has the relevant ability, even though it has passed the PQ screening in Korea. In the early days, the number of companies that passed PQ is near 30; however, this number increased to an average of 70 in 2009 and sometimes it is over 150 (Lee 2006b; Choi, Shim et al. 2011) (refer to figure 3).

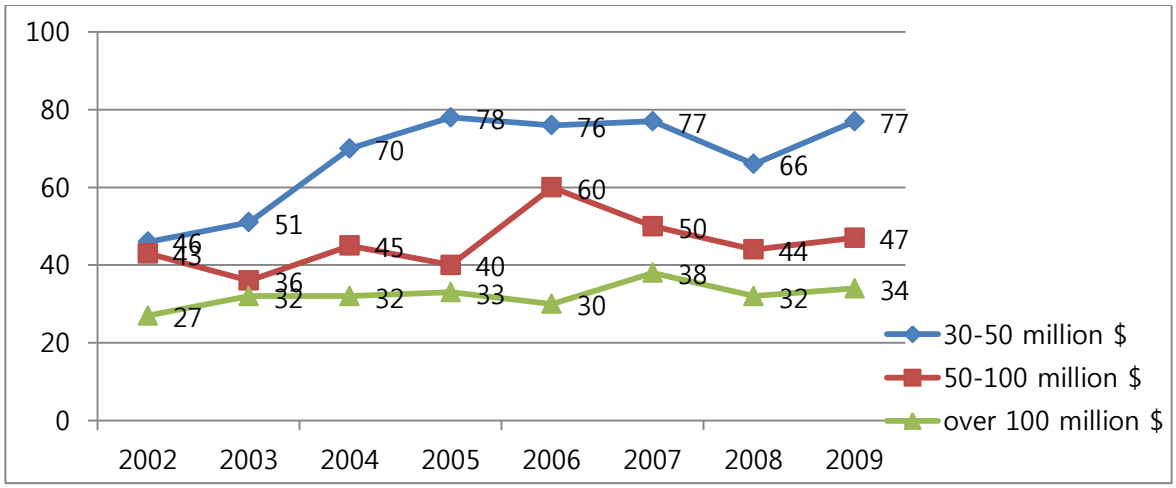


Figure4. The number of biddersby The Korea Construction Industry Institute (2010)

Thirdly, the excessive low-bid price is the biggest problem in the low-bid system. A great deal of effort has been made to prevent the excessive drop of bid price such as the price screening system; however, the bid price is generally falling. Although the ratio of bid price (bid price/estimated price) increased by 73% in 2009 after decreasing by 59.4% in 2004 (refer to figure4), this increase is due to the change of standard cost which is the basis of comparison of this ratio. It is estimated that the actual ratio has decreased continuously (Choi, Shim et al. 2011)According to a survey undertaken by the Korean Construction Industry Institute in 2005, 50% of respondents (43 out of 87 respondents)

answered that the bid price in the low-bid system is less than the execution budget of the project and 27% (24 in 87 people) anticipated that the deficit can be 10% or more (Cho 2010).

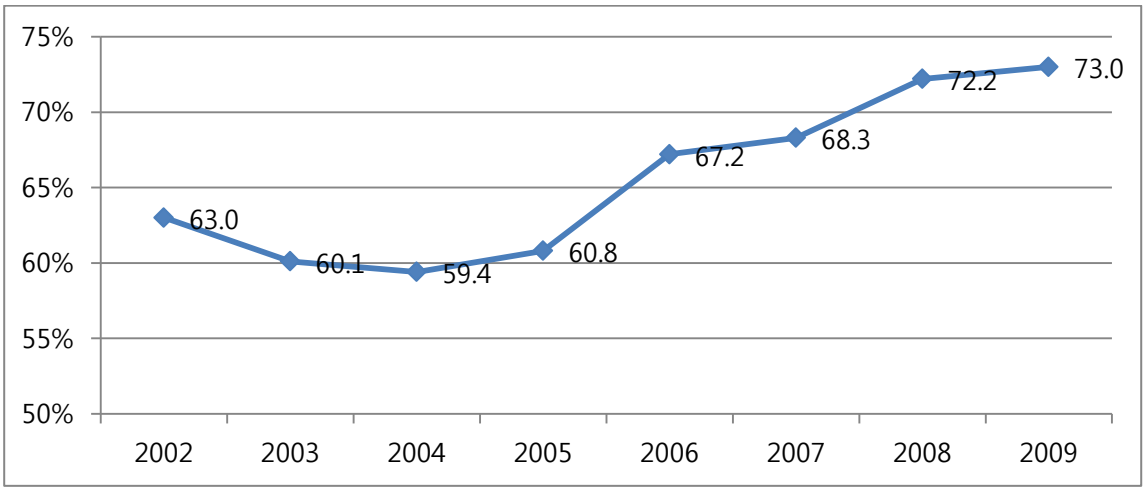


Figure5. Change of the rate of bid price of winnerbyThe Korea construction industry institute (2010)

Lee(2006b) also claimed that excessive low bid price poses an obstacle for the government to secure the quality of the project and manage the project. A low bid less than the execution budget causesthe following problems: i)Faulty construction by cheap and poor materials, unreasonable low sub-contracting, low-level technical staff;ii) Weakening the foundation of the construction industry by a chain reaction loss of contractors and subcontractors;iii)Breakaway of technicians and workers by low wages, andiv)Social cost increases to prevent shortcuts and illegal acts based on cost reduction.

For this reason, the Korean government and construction industry have sought best-value for the purpose of securing construction quality by preventing dumping bids. The Korean government tried to adopt the best-value system to overcome these problems in the procurement system from 2006. That is, best-value procurement has been recognised as an alternative to the low-bid system. The UK, the USA, Japan and other countries also introduced the best-value system as a substitute for the low-bid system(Lee 2006b; Choi, Shim et al. 2011).

2.2. A critique of the best-value system in Korea

2.2.1 Background introduction

While the Korean bid system has been revised numerous times since the enforcement of the low-bid system in 1951 and the qualification evaluation system in 1995, still the complaints about the bid system are continuously being expressed. The issues of the existing system have not been solved, and the new system has brought with it a new set of issues. The Korean government and construction industry began to seek for fundamental alternatives from 2006 (Seo 2007). If the expansion of the

low-bid system in Korea is a trial to overcome the problem of the qualification evaluation system being criticised as a lottery bid system, the adoption of best-value is a trial to solve the problems of the low-bid system such as dumping bids and poor performance(Lee 2006a).

The reason why the introduction of best-value is urgent is related to the rapid expansion of the low-bid system. If the range of the low-bid system expands to $10 million according to the government plans, the proportion of low-bid projects will reach 70% in the entire public construction projects(Choi, Shim et al. 2011). While the expansion of low-bid is scheduled, the problems of the low-bid system such as deterioration of construction quality due to dumping bid still exist. However, it is difficult to solve the dumping bid problem within the low-bid framework despite screening of low-bid costs. Because of this, the transition to best-value is being adopted instead of the amendment of low-bid system (Lee 2006b).

Despite much controversy about best-value, introduction of this scheme is already confirmed by Korean government's policy. The Regulatory Reform Department of Korea suggested the introduction of a best-value system that reflects quality and cost at the same time. It means that it is difficult to solve the problems of low-bid and screening systems by partial supplement. In June 2006, the Board of Construction Technology and Architectural Culture Advancement reaffirmed the introduction of a best-value system that focuses on value by considering cost and quality(Lee 2006b).

2.2.2 Issues

In October 2007, the Korean government introduced the best-value system by revising 'National Contract Law', but there has been no enforcement until 2010 because of a lack of performance procedures such as selection criteria (Yeo 2010). To date, there is no agreed concept of best-value even among experts(Darlymple 2002; Scott, Molenaar et al. 2006). The main reason why the introduction and practice of best-value system is going at a snail's pace is the ambiguity of best-value. Lowest price is objective and has clear meaning, but value is a subjective term and its meaning is not clear. In this regard, people suggest different concepts about best-value respectively. Some claim that best-value does not include evaluation of cost because it is the opposite of the low-bid system. Others suggest that best-value is a subjective rather than an objective system. Others insist that the best-value system has to evaluate total life cycle cost (LCC) rather than initial construction cost (Lee 2006b).

Other researchers such as Lee (2007), Park (2006) and Yeo (2010), have also referred the needs of the best-value system, but the concept of best-value is still not clear. This ambiguity makes it difficult to implement successful measures for the introduction and practice of the best-value system. Therefore, it is a prerequisite that the concept of best-value is clarified in order to ensure successful introduction and practice.

2.3. Importance of public building

In Korea, although public architecture has accounted for a major chunk of the budget and forms a major part of the social culture, adequate attention and recognition to the importance or worth of public architecture have not given (Lee, Kim et al. 2009). Many developed countries such as the UK, France and the Netherlands have recognised the importance of public architecture and have pushed country-wide public architecture-improvement strategies thereby bringing about a successfully improved competitiveness of the city and overall architectural culture. In recent times, reflecting this trend, the Korean government realised the importance of public architecture and has made attempts to reconfigure the function and role of public architecture (Seo, Cho et al. 2008).

Therefore, it is meaningful to applying the best-value concept to Korean public building construction. Below, the importance of public building and the problems of Korean public building will be explained.

2.3.1 Definition of public building

Public architecture is considered as the foundation facilities which form the basis of people's lives and the core of a nation's architecture policy in many countries(Seo and Lee 2008; Kim 2009). Although the definition of public architecture is not clearly defined in the current Korean legislation, it is generally interpreted as the architecture procured by central and local government based on the public budget, which includes public buildings, education, cultural, sports and welfare facilities, and so on (Seo, Cho et al. 2008).Kim (2004)classified Korean public architecture based on legal definitions. He divided public architecture into four groups according to its role: national authority offices, local government offices, other public buildings, and culture or services facilities to promote public interests. These are presented in table 1.

Table 1. Kinds of public architecture. Source: Kim (2004)

Division	Facilities
National Authority Offices	Administration buildings, Court buildings, National assembly buildings
Local Government Offices	Local Government buildings
Other Public Buildings	Police offices, National Research Institutes, Central banks, Fire stations, Post offices, Public health centres, School buildings, Embassies, etc
Culture or Services Facilities	Museums, Art galleries, Libraries, Theatres, Conference Halls, Concert halls, etc

2.3.2 The Effect of good public building

Public architecture is an important asset of any nation and plays an important role in public life. It reflects and leads the national architectural culture and is the centre of citizen's lives. The Ministry of Culture and Tourism of Korea elucidates that public architecture forms an intrinsic part of the public memory. It is symbolic and directly affects citizens' lives. It also determines the level and quality of development in the city. It would not be wrong to say that the level of a country's architectural culture is determined by its public architectural level. In a survey conducted in 2009 by Architecture & Urban Research Institute of Korea, historic buildings (46.4%) and modern buildings (11.8%) rank high in deciding the core elements in traveling and forming reminders of foreign cities (Kim 2009) (refer to figure 5).

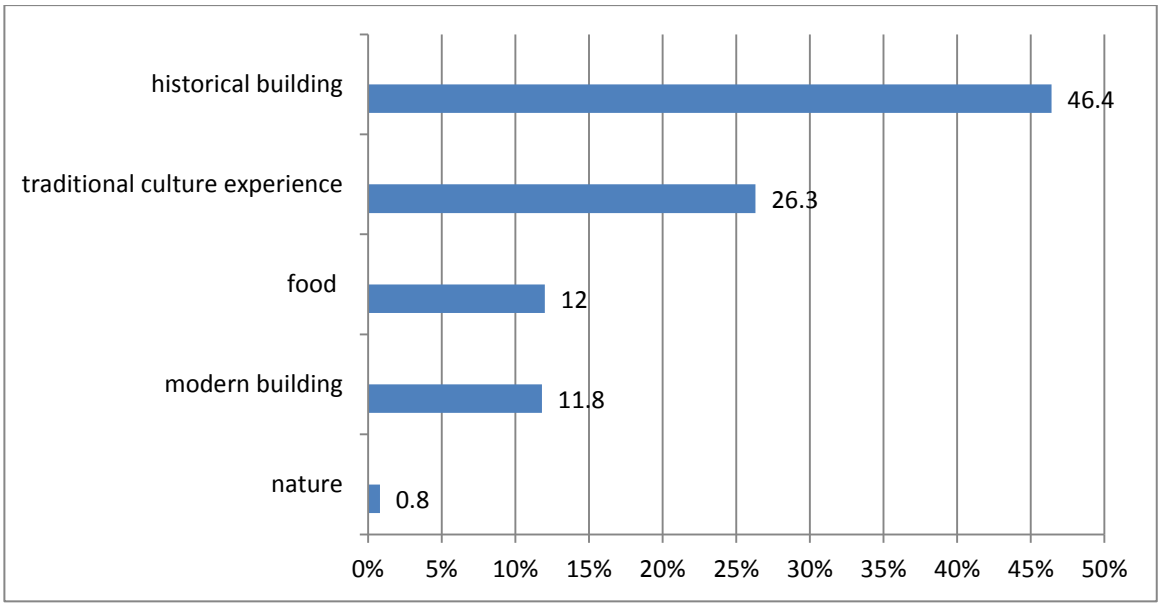


Figure 6. The representing images of city. Source: Architecture & Urban ResearchInstitute of Korea (2009)

Seo and Lee (2008)claimed that the building created by rational design principles is a good cultural asset and a key element in influencing the competitiveness of a nation and its city. Good buildings also provide enriched living conditions, and a convenient environment for work, social activities and daily life. They also claimed that public buildings play a central role as leaders of city design and a place where local people meet and communicate. Cho(2007) claimed that public architecture represents and includesthe collective lives of the city such as public administration, education, welfare, culture, etc. These architectures support the architectural publicity of the city as well as guide people from personalized urban life to a democratic community. Public buildings and buildings for cultural affairs that act as focal centres of community life play an important role in bringing people of the local community together to participate in social life(CABE 2006).

In a MORI poll commissioned by CABE (2002), it was found that people consider well designed buildings and spaces as positive influences which enhance the quality of life, professional productivity, educational attainment and physical well-being, and reduce the levels of crime.(refer to table 2)

Table 2. Public attitudes towards architecture and the built environment. Source: MORI/CABE, 2002 (Number of respondents 1,018)

Survey questions	**A**gree	Disagree
People work more productively in well designed offices	77%	7%
Well designed schools improve children's education	70%	17%
The design of hospitals makes no difference to how fast patients recover	29%	52%
How streets look and feel makes no real difference to crime	22%	66%
Well designed houses will increase in value quicker than average	72%	9%

Good building design helps officials to perform their services effectively, which in turn improves productivity; it can help employ and retain staff, reducing the costs of staff turnover; and it can help extend services to sections of society which may have been excluded on earlier occasions. The profit of good design comes alive within specific sectors such as schools, hospitals, libraries, offices, civic buildings or public spaces (CABE 2006).

In schools for example, a good design is bound to have effect on the performance of the students; it helps in retaining the staff, and brings about a more creative approach to teaching and learning(CABE 2002). A UK-based study of students' performance concluded that capital investment in school buildings positively influenced the staff morale, motivation levels in the students and also the effective learning time. (PricewaterhouseCoopers 2001).Studies on the relationship between pupil performance, achievement and behaviour and the built environment reflected that test scores in well-designed buildings showed a marked difference; they were upto 11% higher than those of children who studied in poorly designed buildings (CABE 2002). Healthcare professionals clearly acknowledged the affect of design on their work (CABE 2004). When surveyed, 86%of directors of nursing schools or colleges stated that hospital design is 'very important' or 'important' in relation to the performance of nurses. They found the design and organisation of the hospital environment to be the most important in influencing the performance of the staff(CABE 2004).

The quality of the workplace in terms of design and planning can prove beneficial for government departments and other public agencies(CABE 2006). It has been noted that the design of the workplace can influence staff performance by 5% in the case of individuals and by 11% in the case of

teams. One major UK company concluded that staff turnover fell by 11% after moving to new premises, to hint at the influence of good design on the workforce(CABE 2005).These effects of good building are similarly understood in Korea. In the poll commissioned by the Architecture & Urban Research Institute of Korea in October of 2008, 63.4% of respondents were of the opinion that the design of a building has a great influence on academic achievement and efficiency of work (Kim 2009).

2.3.3 The amount of investment

The Korean central government's investment (refer to table 3) on public architecture reached US$3,479 million in 2009. The amount of new construction was US$2,088 million and the remainder was accounted for by maintenance costs (Lee, Kim et al. 2009).

Table 3The budget of public architecture in the Korean government

UNIT: US million dollars

Division	2008 Budget			2009 Budget			Changes
	Budget	Rate	Cases	Budget	Rate	Case	
New construction	$ 2,217	71%	142	$2,088	60%	176	$ 129
Maintenance	$ 892	29%	84	$ 1,391	40%	129	$ 499
Sum	$ 3,109	100%	226	$ 3,479	100%	305	$ 370

Source: Korean Government (2009 budget explanation)

In particular, since many public buildings will be constructed and rebuilt in Korea because of the administration capital-moving project and aging of many public buildings, it is a golden opportunity to shape Korea's public architecture culture so that they contribute to public achievement and nation cultural competiveness.

2.4. Problems of Korean public buildings

The public buildingsof Korea are not designed to meet various needs and purposes(Lee, Kim et al. 2009) despite their quantitative increase. According to the diagnostic results on the level of Korean architectural culture, the city landscape level of Korea has remained just 70% or less compared to developed nations. The main reason for this result is the lack of unique identity in architecture and the degradation of buildings(Korea National Housing Corporation 2006).

Recently in Korea, the realisation of publicity became the main goal for architectural design for a better life for the citizen. This publicity is divided into spatial, social, and cultural publicity. Spatial publicity provide userswith comfort during their activities. Social publicity will be implemented

through the space which accepts the diverse needs of the users and considers the environment. This can be realised through the participation, understanding and cooperation of diverse stakeholders in the process of design and construction. Cultural publicity can be realised not only by beautiful buildings but also by the design that has unique identity and historic value. These three factors are the rules of architectural design in Korea (Seo and Lee 2008).

Currently, while the requirement for improvement about the aestheticsand quality of public buildings is growing, the problems in public buildings in Korea are also being pointed out. The main issues include uniformed procurement system, standardised style, and lack of creativity and performance (Lee, Kim et al. 2009). Seo and Lee (2008)claimed that Korea's public buildings are accused of causing inconvenience and discomfort, as well as increasing the whole life cycle cost such as maintenance and running costs. The main reason for these problems is insufficient reflection of the opinions of stakeholders such as end users, operators and administrators in the planning and design stages. In addition, the design guidelines and criteria published by government present uniform administrative standards on style, materials, colour, height, etc, instead of professional decisions according to the characteristics of each project. For example, the public buildings in Korea are similar and uniform in appearance because they are constructed against standardised criteria rather than the demands and requirements of users and local communitiesin terms of their characteristics. Sometimes, public buildings are often designed larger than they need to be, which is intended to show the symbolism and authority of the administration. Recently constructed or scheduled local government buildings attracted criticism for their excessive large-scale, luxury, and energy inefficiency such as glass curtain walls without adequately considering local administrative demands (Kim 2009).

While local public buildings should play the role as a community space for citizen that are easily accessible, it is difficult for them to be a central place because their plan is based on the provider's agenda. It is difficult to effectively link such buildings as tax offices, police stations, post offices and schools which are provided by central government within the region, and they can even create disharmony with their surroundingss, since they are planned independently by each provision without considering the opinions of local citizens and local government (Seo and Lee 2008). Libraries, art centres, gymnasiums, community centres, etc, have the potential to serve as local community centres; however, their practical uses are limited because they are located in the outskirts of the city separately. (Kim 2009).

The problems of public building in Korea can be summarised as that these buildings are constructed with low design quality because of poor plan and design without consensus about good building. These buildings do not reflect the demands and requirements of stakeholders such as end users (Kim 2009). The best-value building and architecture design in Korea can be achieved by reasonable

accommodation of the needs of user and the requirements of various stakeholders.

Ultimately, public architecture as a nation's major asset plays a significant role in social, cultural and economic aspects. Based on this recognition, the Korean government has tried to improve the quality and value of public buildings. So far, however, even the concept of a good public building is not defined clearly. At this point, it is timely and significant to apply the concepts of best-value to the Korean public buildings construction. However, since the concept of best-value is also not defined clearly in previous research including in western countries(Darlymple 2002; Scott, Molenaar et al. 2006), it is difficult to apply western best-value systems to Korea(Lee 2006b).

Therefore, in the next chapter, the new concept of best-value will first be defined, and then will be applied specifically to the Korean public office building construction, not to the overall public architecture. The reason why the research target is just confined to public office buildings is that,essentially, best-value changes are based on a projectas suggested in chapter three. If the research target becomes overall public architecture, including various building such as libraries, conference halls, schools, prisons, hospitals, etc, it is difficult to elicit the features of best-value based on general, common requirements or needs of stakeholders. Therefore, this study will focus on public office buildings based on the similarity of structure and serviceability. In addition, social,economicandcultural importance of public office buildingsare also considered in this selection.

Chapter 3. Literature Reviews

3.1. Reviews of Best-value

The concept of value plays a vital role in the construction industry(Barima 2010). The undue emphasis on low cost in construction procurement has been criticised as one of the primary reasons for the poor performance of buildings and structures constructed without paying attention to value. This is the reason why important public studies in several countries across the globe are now shining the spotlight on delivery of value which has caught the attention of all concerned in the construction industry(CIRC 2001; Barima 2010).Johnson (1990)pointed out that the key issue in a building's design is delivering a building that is of value to the client.

The construction industry has been transferring the focus from reduction costs to achievement of value. In this context, best-value is a prominent trend these days. It is possible to ascertain the abundance of best-value usage in construction by searching on the internet.

- Google search: 'best value in construction'- 120,000 hits
- Emmerald database: 'best value in construction'- 16,102 hits

This figures show that best-value is a popular term in the construction industry;however, whilst there has been a great deal written about best-value and its development there is still no precise definition of best-value. The concept of best-value has attracted varying interpretations. It has been difficult to define and is an evolving concept (Darlymple 2002; Scott, Molenaar et al. 2006). This ambiguity of best-value causes some confusions and hindrance in its actual application. In this section, the various concepts of best-value will be analysed within previous research as a foundation to constructan appropriate concept of best-value.

Darlymple (2002)also claimed that the concept of best-value is now popular in many countries throughout the world, and it is used more or less as an umbrella term to replace the "Compulsory Competitive Tendering (CCT)" process which is no longer favoured. In the 1980s, the UK government introduced CCT for local government services hoping that it would bring about efficiency, effectiveness and value for money. Later the government replaced CCT, directing the local government to demonstrate best-value in 1997. Likewise, the Australian government also introduced CCT in 1992 and replaced it soon after with a best-value pattern in 1999. The Scottish Executive made it mandatory for local government services to use the best-value system via Local Government in the Scotland Act 2003. In each of these cases, however, there was a lack of clarity relating to what

might best define and comprise best-value. The concept of best-value in above countries is not prescriptive but descriptive.Although there is sufficient description of the elements that best-value should contain, no treatise prescribes any specific way of attaining best-value. The works acknowledge the fact that best-value can take a myriad of forms.

The United Kingdom's Local Government Act 1999 sets out the general duty of best-value:

> Best-Value is a duty to deliver services to clear standards - covering both cost and quality - by the most effective, economic and efficient means available. In carrying out this duty local authorities will be accountable to local people and have a responsibilityto central government in its role as representative of the broader national interest(Rushcliffe 2011).

Updating and modernising the services provided to the public through a process of democratic renewal was among the foremost aims of best-value policy (LGA 1998). Using an approach that targets the market, the best-value system gives priority to fulfilling the needs and expectations of clients and providing new service at optimum cost. Behind the best-value regime operates the principle of wider participation of the main groups in the society, their collaboration and mutual consultation in respect of the concerned legislation (Geddes and Martin 2000).Akintola et al.(2003)opined that best value is defined as a relative notion which refers to the best possible outcome of a business process. It is universally applicable to all industries, sectors, countries and cultures. The prime objective of best-value is to help organisations enhance their performance. Adams et al.(2000)observed that the best-value approach to service delivery is an approach that strikes a balance between cost and quality considerations. In this light, it can be concluded that the cheapest supplier of a service may not necessarily meet the best-value criteria if the quality of the service provided is inadequate.The US Army Source Selection Guide (2001)defines best-value as "The expected outcome of an acquisition that, in the Government's estimation, provides the greatest overall benefit in response to the requirement."

Scott et al.(2006)suggested a comprehensive definition of best-value procurement for highway construction based on the analysis of the literature, case studies, surveys, and interview results. They defined best-value procurement as a procurement process where price and other key factors are deemed necessary in the evaluation and selection process to reduce impact and improve the long-term performance and value of construction. This definition is able to classify and present best-value procurement as a flexible, multi-parameter system where the selection of parameters depends on the owner's priorities and project objectives. The authors listed the best-value parameters identified from case studies under the heads of aspects of cost, schedule, qualifications, quality, and design as follows:

$$\text{Best Value} = A*X + B*X + P*X + Q*X + D*X \quad (1)$$

Where: X = Weighting, A = Cost, B = Time, P = Performance and Qualifications
Q = Quality Management, D = Design Alternates

Although there is no logical explanation about why best-value includes the consideration of key factors such as quality as well as cost, these previous studies suggest that the best-value concept includes some features such as: including price and other key factors, relative notion, quality, balance between cost and quality, and meeting the needs of stakeholders, etc. Though it is possible to grasp the concept of best-value from these studies, the definition of best-value is still not clear. Without clear understanding of best-value, it is impossible to achieve best-value. Therefore, it is critical to make clarify the concept for its successful application. However, since it is difficult to find appropriate definitions of best-value through previous literature, it is first necessary to define the concept of best-value for this study. On the other hand, this ambiguity comes from the obscurity of the meaning of value(Lee 2006b). It is reasonable to begin with an understanding of the concept of value in order to define best-value. Barima (2010)claimed that with the passage of time, 'value' studies have had to face a number of discrepancies. In certain cases, despite many years of debate, underlying issues of contention have still not been resolved. Since the identified terms have the potential to be represented as distinct constructs, these discrepancies pave the way for further examination in yettobeexplored formal disciplines like project management. The purpose of the next section is to review briefly the definitions of value in the literature.

3.2. Reviews of the concept of value

Rohan (2000)observed that the word 'value' as a noun has an entry in the Compact Oxford English Dictionary dating back to 1303, where it has been used to refer to the fairness and equivalence of the amount of a commodity in an exchange. The use of value as a verb also has an entry around the same time and is used to describe the act of appraising worthin terms of its appropriateness for exchange of a commodity. Interestingly, however, this meaning was later broadened to incorporate more abstract exchanges and standards. Used as a verb, value refers to the process of ascertaining the merit of an entity with reference to an abstract value system structure, and used as a noun, value refers to the result of this process.

According to Frondizi (1971)the distinction between the concept of 'value' from that of 'being' was delineated way back in the nineteenth century. Since that time the concept of value has undergone several examinations across varied disciplines such as psychology, philosophy, and economics(Rokeach 1973). However, in spite of the dictionary meaning and the definitions from various studies, what is often deemed is that value is a complex structure, which has the potential to assume varied meanings (Holbrook 1999; Ramsay 2005).Sweeney and Soutar (2001)delineated four distinct value dimensions: emotional, social, quality/performance and price/value for money. These

multiple value dimensions explain consumer choice better than single value for money items.Uejima (2009)is of the opinion that the meaning of value is linked to various concepts such as deserving, material, money, behaviour, magnitude, quantity and number. In short, when we use value as a word, we internalise the meaning and relate it to a concept deep in our sub-consciousness. Words used most frequently in society becomes symbols. "Value" is one of the words that reflect the attributes of humans in modern society with materialistic objectives. We create value by associating it with cognition.

This section will trace the various uses of value in previous research and establish common features. It is necessary to categorise the use of value for a systematic approach.Miller (2008) claimed that the word value has been used by almost everyone at almost any time. He further states that the word value has an unusual and remarkable semantic range in the English language. On the one hand it can mean the work involved in giving a monetary worth to an object, as in valuing an antique piece of porcelain, and thereby it becomes almost synonymous with price. On the other hand, the word value can also mean that which has significance to us precisely because it can never be reduced to monetary evaluation. For example the value we hold dear in relation to family, religion and other inalienable possessions can never be measured in terms of money but still has value for us. Miller also used the terms value and values for the two extremes. The former relates to economical use and the latter can be termed as the philosophical use.

Fekete (1988) argued that value has been traditionally addressed in terms of either its objective meaning (largely within an economic context) or its subjective meaning (as a largely affective, human-based characteristic). It has been evaluated, typically, in a 'modern' domain that separates 'value' from 'values'. This facilitates analysis and measurement, and delivers a perceived certainty and exactness.Shillito and De Marle (1992)opined that value is dichotomous, intrinsic to people and the objects they desire. This suggests that value can perhaps be conceptualised and can be best comprehended through the combined appreciation of economic and abstract/philosophical perspectives that, together, recognise the existence of value-oriented properties. Based on the above research, the usage of value will be confined to economic and philosophical use in this study.

3.2.1 Economic value

Smith (1776)suggested that the word value serves two different purposes and sometimes denotes the utility of a particular object, and sometimes the power of purchasing other goods which is conveyed by the possession of those objects. One of the meanings may be termed 'value in use'; the other might be called, 'value in exchange'. Ramsay (2005)holds a similar opinion and claims that the value in use consists of the utility, benefit or pleasure individuals derive from consuming a product or service while the value in exchange refers to the revenue it will generate in exchange of the product.

Sheldon (1914), however,distinguished value from utility. In his opinion, the word value has only one connotation; therefore the value of an article is always and only the power to command other desirable things in peaceful and voluntary exchange. He distinguishes the value of a thing from its utility.The latter has a certain kind of value in that it is useful to the one who wants it; but it is useful merely because it is wanted, and not because it possesses any power of exchange for other utilities. Hence a utility might come under the first class of values, the 'condition worth'; whileon the other hand, value as used in economics forms a distinct type, owing to the fact that it possesses exchangeability.Unlike Sheldon, Porter (1985)tried to find the connection between value and profit. He suggested that value is the amount buyers are willing to pay for what is being provided. Value is measured in terms of the total revenue. Thus, a firm is profitable if the value it commands is more than the costs incurred in creating the product.

On the other hand, the concept of value in economic terms refers to the ratio of costs to benefits. Thus the fundamental system that communicates the effectof all value decisions has always been money (Johnson 1990). Miles (1989)however claimed that value has also been inferred as being more than simply a straight cost/benefit issue. It is delineated by four characteristics: use, esteem, cost and exchange. Use refers to the qualities that make it fulfill its use; esteem refers to the features that make us want to own it; cost refers to the sum of labour, material and other costs needed to make it, while exchange refers to those properties that enable us to exchange it. Miles (1989)continues that the definition of value is dependent upon whether one considers it from the producer's end or from the user's end. This broader interpretation of value once again has utility as its primary characteristic, where utility is defined as that property in any object, which tends to produce benefit, advantage, pleasure, good, or happiness, or prevents the happening of mischief, pain, evil or unhappiness to the party whose interest is involved(Bell 1994).

Despite a number of studies on the meaning and connotation of value, there is no unanimous and clear definition of the term. Miller (2008)commented on the popularity of the term and suggests that there are two very diverse reasons why the term 'value' has become ubiquitous. One of its uses is taken from people's colloquial use, and the other is is located in a more formal usage intended to promote some particular purpose. The word is used in more formal situations when groups of theorists such as economists or consultants are able to impose their abstract ideas on practice.

From the economic perspective, value implies several concepts such as utility, exchange, benefit, satisfaction, price, evaluation, customer's priorities, etc. It is however difficult to use these economical concepts of values to explain the reason why the best-value concept in real life includes cost and other factors.

3.2.2 Value in Philosophy

Schwartz and Bilsky (1990) found that five characters of the values system are continuously mentioned in the research on values. Values (a) are concepts or beliefs, (b) pertain to desirable end states or behaviours, (c) transcend specific situations, (d) guide selection or evaluation of behaviour and events, and (5) are ordered by relative importance. These features are compatible with the assumption that the value is a stable meaning which produces superordinate cognitive structure.Rokeach (1973)conducted a survey in which he named values, briefly explained their meaning, and asked people to arrange the value words in order of importance to them, as guiding principles in their life. He listed two sets of value words: goals (terminal values) and modes of conduct (instrumental values). The list of goals included such things as a 'comfortable life' (a prosperous life) and 'self-respect' (self-esteem) and the mode of conduct list included such things as 'broad-minded' (open-minded), 'forgiving' (willing to pardon others), and 'helpful' (working for the welfare of others). Schwartz (1992)contributed to understanding not only the human value system but also how people differ in terms of the dynamic organisation of value priorities denominated by the 10 value types: power, achievement, hedonism, stimulation, self-direction, universalism, benevolence, tradition, conformity, and security.

While Schwartz speaks of 10 value typesHoldbrook (1999), Dawis (1991)compiled 12 different terms used by scholars over the years to imply 'value'. They are: attitude, belief, desirable, interest, need, preference; standard, criteria, rules, norms, goals, and ideals.On the other hand, Williams (1979) suggested that the term 'values' has been used variously to refer to interests, pleasures, likes, preferences, duties, moral obligations, desires, wants, goals, needs, aversions and attractions, and many other kinds of selective orientations. This philosophical usage of the word 'values' is capable of causing much confusion. Discrepancies may creep in because many researchers list virtues in their studies as values. Hitlin and Piliavin (2004)pointed out that sociologists often employ cursory understanding of the term values, and label a broad array of social psychological phenomena as values. Often, values are construed as almost effectuating observed behaviours. Generally, values are neglected as too subjective or too difficult to evaluate accurately. Thus the concept of value drifts in and out of such sub-disciplines of sociology as family, organisation, and politics.Hechter (1993)concludes that the study of values has four major obstacles: (a) values are unobservable, (b)current theories give little guidance for understanding how values shape behavior, (c) behavioural explanations are unconvincing, especially when the process that generates values is not known, and (d) there is difficulty in measuring values. Although recent empirical and theoretical work has made some headway with a few of these concerns, this list of impediments provides a useful starting point. Hitlin and Piliavin (2004) added two more hurdles to the list: (e) values are often conflated with other social psychological phenomena and (f) values have historical and cultural variability in their content.

Previous research on values in philosophy focus primarily on identifying the needed virtues such as beliefs, bravery, ideals, and other such qualities of character in tandem with the changing conditions such as era, country, age, and race. These studies have looked for the values in each condition instead of the fundamental concept of values. For example, Rokeach (1979), Schwartz and Bilsky (1990) and Spini (2003)studied the change of values (virtues) according to the era or culture. However, these philosophical concepts of values may also not be sufficient to explain the best-value concept. It is necessary to propose a holistic concept of value which can include previous value concepts.

3.3 Development of the value concept in this study

A review of the literature suggests that 'Value' and ‘Best-Value' are considered to be of importance in the construction industry. Despite many definitions of value in previous research, it is difficult to explain the reason why best-value in real-time use includes costs and other factors. It is necessary to suggest a holistic concept of value that can explain best-value and previous value concepts. It is impossible to accomplish best-value without a clear definition of value and best-value. Therefore, this chapter will endeavour to fill the gap created by the dearth of a clear concept of both value and best-value. Interpretation of practical usage of languagecan bean appropriate method to develop the concepts of value and best-value. The obscurity of best-value may come from the obscurity surroundingsthe meaning of value. Therefore, it is a reasonable process to begin with gaining an understanding of the concept of value for defining best-value. Since language is social semiotics(Halliday 1978), it is natural to analyse the use of the term in the context of how it is used in society in order to identify its meanings. In this study, a new definition of value will be traced based on the empirical observations of how people use this term; this new definition will then be applied to the previous value theories and social phenomena in order to identify the validity of a new definition. Miller (2008)was of the opinion that the theory of value could not be derived from mere intellectual discussions about previous value theories but would need to be culled out of a close scientific examination of specific cultures and the informal, everyday use of the word. Thus he advocated analysing the use of the word ‘value’ in order to understand the meaning of the word ‘value’.

Radnitzky (1968)claimed that observation and interpretation of language usage can be an effective tool to construct new theories as it provides the basis for creative or speculative ideas which can subsequently be tested. Both verbal and non-verbal forms of communication are included as an integral part of the development of value concept.The basic question in the development of value concept is: what is the meaning of value in this use?For the efficient approach, the concept of value will be traced within the ordinary usage of the term ‘value’ within two categories, Economical and Philosophical,as was the case in the previous section.

3.3.1 Value in economic use; Value as degree of needs

When exploring the use of value in economics, two concepts will be considered as important factors. These are definition and the expression of value in economical use.

Definition:When people say that a watch has value, what kind of feature does the watch have? When people buy goods, people usually say that it is something that is necessary and therefore they have to buy it or the goods have some value, for which they can be bought. Another example would be: when people exchange something, they say that the new one acquires more value, as compared to the thing that they already have. In other words, people need the new object more than the previous one.It is possible to assume from such statements that there is a relation between value and need. (Bruner and Goodman 1947; Pryor 1982; Wiggins 1998; Oishi, Diener et al. 1999). The assumption can be that the needed thing has value or the thing that has value is needed.

How about considering the aspect and use of the word ‘like’? Some people say a watch has value because they like the watch. Is it possible to suggest that the word 'value' implies the meaning of the word 'like'? It is possible to confuse ‘like’ with value. However, although children do not like to ‘study’, people say it has value for children. Therefore 'like' does not always correspond to 'value'. How about pleasure? Although a TV programmemay give pleasure, people say sometimes that it has no value. Although the hardships of life do not give pleasure, nevertheless people say that they do have some value. Now let us consider the word ‘profit’ People sometimes say the value of something is small despite it being sold at a great profit. On the contrary, loss has more value than profit in certain cases. Sometimes, satisfaction is suggested to explain the meaning of value. Sinden and Worrell (1979)defined value as the intrinsic property of an object which has the capability to satisfy. The greater the capacity to satisfy, the greater the value of the object.

Value = *f* (capacity to satisfy) (2)

This definition, though, is insufficient in understanding how something that is of value to a person might be completely valueless to another (Johnson 1990). How about the term ‘need’? It is difficult to find something that has value despite it is not needed. It is possible to suppose the value is strongly related to need.

In economics terms, however, value is not exactly the same as need(Wiggins 1998; Butts and Sohi 2002). People can use the expressions: it has value, its value is high, less, big or small, its value increased, its value is $300. From these uses of value, it is also possible to assume that the term value includes the concept of measured degree. However the following expression is not correct; the need is high: the need is $300. These expressions should be rewritten like this: the degree of need is high: the

degree of need is $300. In this context, it is possible to assume that the concept of value is the degree of the need of an object.

On the other hand, the value of something changes continuously(Smith 1988; Konty and Dunham 1997). When do people buy an umbrella? The answer is that when an umbrella has value or when it is needed. When is an umbrella needed? It depends on the state of the umbrella, and people's situations. Suppose, for instance, an umbrella is torn - such umbrella cannot protect people from getting drenched. People then say that it is needless or has no value. The state of an umbrella such as torn, broken, size, colour, and so on are important to define the value of an umbrella.

Secondly, though the state of an umbrella is good, if it is too big, it is not of much help to small children, because they will not be able to handle it. In certain cases; when a person has no money, or wants to enjoy the rain or wear a raincoat, or even when he might have many umbrellas, the umbrella has little value, despite the rain. Therefore the value of an umbrella depends on the user's state such as age, circumstances, physical and emotional state, financial ability, preference, and clothing. Third, even though it might be raining, if someone has already arrived home, an umbrella is again needless. In general, the value of an umbrella is far less in a desert than in a rainy area. Therefore, the value of an umbrella also depends on the time and place. As per Johnson (1990)value is a relativemeasure, not an absolute one. It also depends on time(Konty and Dunham 1997).

Fourth, an umbrella has no value because it may not be needed for protecting someone from rain in the desert, but it does holds the value of protecting someone from a sandstorm or the harsh sun in the desert itself. Sometimes even a tattered umbrella is needed by someone, if it has another purpose such as antique value, a memorial value, etc. If an umbrella is very good but common, it has little value as a gift. If an umbrella is old, it is needed for use, but it is needless as a gift to someone. Therefore, value changes according to the purpose of the person(Darlymple 2002; Magendanz 2003). Korsgaard (1996)uses mink coats as an example of an object of mixed purpose related to value. A mink coat has an instrumental value in that it effectively keeps out the cold. However, keeping the wearer of the coat warm is not the only or the primary reason why some people, especially women, collect mink coats. It can be deduced from the exclusivity, the cost, the appeal that lies in the rarity of the product and its desirability that they buy and wear mink coats because they value them for the many qualities and attractions associated with the mink coats. Thus, the mink coats are the kind of thing that women want. In this light, values are complex. People respond to values differently and while doing so people inadvertently apply different evaluative standards(Magendanz 2003).

Therefore, the value (the degree of need) of an umbrella depends on the state of the umbrella and the conditions of the person who needs the umbrella, which include age, physical and financial state, preference, place, time, purpose of use, weather, etc. The value of an umbrella is determined by the

degree of need that the umbrella has to a person in certain conditions. In the end, it is possible to suggest that the general definition of value as a noun in economical use is the degree of need for object(X) to subject(Y) in certain conditions;

Value of X= F (state of X, conditions of Y) (3)

Kahneman and Tversky (2000)suggest a similar definition where value or utility is the degree of satisfaction or pleasure obtained from the actual experience outcome. They suggest an analogy wherein it is assumed that an employee who receives a raise in salary would normally feel an increase in satisfaction. However, an employee who receives a raise in salary that was smaller than that of everyone else in the office may experience a net loss of satisfaction. Based on this phenomenon, the authors claimed that value varies depending on the specifics of the decision-making situation. This definition included the concept of degree and ideathat value depends on the condition of the subject. It is difficult however to say that the salary is not valuable to the employee even though Kahneman and Tversky claimed that the employee cannot be satisfied with the smaller increment in his salary. If the employee needs money for his living expences, the salary is valuable to him despite the dissatisfaction it brings. Therefore, satisfaction cannot always correspond with value.On the other hand, value as a verb can be naturally defined as 'the measure the degree of need of an object to subject in certain condition'.

***Expression of Value as a degree of need*:**How can value be expressed? Basically, while speaking about the value of objects, people can use some expressions like: it has value; there is no value in it; its value is high, and its value is low. Since these expressions are very obscure, though, it is difficult to express the exact value in ordinary life, especially when attempting to find something of similar value for exchange or in the market. In this context, when people intend to exchange something or find the market value of something they use a more concrete expression such as a lump of gold, three heads of cattle etc. According to the development of market, the monetary price becomes the most useful expression of value(Johnson 1990; Anderson, Thomson et al. 2000; Hutter 2008). In the economic sphere, value is often understood as price. That is, the price of an article is its quantification of value. Of course, there are still many things that cannot be easily expressed in terms of price such as religion, belief, love, or friendship. On the other hand, it is extremely complicated or near impossible to express the exact value of an object, since the state of the object and conditions of the subject that determine value comprise of numerous, continuously changeable factors. Furthermore, many of them are qualitative factors(Johnson 1990; Best and De Valence 1999; McDougall 2002). This concept will be discussed in detail in section 3.3.3.

3.3.2 Value in philosophical use; Value as needs

People often use the word ‘values’ to express that which is an important characteristic of a human being. For example, what values are important to the British? This is actually asking, what are the things or principles that they live their lives by or what are important values in their lives? The question might be answered by naming character traits such as faithfulness, loyalty, beliefs, honesty, and so on. Likewise, if one was to ask what the desirable values in a Korean university student are, the response might elicit expressions like academics brilliance, sincerity, hardworking, friendship, achieving one’s dream, etc. The same question can be paraphrased as: ‘What are the features needed by the British in this era?’ and ‘What are the features essentially needed in a Korean student?’ In this context, value is not a degree of need but the need itself. Schwartz (1992)reiterates the point that “values are cognitive representations of three universal human requirements: (a) biologically based organism needs, (b) social interactional requirements for interpersonal coordination, and (c) social institutional demands for group welfare and survival.”

Nonetheless, the values as needs themselves may have some restrictions. To begin with, values are openly not used as material and physical needs(Fisher 1987; Rohan 2000; Hitlin 2003). There are some examples to support this idea. What are the values that people pursue? If value is need itself, this question can be paraphrased like this: What are the needed things in our life? The answer might be money, car, job or house. These can be needs but we do not call them values. However, if the answers are intellectual, intangible and immaterial virtues such as love, bravery, religion, etc, we refer to these as values. In another example, what is that something that is needed to be a good football player? It could be stamina, technique, and/or experience. In this case, we do not generally refer to these as values. On the other hand, if the particular needs are ‘endurance’, ‘cooperation’, and ‘will for victory’, we can easily identify them as values. But if these material or physical needs can be translated into abstract expression, it can be interpreted as values. For example, although it is difficult to categorise the value of money and cars in our lives, the idea of a prosperous life can be termed value asRokeach(1973) claimed. This value can be correlated with Schwartz’s(1992) value concept; ‘biologically based organism needs’.

Second, the term ‘value’ is related with human will. The word value is not used for an animal or non-living object. For example, we do not use expressions such as ‘what are the values dogs have to follow?’or ‘What are the values a car should follow?’ The values are mainly used to express virtues related to human beings. The following expressions are natural. What are the values the students have to follow? What are the values the judge has to follow? Sometimes, organisations can use values as virtues that are required for those organisations, for those organisations. For example, what are the values the company has to follow? What are the values the country has to follow? These values are

related with ‘social institutional demands for group welfare and survival’as claimed by Schwartz (1992) .

Thirdly, the term ‘values’ is usually used for positive or ideal cases(Rokeach 1979; Fisher 1987; Wiggins 1998). For example, the following usage cannot be appropriate: what are the values that a thief (or a murderer, or a beggar) has to follow? This would be wrong because evil acts or immoral acts cannot have values attached to them. On the other hand, these expressions are natural:what are the values that a teacher (or a student, a clergyman, or a judge) have to follow? These values are also connected with ‘social interactional requirements for interpersonal coordination’ suggested by Schwartz (1992). Keeney (1992) claimed that the values of an organisation or even a society should reflect the values of the individuals in it.

Fourth, values tend to change according to the condition of the subject(Deutsch 1975; Rohan 2000). That is, the needs change according to the condition of the subject. For example, the important values (needed virtues) are different according to the subject’s conditions, such as religion, nationality, age, gender, time, or occupation. The value-sets upheld by the people of the UK are different from those held in esteem by the Korean people. The values which Koreans had to follow in the 1940s are different from the values they followed in 2010. The values that are followed by the soldiers during war-time, are different from what they have to follow during peace-time. Rokeach (1979), Schwartz and Bilsky (1990) and Spini (2003) studied the changeswithin values (needed virtues) according to historical era or culture concerned.

In the end, it is possible to define the values in philosophical use as intellectual, intangible, immaterial and ideal virtues(X) that are needed by human beings(Y) in certain conditions. In other words, values are virtues needed by human beings in certain conditions.

X(values) = Needed features to Y = F (conditions of Y) (4)

Virtues however are usually ideal, abstract, and intellectual elements. The subject is generally applicable to humans but can sometimes be ascribed to a gathering of human beings such as a nation, a society, an organisation, a culture, an occupation, and so on. For example, Treacy and Wiersema (1995) suggested it is an implicit promise that a company makes to its customers to deliver a particular combination of values such as price, quality, performance, selection, convenience, and so on.In the context, the relationship between value and values can be suggested. For example the value of leader is the degree of need of the leader within the organisation in certain conditions. It can be evaluated by criteria such as ability, braveness, honesty, generosity and so on. These criteria are values since values are the features that are needed by the leader (subject) in certain conditionsaccording to the definition. In the end, value is evaluated by values. In other word, values

are criteria to identify the value of something. Konty and Dunham (1997) claimed that values are the criteria used in attitude evaluations.

3.3.3 Features of value

For the exploration of the features of value, two important features will be considered. These are *Real value and Perceived value*, and the *Diversity and Subjectivity of value*. These features are related to each other. In this study the following meanings of value will be suggested: value as degree of need (economical use) and value as needs itself but immaterial, mental needs (philosophical use) in certain conditions. In connection with this definition, two main concepts were adopted; the first is that the concept of conditions was included in the definition, and the second is that value was classified distinctly into 'value as degree of need' and 'value as needs itself'. The propriety of this new definition will be verified by applying it to the previous theories on value and the social phenomenon.

Real value and Perceived value: In economic use, 'value' can be defined as degree of needs for an object to a subject in certain conditions.

Value of X= F (state of X, conditions of Y)

It is necessary to know about the state of X, and the conditions of Y in order to find out the value of something. However it is difficult if not impossible to identify the exact state and conditions, since they are composed of infinite factors. Furthermore these states and conditions change continuously and include unpredictable factors such as time that relates to the future. For example, the state of a car can be explained by numerous factors such as its price, size, colour, design, speed, fuel efficiency, its age and so on. On the other hand, the conditions of the buyer consist of infinite sub-factors such as age, gender, financial and physical state, preference, education, nationality, purpose, time and others. The state of the car and the conditions of the buyer also change continuously. Furthermore, we cannot assumethe state and conditions in the future.

In general, people do not use all the factors relating to the state and condition of something to evaluate the value of X, just some of them(Glenn 1980; Fekete 1988; Konty and Dunham 1997). While children and simple minded people use just one or two factors, specialists and wise people use more factors. This difference comes from an individual's diverse value judgments systems. People decide the value of objects based on their experience, intuition, education, comparison and so on without an exact perception of the state of the object and the conditions of the subject(Schwartz and Bilsky 1990; Konty and Dunham 1997; Holbrook 1999). If someone can consider all the states of an object and the conditions of a subject properly, he can find the real value of an object to the subject in certain conditions. In general, however, people just use some elements of these factors on account of a

restricted ability to perceive, and also due to the infinite, unpredictable and innumerable features of factors. Therefore, our value judgments on an object are not perfect and change continuously(Smith 1988; Konty and Dunham 1997).Ultimately, it is possible to suggest that 'real value' is the degree of needs about X (object) forY (subject) when all states of X and conditions of Y are properly considered. On the other hand, the 'cognitive value' is degree of needs of X forY that is estimated by some conditions and states. Most value concepts such as market value, exchange value, customer value and so on imply the perceived value.

Some researchers claimed that value is a subjective concept. Rohan(2000)agrees with the opinion that many value theorists analyse value constructs from the perspective of a person who evaluates the object in his or hersituational conditions. The information about past evaluation, which is gathered within a cognitive structure,helpspeople's perpetual analysis of the events or objectsin their environments. This information could further be used as an analogical principle for evaluating and ascribing meaning to freshly encountered objects and events. Such principles would be relevant across all situations and time, and could be referred to as values. Monroe (1990)suggested that most purchasers recognise value as a trade-off between perceived quality/benefits of the goods or service and perceived cost to obtain the goods or service.

The diversity and subjectivity of value: The value of something is interpreted and experienced differently by each subject.Smith (1988)disputed that value is not objective, but only contingent. In our everyday life, not only do we evaluate the value of the same things differently, but we also individually appraise the value of things at different times in different ways. Thus value is very subjective(Zeithaml 1988). From this perspective, it would only be possible to judge value within the limited set of conditions determined by environmental, social and cultural factors(Smith 1988). Consequently, value is extremely subjective or personal and exists at various levels(Smith 1988). The object and the subject are inalienably connected, and value can be recognised only when it is at a specific evaluation point, or when it brings about the connection between the object and the subject.Magendanz (2003)expanded this further by suggesting that the observing of the different values responding to a single object reveals the complexity value. He believed that this phenomenon is similar to the different interpretations of the meaning of a thing. Zeithaml (1988) defined the term value as follows: "Customer-perceived value is the consumer's overall assessment of the utility of a product based on a perception of what is received and what is given". He also indicated that the value is subjective and individual, and therefore the interpretation of value varies among people. In addition to this, an individual evaluates the same product differently on different occasions. However, Ravald (1996) claimed that Zeithaml (1988)did not explain a reason why consumers may recognise the value of the same product differently. In this respect, Ravald (1996)also suggested that this occurrence should be linked with different personal values, needs and preferences as well as the financial

resources of consumers, since these factors obviously have an affect on the perception of people about the value of an object.

Although some scholars such as Smith (Smith 1988) and Zeithmal (year) identified the diversity and subjectivity of value, they could not show the reasons for this. Despite Ravald's (1996) explanation, his reason alone is not sufficient. However, the definition of value in this study settles the issue better. The value of an object changes according to the state of an object and condition of a subject; and the state of an object and the condition of a subject vary tremendously. Although there are infinitive value factors, in general, people just use some of them. Furthermore. value is the result of the perception of the subject under specific conditions and at a certain point in time. People perceive value by their experience, education, intuition, and so on.Magendanz (2003)supported this idea through his suggestion that the complexity of value could be best explained as the interactive results of cognitive activities such as perception, imagination, belief, emotion, and psychological projection. Eventually, people's perceptions changes the value of an object;they evaluate the value of an object by assessing and identifying the most important factors among all the factors defining the state and the condition. Therefore it is natural that value varies from person to person and is thus subjective.

On the other hand, scholars tried to find terminal values in the realms of the philosophical. Rokeach's(1973)list of value words was produced with the assumption that all men everywhere possess the same values to different degrees. However, since values are synonymous with the characteristics required by the people who live in a certain condition, they are various and change continuously. Therefore, it is impossible to find terminal values. Rokeach's assumption could be changed like this people everywhere possess different values to different degrees'.

Use value, Exchange value: Smith(1776)divided value as 'value in use' and 'value in exchange'. Expanding on this idea,Bowman and Ambrosini (2000)defined 'value in use' as a factor characterised by the user's level of satisfaction. They also described 'value in exchange' as the value of an object denoted by its price.

It has also been observed, however, that this distinction is not critical to understand the meaning of value. In this study, value is defined as the degree of need of object for subject in certain conditions. The value depends on the conditions of the subject include time. Use and exchange is one point of time. Therefore, it is possible to suggest that 'value of use' is the perceived degree of need of an object when the subject uses the object(Ramsay 2005). On the other hand, 'value of exchange' is understood in this study as the perceived degree of need of the object when the subject exchanges the object for money or another object(Sheldon 1914; Porter 1985). These two values are often different, because of the difference in the conditions influencing the value at two points in time(Bowman and Ambrosini 2000). This difference between two values is just change of conditions. The 'value of use'

and the ‘value of exchange’ are also different in their boundaries according to the conditions. For example, the use value of a bottle of water differs according to the condition of the subject; that is whether the subject is thirsty or not. The same holds true in the context of the value of exchange.

Referring back toBowman and Ambrosini (2000)is relevant here for they express a similar opinion about the ‘use value’. In their opinion ‘use value’ is influenced by customers’ perceptionsofthe special qualities of the product in accordance with their needs. They used the example that the use value of a car would depend upon features like the acceleration capabilities and/or design of the car; likewise the use value of an apple would depend on the taste and texture of the apple, etc. So conclusions about the use value are pretty much subjective, and they vary from individual to individual. Thus it would be appropriate to state that the use value is something that is perceived entirely by the customer. Therefore, perceived use valueis primarily subjective(Bowman and Ambrosini 2000). Accordingly, the exchange value is the total monetary value or the amount the customer is prepared to pay for the product. Thus exchange value refers to price. Bowman and Ambrosini (2000) also claimed that when the exchange of the good takes place, the monetary amount of object can then be realised.Exchange valueis realised when the product is sold. It is the amount paid by the buyer to the producer for the perceived use value.

On the other hand, it is important to note that an exchange of commodity is necessitated only when exchanging something becomes more profitable than retaining or using it. This can also be understood in this way that an exchange occurs only when the need of the thing that is achieved by exchange is bigger than the need of the thing that subject already has. In the other words, the value of the thing that is achieved by exchange is bigger than the value of the thing that subject already possesses.

Marginal utility: The concept of value in this study can also explain ‘the law of diminishing marginal utility’. According to this law, the utility of each subsequent commodity diminishes in comparison to the one before it (Easterlin 2005). For instance the first apple a person eats has the most utility, the one after it has a utility but less than the first and so on. The reason why the second apple has lesser value than the first apple is that the condition has changed. After eating the first apple, people naturally have a reduced need for the second apple.

Market value:The market value (price) is the degree of need for a certain object in the market under certain conditions (refer to figure 6). The focus changes from the person to the market in this case. Since markets consist of many people and since the value of an object is different for each person, the market cannot exactly reflect each person’s conditions, and needs. Therefore the market often uses the average or general value of people who form the market. In the end, the inconsistency between each person’s value and the market value is bound to occur. In the real market, however, people do not feel a severe discord between personal value and market value, since the market value is decided through

many experiences, trials and errors. A buyer purchases goods on the condition that the personal value of the goods is higher than the market value. Price negotiation is the process of adjusting the personal value and market value. However, since the market value is often decided by the average value of buyers in the market and it cannot be the same as each person's value, there is still a gap between personal value of an object and its market value. For example, there are some people who experience regret after buying something because they think they have paid more than they valued it at; on the other hand the others are satisfied buying the same thing(Smith 1988; Rohan 2000; Magendanz 2003).

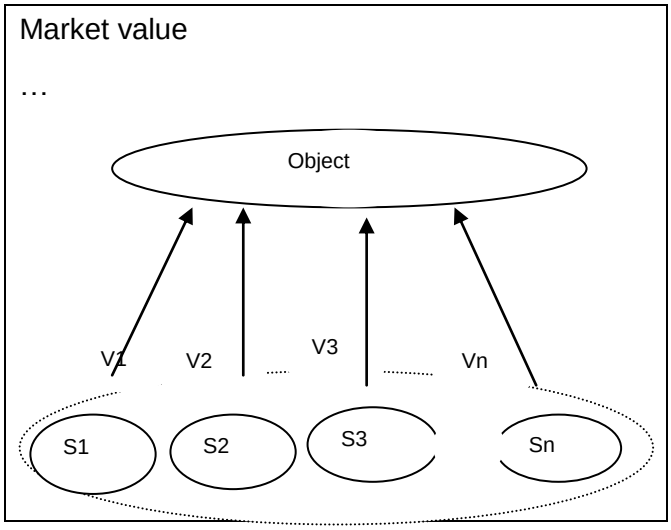


Figure 7. Market value

Scarcity and value:Among the various features of value, scarcity is also an element that influences value (Sheldon 1914; Rohan 2000).Sheldon(1914)concluded that the lesser the availability of a commodity, the greater the value. He used the example of gold, because the less gold there is, the greater is the overall value of gold. Therefore, if there was an infinite amount of gold, it would not be as valuable as it is today. In short, he insisted that the value of a commodity exists only when the quantity or supply of the valuable article is limited. The more limited the availability, the greater the value (up to the psychological threshold of the consumer). On the other hand, if everyone has the commodity, because there is no scarcity, then it follows that there will be no demand or desire to procure it, because the need and desire is already fulfilled; hence scarcity is necessary to value.

Sheldon's (1914)hypothesis however does not explain every economical phenomenon related to scarcity. There are many things that have value despite their being present in sufficient quantity. On the other hand, there are some things that have no value despite their scarcity. Even though gold is scarce, if we do not need the gold, or if we do not know the value of gold, it has no value to us. If someone has to live alone in a desert or on an island forever, gold is needless and valueless. Sometimes, the air is much more valuable than gold, even though air is plentiful and gold is scarce. If

we were trapped underground and there was a lack of air, the value of air would be very high. This again proves the point that the value of something is defined by the situational conditions of the subject. The deciding factor of value and its relation to scarcity is not the total amount of a commodity, whether available or scarce, but the amount of that commodity available or scarce in certain conditions. For example, the value of air is not decided by the total amount of air in the world but decided by the air in certain conditions. Of course, scarcity is one important factor that decides the value of something (Sheldon 1914). Furthermore, scarcity creates or adds value to some commodities such as diamonds and luxury goods (Yao and Li 2005). Value does not exist only when the quantities of a valuable article is limited. It depends on the condition of the subject (Smith 1988; Magendanz 2003). People need, want or desire to possess rare goods because of the elements of esteem, self-contentment, vanity, fear and so on associated with them. Some companies use these characteristics for their marketing.

Ramsay (2005)claimed thatSmith(1776) had a question about the peculiar phenomenon wherein extraordinarily useful substances such as water have very low exchange values in markets. This peculiar phenomenon of value can be explained by the concept of value as defined in this study. Smith's dilemma(Smith 1776) about the value of extraordinarily useful things being available at cheap exchange prices stems from a lack of consideration that value changes according to the conditions. The reason why the value of something generally considered valuable is not considered as important is that a person may not have the need for that object at particular condition. For instance, if someone is in a desert and lacks water, then the price of water and its value will be high and he will be willing to pay more for it. However, if the same person is still in the desert, but already has enough water or will soon exit the desert, the additional water offered to him has low value. Thus, the reason that the exchange value of water is low in markets is that people do not need that water as much because there is enough water available in the market.

Mathematical use:In mathematics, we use the terms such as value x, and value y. The dictionary meaning of the mathematical use of value as expressed in the Oxford Dictionary (2011) is: "The numerical amount denoted by an algebraic term". This usage can also be explained by the definition of value in this study. For example, if there is an equation such as $X = Y^2$, and if Y is 5, then X becomes 25. This means that '25' is the degree of need of X on the conditions that Y is 5. In mathematics, however, the condition is simple and uncomplicated; unlike the varying conditions in people's lives.

3.3.4 Value Judgment

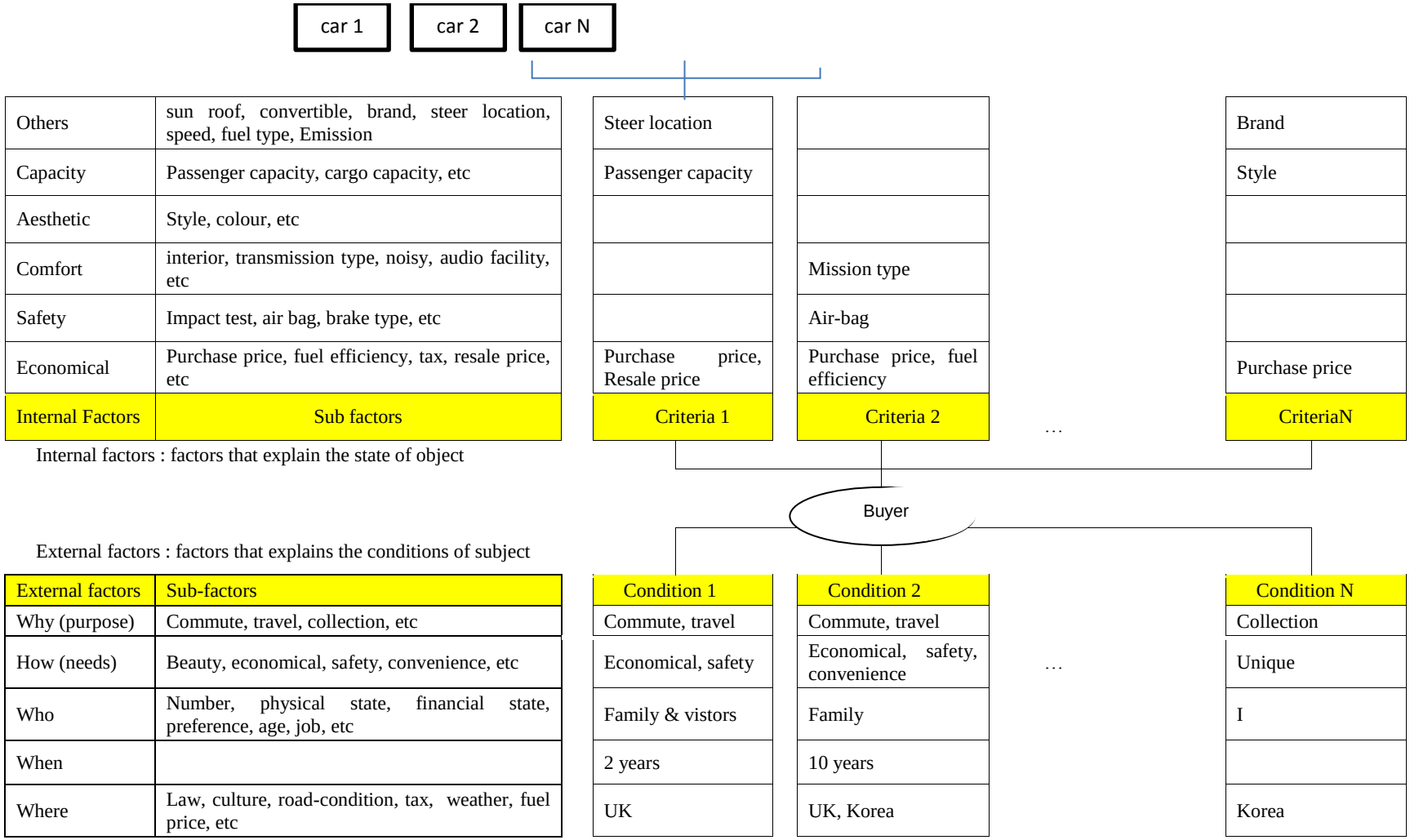
3.3.4.1 The process of value judgment

When people buy a car, a process of decision making is involved (refer to figure7). People try to find the value (the degree of need) of a car. Value judgment is the process of finding ‘how much value a car has or how much a car is needed’ and ‘which car has the best-value or is the most needed’. Value judgment is the process of finding how much value an object has(Albus 1990; Griffin 1997). At first, people usually consider the purpose for purchasing car. The common purposes are for commuting; although sometimes the car can be bought for the sake of collection. People then look for the required features (needs) in the car, to suit the required purpose. If the car is to be used for commuting, the features would be those associated with commuting, such as safety, comfort, petrol consumption and so on. On the other hand, when the car is meant to be included in a collection, people will look for a different set of features such as its antique value, unique, beauty, rarity and price of the car.

The next step will be finding the degree of needs; how much cheaper, safer the car should be. These factors depend on the buyer’s conditions such as the financial state, preference, and physical state. Once these criteria are set, people select a car to meet their needs and degree of needs. The selection criteria will be decided by these needs. If someone needs a cheap, safe car for commuting, he will use price, fuel efficiency and impact test (among other factors) as criteria. If someone needs a unique car for a collection, vintage and design will be the important criteria. Although there are infinite factors that explain the state of car, such as colour, design, price, and so on, nevertheless some of them are generally used for selecting the car. These factors can be identified as criteria. These criteria are the internal factors that are used only to evaluate the value of a car, and aretherefore closely linked with needs. This relation between factors and criteria will be discussed in greater detail in section 3.3.5.

The process of finding value consists of a hierarchical structure(Parasuraman 1997; Woodruff 1997; Schwartz and Bardi 2001)(refer to figure 7). Checkland (1981)stated that value is structured hierarchically with a common purpose that can conflict when judging best value and value for money. Keeney(1992)is of the opinion that a hierarchical structure improves the understanding of the value-focused thinking. The fundamental objectives hierarchy is advantageous in specifyvalues, while higher levels of an objective hierarchy relate to general concerns like economics, health and safety, and flexibility; in short, it helps to identify missing objectives.In the end, it is established that we have to know the subject’s needs to determine the value of an object. In most cases, since needs are diverse, it is necessary to weight each need. Furthermore, since these needs often conflict with each other, trade-off and weighting of each need is important to evaluate the value of an object. Due to this, it is possible to categorise value evaluation into Multi-Criteria Decision Analysis (MCDA)(Scott, Molenaar et al. 2006; Xia and Wu 2007).

Figure8. The decision process of car purchase



3.3.4.2 Types of value judgement

Basic type: The basic type of value judgment is concerned with evaluating either the value of an object or the degree of need of the object (refer to figure 8). Value judgment comprises several steps. First identifyingthe needs of the subject based on one's conditions should be conducted. Once the needs are gathered, they are transferred by criteria to evaluate the value properly. These criteria are selected from among the internal factors which explain the state of the object. Finallyevaluating of the criteria will be conducted. It is the evalator who selects needs and criteria. Therefore the evalator's ability such as judgment, intelligence, experience, intuition, education, preferences, and so on have a significant effect on the value judgement. This process is suggested in detail in figure7 above.

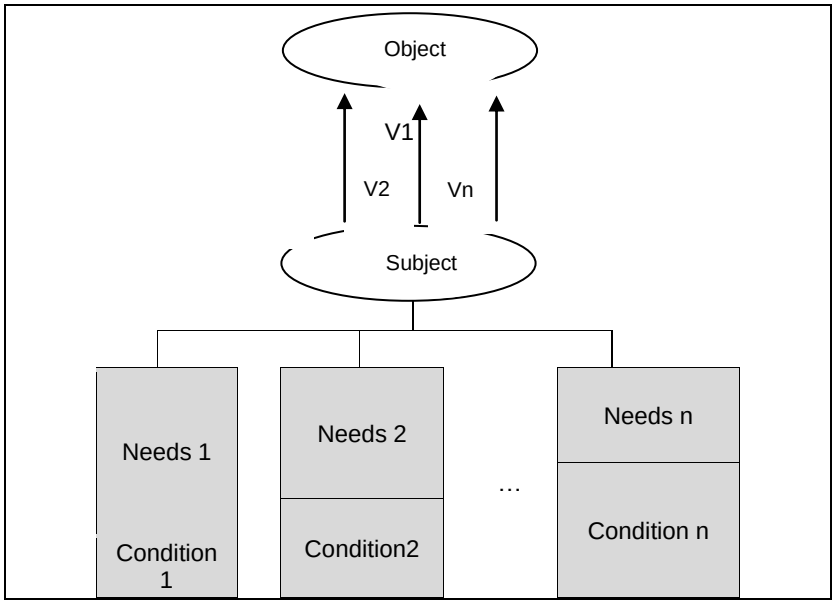


Figure 9. Basic value judgment

Selection type:Choices are an essential part of our general day-to-day lives and we are often confronted with the difficult task of making selections in ordinary life. Likewise, a contractor has a tougher job because he has to make selections and choices in every purchase or while taking important decisions. Johnson (1990)makes a similar observation when he notes that we are required to make endless decisions in our everyday lives. One cannot always have everything because of certain constraints like limited resources. Therefore, one needs to select the best one of the options available. These selections are generally shaped by the needs of the individuals, demands of the customers, and the subsequent effect on product; so, these factors become the driving forces of the exchange. The customer is desirous of a balance between perceived quality and its cost when selecting one product over another similar product. Consumers will purchase a product that they perceive has greater value than the others.

People try to select the option that is best-valued or most needed from among several options(Johnson 1990). In order to select the best-valued option among several options, the value judgement of each option should be conducted in turns. The process is similar to a basic value judgment;however, this includes one more step - the comparison of the results of each value judgement. This is the extension process of basic value judgment (refer to figure 9).

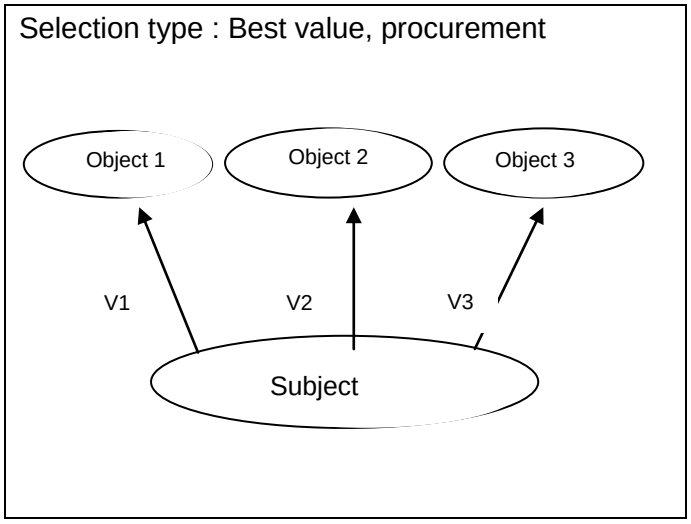


Figure 10.9 Selection type of value

Socialisation/Education:The value judgment related to the economical use of value can be improved by socialisation and education (refer to figure 10). For example, an amateur connoisseur does not know the value of art, nor can he judge the original from the fake. However, after acquiring knowledge in the field, and with experience, he can identify the original work of art as well as estimate its value accurately. Socialisation and education as the processes of delivering value judgments assist an individual in almost everything in life,not only in this field, and in passing on the important values from one generation to the next. Another example is wherein many cases, there are times when the priceand special features do not match the budget. An appropriate decision-makingmethod for selecting the best car is useful tocustomers. Many customersseek advice from car experts or friends when purchasinga car(Byun 2001). This is another kind of education about value since the expert can gauge more accurately the value of car based on the condition of the buyer.

Some studies (Glenn 1980; Jon and Mortimer 1985; Konty and Dunham 1997; Johnson 2002)related to the philosophical use of values have claimed the values stabilise according to aging,but they did not identified the reasons fof this phenomenon (Hitlin and Piliavin 2004). It is possible to explain this phenomenon by the concept of the values in this study. Values are virtues that are needed by a subject in certain conditions(Rokeach 1973; Schwartz 1992; Schwartz and Sagie 2000; Spini 2003). For example, people are asked to follow certain virtues prescribed by the society in which they live. Social agencies such as education, law, regulatory, and others might be used to ensure the proper

implementation of and adherence to these virtues. If a member of society disobeys or deviates from these virtues or values, he has to pay the price for this. He may be punished or condemned by the society. Therefore, it is more natural for adults to adhere to the values prescribed by the society that they belong to than it is for their children to follow them(Konty and Dunham 1997; Hitlin and Piliavin 2004). Kelly (2002)claimed that the number of interfaces that exist between individuals and groups of individuals is involved in the value judgment process.Parents encourage their children to adopt values that they (as parents) found vital to educational and occupational success(Hitlin and Piliavin 2004).

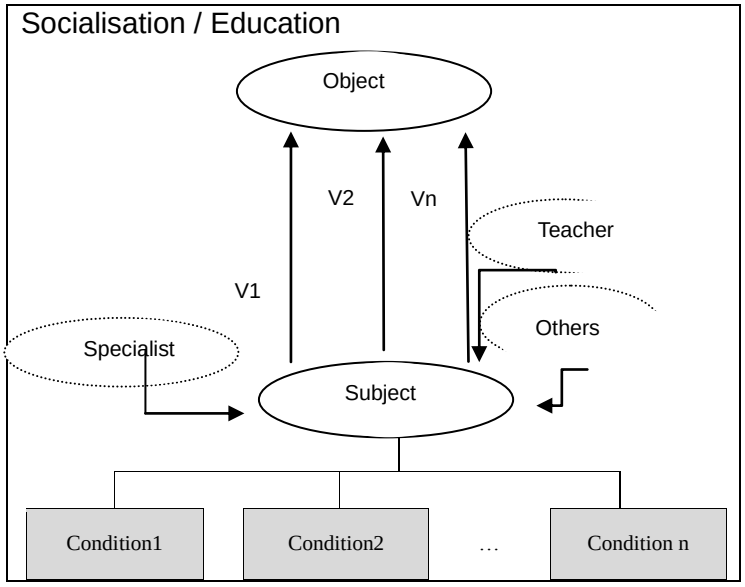


Figure 11. Socialisation/Education of value

Public value type: The public sector comprises of various shareholders; these can be the citizens, government officials, civic groups and environmental groups. Therefore, it is natural for the public sector to have more complicated needs that often conflict. For example, while the main requirement of the private sector is profit, on the other hand the public sector has to consider the various needs of the citizens and public officials. As a result, public value judgment is more complicated because of these various needs (refer to figure 11).

Bell (1994) claimed that the definition of value will vary according to the nature of the definer and their circumstances. This creates particular problems when a number of people are involved in achieving value for a third party, where value may be interpreted differently by those involved in its production.

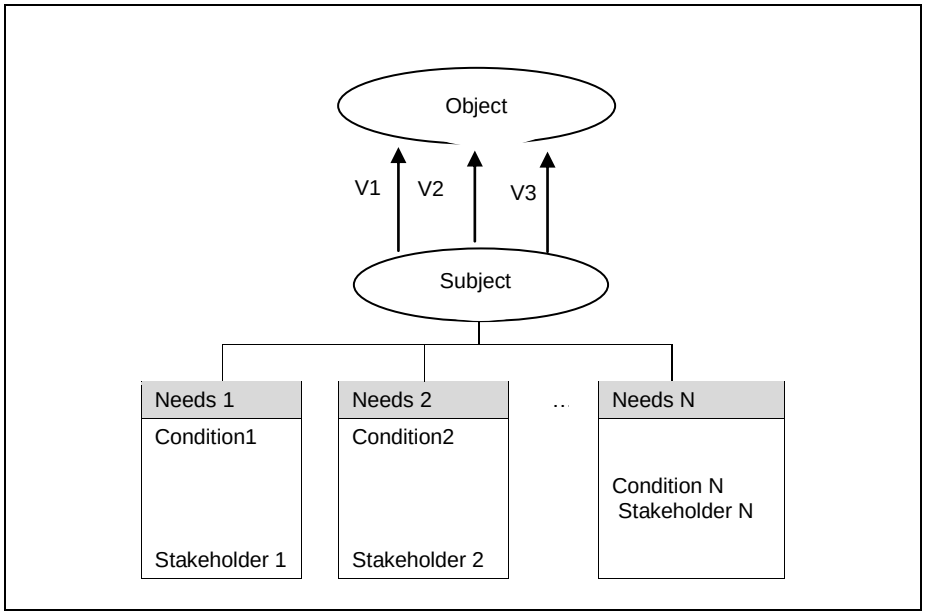


Figure 12. Public value

Value creation and risk:It is really important to have knowledge about the factors that increase or decrease the value of an object. In the following scenario, if the value of a watch is 100 dollars in general conditions, then by perceiving it as an antique or by loading it with a new function, its value can be increased to 200 dollars. On the other hand, if the watch stops working, or if a person buys a new watch, then the value of the watch will fall to 50 dollars. The first change is referred to as value increase or creation and second instance is value decrease (refer to figure 12). Value creation is related to thecreation of need(Walter, Ritter et al. 2001; Ulaga 2003). For example, a watch that is out of order is generally useless. If,however, people come to know it is an antique watch, its value will increase. In this case, its new value was created by classifying it as an antique (the change of perception of subject)t. Since it is not the product but the buyer's conditionthat has changed, this resultcan be referred to as the value creation by the change of condition. On the other hand, if there are additions to the state of the watch such as a camera, an mp3 player, and so on, its value will be increased. This is referred to as internal value creation (refer to section3.3.5).

On the contrary, the decrease of value is related to risk. Risk can be presented in something that has potential to decrease the value of something in the future(Tufano 1996; Duffie and Pan 1997). Therefore, it is important to minimise any risk that can cause value depreciation by managing risk factors(Tufano 1996). The risks can be classified as internal and external, whereinternal risk is related to the depreciation in the state of object, and external risk refers to the change of the condition of subject related to the decrease of need for the product. For example, when we buy a car, the breakdown of a car is an internal risk factor that depreciates the value of the car while the rise in oil prices can be categorised as external risk factors(referred to section3.3.5).

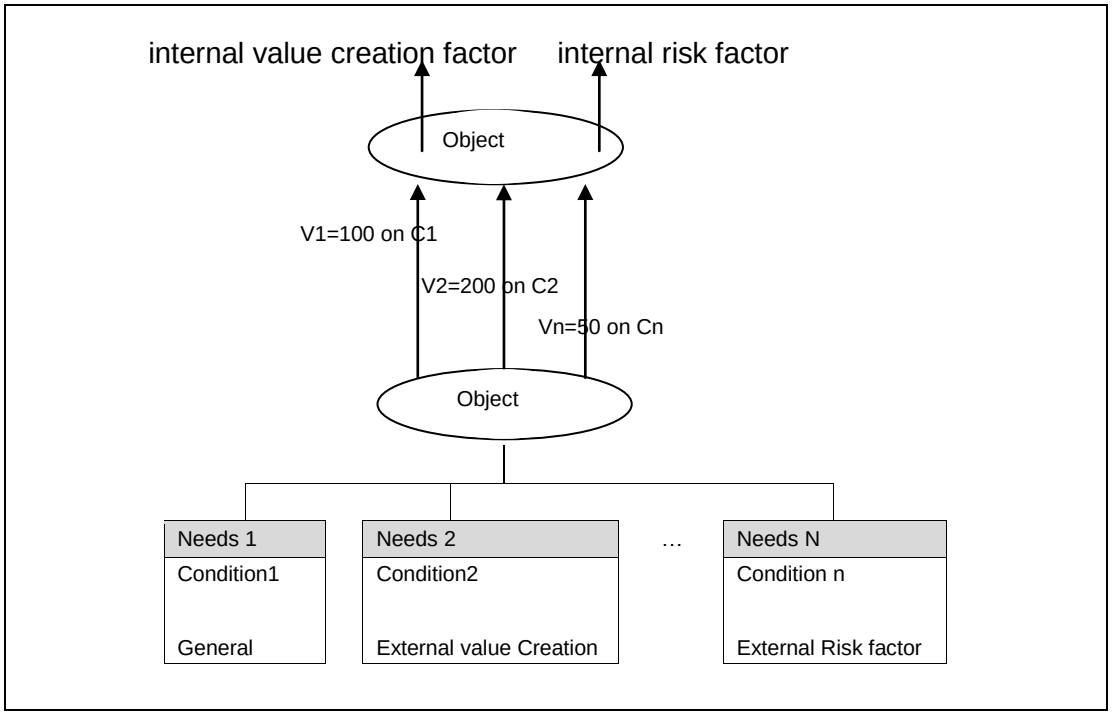


Figure 13. Value creation and risk

Fromthe manufacturer'sperspective, there are two methods to increase the value of goods; internal or external value increase. For example in the car, value can be increased or created through the improvement of general functions such as speed, fuel efficiency, comfort ability, safety, or adopting a new function such as new engine, advanced technology. This is internal value increase since the value is created by the change within car itself. On the other hand, marketing or advertisingcan be considered external value increase methods, since these cause a change in the buyer's perception, which is one of the conditions of the buyer.

3.3.5 Value Factors and Criteria

How do people judge whether something has value or not? What affects the value of an object? What determines whether something has value or not? What is the standard against which value is judged? These are important questions to understand the concept of value.

Factors:It is possible to assume that what affects the value of something is value factor. That is, the value factor determines the value of something. It has already been stated above that value is defined by the state of the object and the condition of the subject. It is critical both these facts in order to find out the value of the object. For example, if people buy a car, we have to know the state of the car and the condition of the people themselves. At first, people consider their conditions before making a purchase; these could consist of numerous factors such as gender, age, job, height, weight, financial state, purchase purpose, the number of users, preferences, oil prices, nationality, amongst others.

Once the conditions have been assessed, people will select a car in accordance with those conditions. The check list for the selection of a car may be its price, brand, model, colour which can explain the state of the car. The state of the car also consists of numerous factors; price, brand, colour, design, engine power, audio system, resale price, fuel efficiency and so on. These numerous factors affect the value of the car. The former conditions factors can be defined as external value factors like age and gender because they decide the condition of the buyer (subject). On the other hand, the latter such as price and model can be referred to as internal value factors since they explain the state of the car (object). Therefore, it is possible to suggest that these factors could be the general value factors of a car, since these factors determine the value of a car. In general, people buy the car through evaluation of the state of the car based on the condition of the buyer. That is, the car is bought through the evaluation of the internal factors of the car based on the external factors of the buyer (refer to table 4).

On the other hand, these internal factors are further classified into sub-groups: economic factors (price, running cost, resale price); safety factors (air back, brake type, impact test); and aesthetic factors (style, colour). These sub-factors can also be divided into further details. For example, the running cost can be divided into fuel price, fuel efficiency, road tax, insurance fees and parking fee. Therefore, the structure of these factors forms a hierarchy frame. In accordance with the in-depth analysis applied, these factors become more detailed and accurate. In the development of knowledge, people can use factors directly to express needs. For example, at first, people say 'I want an economical car', but with deeper insight and increase in knowledge, people can say 'I need a high fuel-efficient car', instead of just saying that they need an economical car. As another example, if someone says that he needs a low running cost building, instead of an economical building, in this case, the low running cost can imply need and factors at the same time. Furthermore, these factors can be divided into quantitative or qualitative factors.Johnson (1990)claimed that while most techniques focus on evaluating quantifiable costs and benefits, it is equally essential to include qualitative factors associated with the broader decision-making context.

Table 4. Value factors

Division	Role	Sub-factors
Factors of subject (External factors)	Explain the conditions of subject (Buyer)	Physical and financial state, purpose, number of users, preference, oil price, etc
Factors of object (Internal factors)	Explain the state of object(Car)	Price, design, colour, number of seats, fuel efficiency, audio facilities, etc

***Criteria*:**If we consider all the factors correctly for identifying the value of a car, it can be identified as the real value of a car. However it is difficult to identify all the various states of the car and the innumerable conditions of the buyer with precision, since they are composed of infinite factors. It is impossible to consider all factors which comprise the state and conditions when defining the value of the object as suggested in section 3.3.3. People usually use some of these factors for identifying the value of something. These factors can therefore be referred to as criteria. For example, when people buy a car, they usually do not consider all the factors such as thickness of the car body, the material or quality of the paint, or the brightness of the lights, although these factors do affect the state of the car. They use some important factors including price, brand, space, and oil type. These important factors are the criteria. Thus, criteria can be the internal factors that are used to identify the value of the object.

Factors and criteria are related with need(Geringer 1991; Kontio, Caldiera et al. 1996). For example, if a buyer wants to buy an economical car, this can be identified as a need. This need is based on the conditions of buyer such as income or job. External factors determine the kind and degree of need. This need can be expressed through internal factors such as price, fuel efficiency, resale price, maintenance fee, tax, insurance fee, and so on. Therefore a need can be expressed by several factors(Bruner and Goodman 1947; Blanchard and Fabrycky 1990). In another example, if a person wants an economical building, then this is a need which can be expressed by internal factors such as initial construction cost, running cost, and maintenance cost. That is, a need can be expressed by the internal factors(Labov 1994). The difference between need and factors is that need includes the demands of the subject such as low, high, cheap, beautiful, etc., but factors are just the evaluation tools for determining and expressing the need. However, all internal factors are not used to identify the value of the object. In reality only some of the factors are used, and they become the criteria.

In the end, value factors can be expressed as the expression tool of the state of the object and the condition of the subject(Bruner and Goodman 1947; Bales and Couch 1969).On the other hand, criteria can be the internal factors that are used to define the value of the object(Bruner and Goodman 1947; Bales and Couch 1969; Kaiser 1974). Once the needs are identified based on the conditions of the subject, then the evaluation criteria can be listed with internal factors that explain the state of the object to express the needs.

3.4 Development of Best-value concept

3.4.1 Concept of Best-value

From the above definition of economic value, it is possible to define best-value. Since value is the degree of need of an object, best-value can be used to refer to the most needed object. That is, best-value is the most needed object for a subject in certain conditions. This concept can be expressed by the statement that the best-value car is the best-valued car, and that the best-valued car is the most needed car. What is the best-valued or most needed car? For example, even though the Rolls-Royce or Mercedes Benz are considered two of the best cars, they are not always the best-valued car for everyone. In most cases, their economic factors such as price and fuel efficiency does not match the buyer's financial conditions. That is, they are not always needed by every buyer. As a result, the best-valued car is the car that best meets the client's needs. In most cases, however, people have several needs such as the need for a car to be cheap, safe, comfortable, among other factors, and these needs often conflict with each other. Therefore, it is difficult or nearly impossible for a car to be best car in every needs at the same time. In the end, best-value is the best combination of needs of the subject in certain conditions.

Best-valued Object $= f(\omega_1 N_1,\ \omega_2 N_2, \dots, \omega_n N_n) = f(\omega_i C_i(N_1), \omega_i C_i(N_2), \dots, \omega_i C_i(N_n))$ (5)

where:

ω: weighting, N : need, C : criteria that represent needs

$\omega_i C_i(N_1)$:weighting on one of the criteria that representNeed$_1$

This suggestion could be supported by Darlymple's(2002)explanation that best-value is something that provides the most 'value' in the user's estimation. There could be many factors in determining best-value; price is just one of these. Best-value would most likely be achieved through obtaining services that best meet the demands and needs of the concerned party. In his opinion, in order to ascertain best-value, several contexts have to be taken into consideration. If the context changes so will the factors impacting the perception of value. Darlymple (2002)also emphasised that the definition of value must be context-specific and flexible enough to take account of the stakeholders' perspectives.

Hence it is evident that the process of finding the best-value involve finding the needs of subject (including stakeholder) under certain conditions, selecting the criteria representing the needs among several internal factors, deciding the weighting of the criteria, and evaluating the criteria. This idea is endorsed by the following studies.NASA (2001)defined "Best-Value selection as the selection of an offer based on the best combination of price and qualitative merit." On the other hand, there are two types of best-value concept; one is suggesting best-valued object (ideal object) by combination of

needs, the other is selecting best-valued object from among several objects.McDougall (2002) claimed that best-value consists of the evaluation of key factors. This is a sequential process: first, understanding what the key factors are, obtaining accurate measures, then analysing the findings, adjusting the relevance of certain aspects and looking for more appropriate measures.

3.4.2 Best-value in Building Construction

For the purposes of this study, the term best-value means the best-valued or most needed object to a subject in a certain condition. As defined above, the meaning of best-valued is expressed as the best combination of the needs of the subject. In the end, a best-valued building is the one that has the best combination of the needs of a subject under certain conditions. Therefore, it is important to identify the needs of the subject in order to realise the best-value in building construction.Johnson (1990)claimed that the designer should try to deliver the building that satisfies the needs and wants of the client in order to succeed in the project. Therefore, this is the main strategy for identifying the various needs of the subject and the criteria which express these needs, and then to combine these criteria properly in order to achieve best-value.

Of course, these needs of the subject change according to the conditions such as project purpose, client, place, financial state, time, law, and so on. Love et al.(1998)suggest that owners of a similar nature do not necessarily have similar needs, which are based on many factors which are usually project-specific. For instance, if the speed of construction is the most important aspect, then that client would weigh the selection criterion ‘speed’ above other criteria. This asserts that a standard set of importance weightings would overlook the project characteristics. Therefore, the identification of the relevant set of criteria and weighting system that take into account the project characteristics is necessary in every decision. Best and De Valence (1999)claimed that value increases by the increasing of the quality of various criteria which are related to the project characteristics. Many studies support the importance of the needs of client for the best-valued building construction.NAO (2004)claimed that the key factors in building construction are to ensure that the buildingsconstructed are meet the requirements of all stakeholders, most specifically the end users.Johnson (1990)also claimed that the strategic nature of important decisions requires the participation of multiple disciplines and other project stakeholders.OGC (2002)suggested that the best-value building consists of appropriate needs or criteria. Therefore, it is important to identify the dominant needs and criteria and reflect these, especially in the design of a construction project. In the building project, the process of design can serve the purpose of articulating the needs of the users. It is not the procurement process itself that determines the outcome but the client that is more important. The understanding of what good design is is the most important thing for the client (Winch 2008).

Furthermore, in public building construction, since the subjects can be as varied as civilians, officials,

civic groups, etc, it is more complicated to assess and enlist their needs than that of the private sector. Gann et al (2003)concluded that the most significant measure in evaluating the design quality of a building is to ensure that it meets the requirements of the user and to know their opinions about it. They further suggest that although one may be able to collect such information, it is however not easy to interpret or understand such views: it is likely that several different and conflicting views might be held by individuals and groups. The stakeholders, such as managers, clients, occupants, visitors, cleaners, and repair staff,might all have different perspectives on the same facility.

The most important determinant of best-value can be the decision of the most appropriate combination of needs and criteria(Keeney 1999; Martin 2000; Darlymple 2002; Zhou and Bovik 2002).In connection with the combination of need and criteria, in most cases, since the needs of the subject in relation to the best-valued building are several and conflicting, the process of best-value basically involves a kind of multi-criteria decision analysis and trade-off.Loftness et al. (2007)claimed that there should be a balance within the needs as excessive stress on a specific need can lead to problems in other needs. This is evident from the happenings of the 1970s where more emphasis was put on one performance area such as energy, without considering the range of performance areas in buildings, and this resulted in failures in other performance areas such as serious air quality and degradation failures. Likewise, they also claimed that the uncontrolled use of fungicides or disinfection products can add to indoor chemical exposures, which can also result in severe imbalance. Thus, Loftness et al. (2007)concluded that building evaluations continuing in a single area may cause more problems in other aspects.In the next chapters, the needs or criteria of a valuable building will be traced in previous literature,then combined appropriately.

3.5 Needs and criteria of valuable buildings in the literature

Various patterns of needs and criteria that are required for valuable building were suggested in previous literature such as Brandon(1984)and Yasin and Egbu (2009). Basically, since the purpose of building and the conditions of clients are different, these variations are natural. Johnson (1990)claimed that the most widely agreed view is that the most important goal of building design is to provide a facility to the owner/user that can produce maximum value. Johnson (1990) also suggested that there are no standardised methods available that can measure this value; and also this value usually varies among individuals.;however, basic or critical needs/criteria for the valuable building may be available. As such, the needs/criteria which were frequently mentioned as critical factors in previous research will be organised for efficient study.

Building performance evaluation systems can show the needs and criteria of buildings. Vischer (1989)praised the performance concept as the most systematic approach for evaluating buildings.The way that users interrelatewith its physical, business and work environments can be represented by

building performance systems. In a way, the definition of user requirements and performance criteria is necessary to this evaluation system for evaluation of predicted or actual performance throughout the entire buildinglife cycle.For this reason, the building performance evaluation will be first traced to identify the needs and criteria of a valuable building.

3.5.1 The needsandcriteria in building performance evaluation system

For exploration of the needs and criteria in building evaluation systems, following evaluation systems will be traced.McDougall (2002) suggested three dominant tools: Building Quality Assessment (BQA); Serviceability Tools and Methods (STM); and the Post-occupancy Review Of Building Engineering (PROBE) occupant questionnaire.

Building Quality Assessment (BQA):BQA is generally referred to as the degree to which the design of the building and the incorporated specification meets the requirements for that building. According to the BQA, quality is a relative rather than an absolute concept. This system categorises buildings into nine divisions (refer to table 5) so to establish a broad classification of requirements of the users (Yasin and Egbu 2009).

Table 5 The criteria of BQA

BQA category	Description
Presentation	Appearance of the building and impression created
Space serviceability	Factors that determine operation of spaces
Access and circulation	Access of people and goods; security
Amenities	Facilities or spaces for people
Business services	Electrical services and IT
Working environment	Environmental condition
Health and safety	Mandatory and other H&S issues
Structural	Building structure and condition
Building management	Short and long term

Serviceability Tools and Methods (STM):According to the International Centre for Facilities (1995-2000) the STM technique developed in the early 1980s provides a broad-brush, macro-level method, appropriate for strategic, overall decision making. STM deals both with demand (occupant requirements) and supply (serviceability of buildings) ***(Yasin and Egbu 2009)***, andcan be further sub-divided into 14 groups with 78 sub-factors in the occupant requirements category and four groups with 23 sub-factors in the serviceability of the building ***(ICF 2006)***. The 14 groups are: support for office work, meeting and group effectiveness, sound and visual environment, thermal environment

and indoor air, typical office information technology, change and churn by occupants, layout and building features, protection of occupant assets, facility protection, work outside normal hours or conditions, amenities to abstract and retain staff, special facilities and technologies, and location,accessandway-finding. The other four groups are: structure·envelope·grounds, manageability, management of operations, and maintenance.

Building Use Studies (BUS) and Post-occupancy Review Of Buildings and their Engineering (PROBE): Yasin and Egbu (2009)state that the BUS method was originally developed for the Office Environment Survey and then adapted for the PROBE project in the United Kingdom. The BUS and PROBE collect information on 10 factors; overall comfort, temperature, air movement and quality, lighting, noise, productivity, health, design, image, workplace needs. Their main objective is to measure the occupant satisfaction and lever of productivity or output. The following two tools are also often cited to identify the needs and criteria of a valuable building.

Building In Use assessment (BIU):BIU used the ratings given by the occupants as the basis on which to measure the intrinsic qualities of the environment. The BIU assessment made use of six dimensions as the generic criteria to measure the quality of the office environment and these were based on the categories of the environmental judgments made by the users. These six building dimensions are lighting comfort, spatial comfort, thermal comfort, air quality, noise control, and privacy. This assessment system based on building in use appears to focus more on the quality of the office environment rather than on the holistic building performance (Vischer 1989).

Total Building Performance (TBP):There are six building performance factors that are important for measuring the total building performance: spatial quality, thermal quality, air quality, acoustic quality, visual quality, and building integrity. There is however one important factor that has to kept in mind while evaluating these factors. Since none of these factors can be measured in isolation, they all have to operate together well for total building performance. To be an acceptable building in all performance areas, conflicts between performance mandates and limits should be solved. The success of a building's performance depends on the effective integration of the factors and communication with users. This interface is conducted in conception, design, specification, installation, and use.(Hartkopf, Loftness et al. 1986).

To summarise, it can be stated that the main focus of these performance evaluation systems is both on the functional and the comfort aspects among the needs of the building users. Therefore, it could be suggested that these two aspects are important factors of the valuable building. Apart from this, various sub-needs of the valuable building as mentioned in the performance evaluation systems also can be categorised in three groups (refer to table 6).

Table 6 The criteria of building performance systems

Needs(Criteria)	BQA	BUS	BIU	TBP
Functional building (Serviceability)	Space Serviceability Electric and IT Access Management	Productivity Workplace needs	Spatial	Spatial quality
Comfortable building (Comfort)	Health Amenities Working environment	Comfort Temperature Air quality Lighting Noise Health	Air Quality Noise control Thermal Lighting Privacy	Acoustical quality Air quality Thermal quality
Others	Structure safety Security Presentation	Design Image		Building integrity Visual quality

In traditional usage, the term 'building performance' has referred to factors like fire safety, indoor air quality, thermal efficiency and noise control. These factors constitute the 'micro-level' criteria and are important in order to understanda building's performance in the fulfilment of functional requirements of users;however, this alone is not sufficient. Rather, a more holistic approach is needed for long-term assessment of the overall behaviour of the building. Despite this, since a number of factors are involved in holistic building assessment, the predictability of this assessment is relatively low. This is shown in figure13 which explains why most early studies have concentrated on measuring and assessing the performance of building products rather than whole buildings (Douglas 1996).

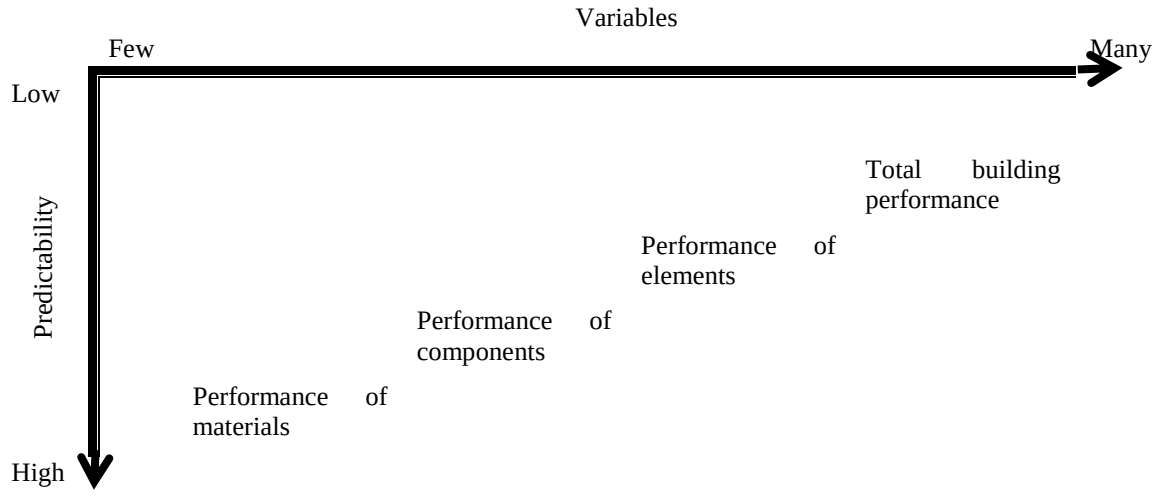


Figure14. Degree of performance predictability. Source : (Douglas 1996)

It is mandatory to hold a thorough investigation into various building evaluation areas in order to overcome the limitations of building performance systems as well as to identify holistic understanding about valuable buildings(Douglas 1996). In recent research, environmental performance and sustainability have been established as issues that need to be approached with a view to continuous improvement. How buildings respond to these issues is well depicted in 'sustainable design programmes'performance measurement (McDougall 2002).

3.5.2 Sustainable Design Programmes

Bunz et al.(2006)compares and contrasts sustainable design programs based on the life cycle of a building in North America, Europe, and Asia in the table 7.

Table 7. Sustainable design programmes. Source : (Bunz, Henze et al. 2006)

Nation	**North America**		**Europe**		**Asia**		
	USA	Canada	UK	Germany	Japan	Hong Kong	Korea
Programmes	LEED, ASHRAE	IDP,CBIP	BREEAM	FOBRP	CASBEE	HKBEAM	GBRS

LEED : Leadership in Energy and Environmental Design,
ASHRAE : American Society of Heating, Refrigeration, and Air-Conditioning Engineers
IDP : C-2000 Integrated Design Process,
CBIP : Commercial Building Incentive Program;
BREEAM : The Building Research Establishment Environmental Assessment Method
FOBRP : Federal Office for Building and Regional Planning
CASBEE : The Comprehensive Assessment System for Building Environmental Efficiency
HKBEAM : Hong Kong Building Environmental Assessment Method
GBRS : Green Building Rating System

Bunz et al. (2006) claimed that these programmes address all the important criteria in a sustainable building. The main factors are energy efficiency, water efficiency, indoor environment, site location, material usage, and atmospheric considerations. The factors like urban sprawl, effects on local ecosystems, and interaction with the surroundings built environment are important in sustainable site locations, while material usage involves the selection of materials with recyclable properties, reusable products, and the implementation of recycling procedures throughout building operations. Another important criterion is atmospheric considerations which are primarily related to the use of ozone-depleting substances. In this respect, the emission of greenhouse gases is also considered in the comparison of programmes (Bunz, Henze et al. 2006).

Although some of the indoor issues have related to building performance, these sustainable design programmes focus more on global and regional issues based on a broader environmental perspective (Cole 1999).Ultimately, environmental building is also an important need of a valuable building in modern society. Apart from the above-mentioned factors, previous studies have traditiaonlly included economic and aesthetic aspects as important factors in valuable building. Therefore, it is helpful to review the studies on the holistic and comprehensive needs of a building in order to gather information about the other critical needs of a valuable building.

3.5.3 Other needs and criteria

According to Cook(2007)humans have deeply interested in the quality of buildings since ancient times. He also suggested that the Roman Architect, Vitruvius, believed that the design quality of a building is based on three principles which remain valid to date: firmness, commodity and delight.The integrity of any building is required to withstand the impact of natural forces (such as age, gravity and wind)during the whole life-cycle with proper maintenance and repair. It must also be commodious and functional to meet the purpose of the building. Finally, the aesthetic aspect of a building should be considered to inspire user and visitors. These three principles can be modified into four needs: safe building, functional building, comfortable building, and asethetic building.

The economical aspect of the building can be also considered as an important factor. Less capital and running costs are also very important. According to Yasin and Egbu (2009),facilities could be measured by three components: physical, functional and financial. The physical aspect is measured by the building's fabric which incorporates physical properties like heating, structural integrity, energy efficiency, lighting, durability, and maintainability. On the other hand, functional performance is related to the occupier of the building and embraces issues such as space, layout, ergonomics, image, ambiance, communication, health and safety and flexibility. Lastly, financial performance depends on the physical and functional performance of the building and includes capital and recurring expenditures within whole life, depreciation and efficiency of use.

According to Brandon(1984)the quality of building design is dependent on its circulation, spatial arrangement, aesthetics, efficiency, flexibility and functional ability along with its capacity to modify the impact of climate and keeping the structure in suitable condition. Quality in this context consists of the criteria set out in table 8.

Table 8Criteria of building quality. Source: Brandon (1984)

Main criteria	Sub- Criteria
Level and type of services	Air conditioning, communications, lighting and the like
Performance of services	How well the services fulfil their intended functions
Flexibility	The capacity for re-use or change of use
Fitness for purpose	How well the final product serves the intended function
Uniqueness	Symbolism role, e.g. as a model of environmentally sensitive design
Natural site attributes	Availability/utilisation of a view, or access/proximity to other localities, installations
Minimised occupancy costs	Low operating costs
Extended useful life	Durability, flexibility
Capacity for a financial return	Sale or lease
Productive working environment	Comfortable, stimulating
Optimal indoor environment	Thermal comfort, air quality, absence of sick building syndrome
Security	
Excursion of external climate	Wind, rain, temperature extreme
Minimised environmental impact	Of increasing importance as public concern for green issues grows

The OGC (2002)claimed that a good design is not all about taste and style. Rather, a good design is one which adhers to the principles which determine the proper serviceability of the building for its users and the community. It includes integrity of structure, efficiency in its function, sustenance, recurring costs for lifetime maintenance, flexibility and adaption to the location.

On the other hand, NAO (2004)believes that a good public building must be a contributer rather than an obstacle to its environment;it must have the capacity to promote socio-economic benefits, and it must be adaptable to changing circumstances. NAO believes that this is more important than technical aspects or aesthetic appeal. The quality of services provided by the public sector can be improved by a well-designed building. In other words, value for money is increased by a good design within the building's whole life cycle. Thus the crux of a good design is build quality, serviceability, efficiency, sustainability, design in context, impact.

A well designed building which will last and invigorate the soul should provide sufficient space to fit all purposes. Safety, sustainability and a healthy environment are assured by a good design. Good designs should be capable of keeping water and energy consumption to a minimum and should help in reducing waste materials during construction and usage(CABE 2006).

Based on the above norms, it is possible to broadly categorise six essential needs (criteria) for study. These are: functional building (serviceability), comfortable building (comfort), safe building (safety), economical building (economicfeasibility), environmental building (environment-friendly), and aesthetic building (artistry). The needs and criteria suggested above can be summarised in these six categories (refer to table 10).

Design Quality Indicator(DQI)(CIC, 2011; Markus, 2003: Slaughter, 2004) is the leadingprogram to evaluate the design quality of building. It has been developed to help building stakeholders achieve more satisfaction from the design of buildings, and to support in develpoing the quality of buildings. DQI questionnaire is a uncomplicated, non-technical set of statements that assemble the opinions from all stakeholders by considering the functionality, build quality and impact of buildings: 1) Functionality is related to the way in which the building is designed to be useful and consist of use, access and space. 2) Build quality is concerned with the performanceof a building structure and is split intoperformance, engineering and construction 3) Impact mentions the building's ability tocreate a sense of place, and to have apositive effect on the local community andenvironment. It consist of form and materials,character andinnovation, , internalenvironment and urban and socialintegration.

Despite the various assessment tools used widely around the world (as referred to above), there is no consensus about the needs/criteria of a good building. These building performance assessment systems mainly focus on the serviceability of a building such as the interior environmental quality of the office. Likewise, sustainable design programmes concentrate more on environmental issues rather than on building performance issues. Other research such as Brandon(1984), NAO (2004)which suggest holistic needs/criteria, also duplicated or omitted some criteria which are suggested as critical in other studies.

3.6 Needs and criteria of a valuable building in this study

According to previous studies, six main needs (criteria) and 34 sub-criteria were developed as features that a good building should have. These are presented in table 9.The six needs (criteria) specified in this study are manageable and comprehensive enough to encompass the needs and criteria along a broad range of aspects which is suggested in other research. Important factors which were suggested as various forms in previous research are also categorised within the six main needs (criteria) as sub-criteria. In addition, 'parking' and 'traffic effect' are also added through a pilot survey, since these two factors are considered as important in Korea. In the planning stage, the trafficeffect should be considered in buildings over a certain size. Parking is also an important issue with many buildings located in urban areas. The experts who joined the pilot survey also suggested that 'energy efficiency' should be included in the operational costs category because operational costsare closely related to energy use.

On the other hand, some studies such as that of Brandon (1984) suggested productivity as an important criteria in good building. However, since productivity is the result of several needs or criteria, it is not categorised as an independent criterion in this study. For example, comfort, functionalality, and beauty in a building can affect the productivity of the building user(s). In other words, each criterion cannot be understood in isolation from the others. the criterionrelating to several categories wastried to be classified within suitable category.

Table 9. The needs of and criteria for valuable buildings

Needs (Criteria)	Sub-criteria	Reference
Functional building (Serviceability)	Accessibility, Layout, Maintainability, Flexibility, IT, Parking	(Yasin and Egbu, 2009) (Brandon,1984) (Vischer, 1989) (Hartkopf et al., 1986) (Bunz et al., 2006) (Cook, 2007) (OGC, 2002) (NAO, 2004) (CABE, 2006)
Comfortable building (Comfort)	Finishing, Lighting, Heating and Cooling, Ventilation, Sanitation, Noise, and Privacy	
Safe building (Safety)	Durability, Earthquake-resistant, Fire resistance, Security, Safety of building equipment (such as lifts, electrics)	
Economical building (Economic feasibility)	Initial construction cost, Operating costs (include energy efficiency), Maintenance costs, Depreciation, Financial return	
Artistic building (Artistry)	Appearance, Colour, Harmony with Surroundingss, Symbolism Role, Tradition, Uniqueness	
Environmental building (Environment-friendly)	Traffic-effect, Contaminants emission, Effects on local eco-systems, Recycling material use, Emission of greenhouse gases	

Summarised by author

This chapter focused on the various opinions of researchers about needs/criteria of a good building, which provide an insight relating to the current perception of needs/criteria in good building from various professional aspects. In order to identify the best-value model in Korean public building construction, the dominant needs/criteria and their respective weightings must be identified. In addition, the difference in the importance and weight fo each criterion according to the demographic background and the kind of building was tested since the concept of value and best-value depend on the condition of the subject such as job of subject, or purpose of project (kinds of building) (refer to section 3.3. 3.4). To realise this aim, the research design will be formulated in the following chapter.

Table 10.Six main needs(criteria) and sub-criteria from previous research

Needs(Criteria)	Brandon (1984)	Yasin and Egbu(1996)	Cook (2007)	OGC (2002)	NAO (2004)	CABE (2006)
Functionalbuilding (Serviceability)	Serviceability Flexibility Fitness for purpose Productive Communications	Space Layout Efficiency of use Flexibility Maintainability Communication	Functional Optimal maintenance	Functional efficiency Flexibility	Serviceability Effectiveness Efficiency in delivery(on time and budget) Comply with third party requirements Build quality(easy to maintain)	Fit for purpose Lift user's spirit
Comfortable building (Comfort)	Optimal indoor environment Air conditioning Lighting Working environment	Heating Lighting Health Ergonomics	Commodious		Productivity	Healthy
Safe building (Safety)	Durability Security	Structural integrity Durability Safety	Robust	Structural integrity		Safe
Economical building (Economics)	Low operating costs Financial return	Capital cost Life-cycle cost Depreciation Energy efficiency		Lifetime costing	Minimise operational and maintenance costs	Minimising energy and water consumption
Aesthetic building (Artistry)	Uniqueness Symbolism role Natural site attributes	Image Ambiance	Beautiful	Responsiveness to the site	Impact positively on the locality	
Environmental building (Environment)	Minimal environmental impact			Sustainability	Sustainability Minimise environmental impact	Reduce waste Sustainable

Summarised from the literature by the author

Chapter 4 Research Methodology

4.1 Research process and questions in this study

This study can be divided into two parts; the first attempts to define the concept of best-value, and the second applies the best-value concept to Korean public buildings construction. In order to identify these research topics, an appropriate research methodology comprising the relevant philosophy, approach, strategy is required. The aim of this chapter is to explain the overall methodology of this research and to develop the research design to detect and weight the needs/criteria of Korean public buildings.

The best-value concept is developed in chapter three by observation and interpretation. The second part of this study(the application of best-value concept to Korean building construction)is addressed in chapters four and five. This section also consists of two steps; one to identify the general needs/criteria of a valuable building, and the other to weight these needs/criteria for a best-valued Korean public office building. This application is achieved by three kinds of research methods in turn: literature reviews, general survey, and the Analytic Hierarchy Process (AHP) survey. Literature reviews and a general survey will be employed in order to identify needs/criteria of valuable buildings and the analysis by the AHP survey will present the weightings of the needs/criteria. The research process for this study is depicted in figure14.

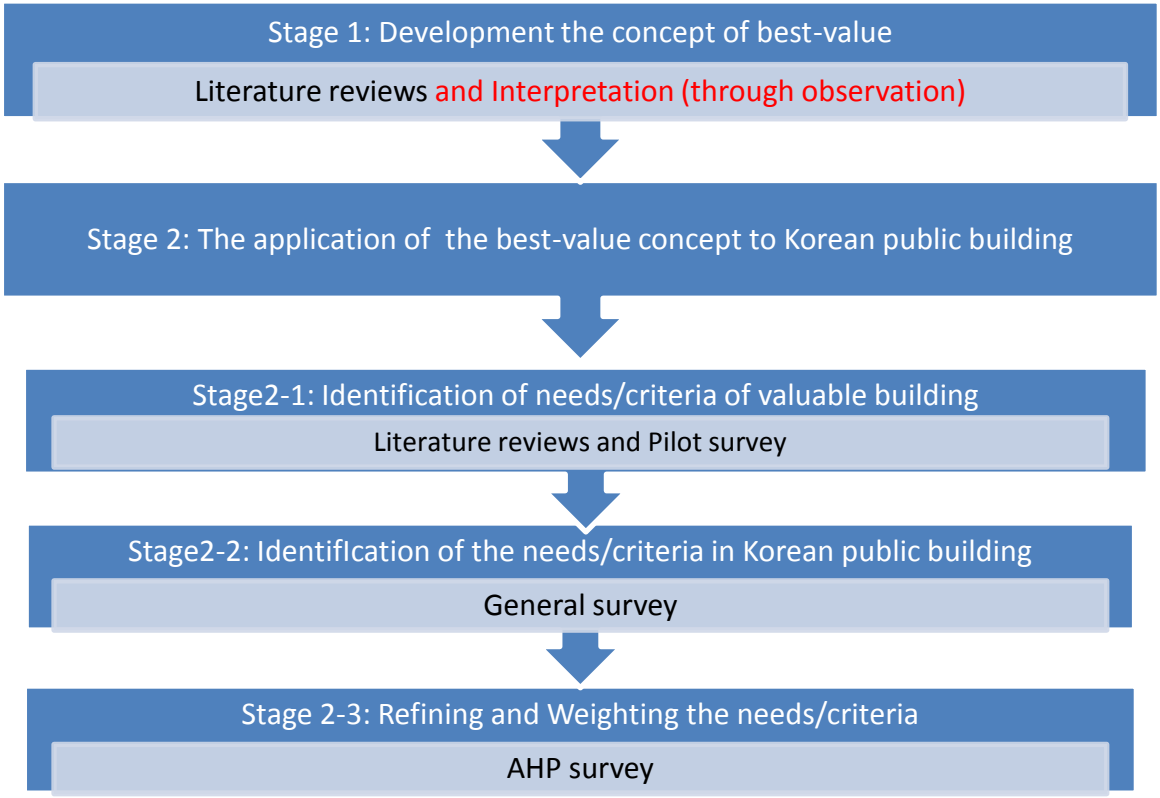


Figure 15. Research Process

What is fundamental in the selection of the appropriate research method is the research question(Johnson and Onwuegbuzie 2004). Research methods should followresearch questions in a way thatoffers the best chance to obtain useful answers(Rossman 1985; Johnson and Onwuegbuzie 2004). In this study, the research questions wererefined in chapters 1 and 3. These are presented figure15.

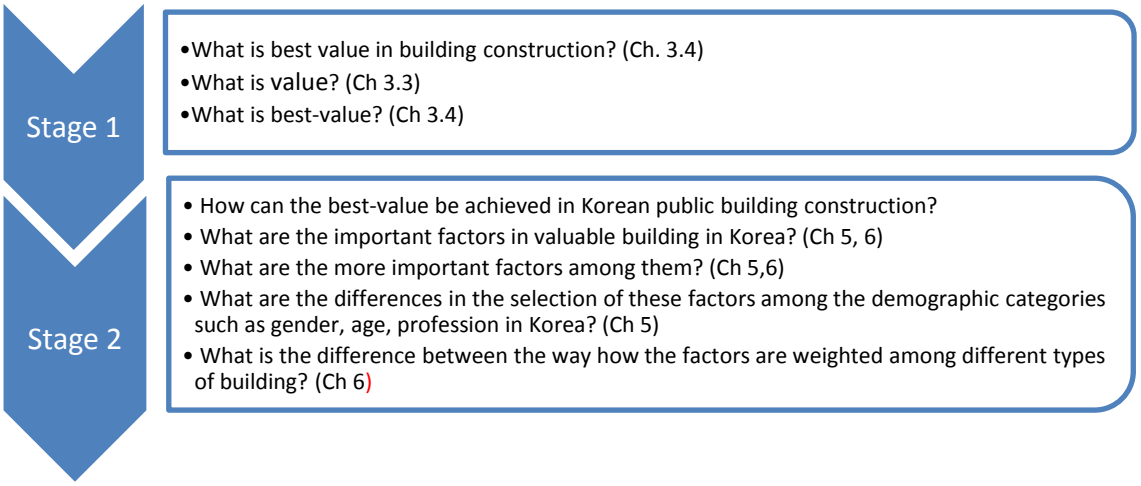


Figure 16. The Research Questions

4.2 Research paradigm

According to Saunders et al. (2009)the process of conducting social research is akin to peeling an onion (refer to figure 16). It is primarily because this process involves a great deal of in-depth analysis which is done layer by layer. The social research moves inwards, going through philosophy, various research approaches, research strategy, and the methods of data collection.

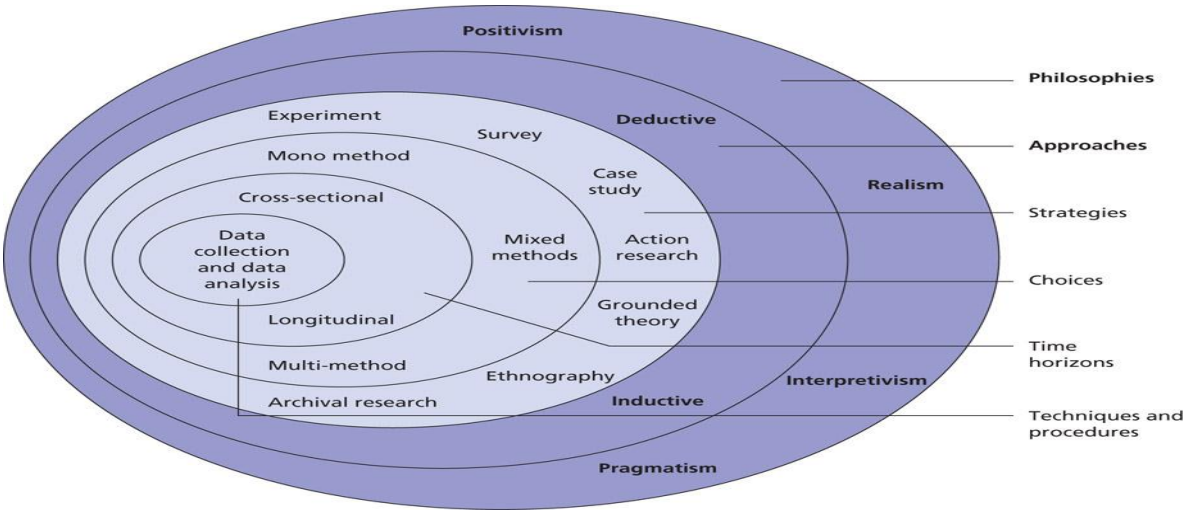


Figure17.The research onion. Source: Saunders et al.(2009)

It is very important to have a clear vision of the nature of the research process and this can be done by studying the research paradigm in depth. While Collins and Hussey (2003)define a paradigm as all about people's opinions of how research should be conducted, Burrell and Morgan (1979)are of the opinion that it is essentially a framework that operates at three distinct levels. The first level is the philosophical one where it reflects one's basic beliefs and attitudes about the social world. The second level is the social level which provides the researchers with guidelines for conducting social research; these guidelines are referred to as the research approach or research strategy in other literature (Collis and Hussey 2003; Saunders, Lewis et al. 2009). The third level is the technical level which is concerned with the data collection. This level refers to the specific methods and techniques that can be used to collect data from various reliable sources as well as to conduct analysis of the collected data (i.e., the research method). The paradigm that is to be used by the researcher depends largely upon the nature of the research problem, the questions that the research activity aims to answer,and the research assumptions that are to be tested in the research(Saunders, Lewis et al. 2009).

Philosophy of research:The philosophical level is the first layer of the idiomatic onion and it primarily deals with the thoughts and the attitudes that a researcher has regarding the development of knowledge (Saunders, Lewis et al. 2009). These thoughts and attitudes aretermed the research philosophy, which is important in interpreting and understanding social phenomena; essentially it is a belief about the way in which the data relating to the phenomenon should be collected and analysed (Greenwood and Levin 1998). This involves the use of various 'ways of viewing' and 'ways of interpreting' in order to grasp the facts, ideas, and events that surround the researcher's world. As such, the understanding of research philosophy can prove beneficial in the selection of appropriate research designs(Easterby-Smith, Lowe et al. 2002). Saunders et al.(2009)referred to Positivism, Interpretivism, Realism, and Pragmatism as the different philosophies which are generally adopted in social research.

Positivism:Positivism is often named as the functionalist paradigm (Burrell and Morgan 1979). This paradigm deals with the theories that propound and support an independent and pre-existing reality; therefore, the researchers should adopt objective, independent and a value-free methods of interpretation and analysis to answer the 'what is reality' question (Collis and Hussey 2003).This paradigm aims to develop general laws and knowledge based on objective research that can be used effectively to predict human behaviour and control the social world(Fisher and Buglear 2007).Positivism is a problem-orientated approach, and its basic aim is to predict and provide explanations that are essentially rational as well as practical solutions to social issues and problems. This approach works by applying the models and methods of natural sciences to the study of social affairs and human behaviour (Burrell and Morgan 1979).As such, the main tenets of this approach are that the data should be collected in an apparently unbiased and value-freed manner, using a highly structured methodology to facilitate replication(Gill and Johnson 2009). Robson(2002)opines that this

approach is generally regarded as starting with theory. The method that the positivistic researchers use is making generalisations on what they are looking for from the available theory and previous research; the researchers generally have specific hypotheses that they aim to test, to either confirm or reject.

Interpretivism: The interpretive paradigm explains the social world based upon the sociology of regulation, but from a subjective point of view. Specifically, theories within this paradigm intended to describe the social world as it is and to understand the nature of the social reality and human behaviour from the observer's own viewpoint and individual experience. (Collis and Hussey 2003; Fisher and Buglear 2007; Saunders, Lewis et al. 2009). Therefore, this paradigm reflects the sociology of regulation in more implicit terms since the proponents of this paradigm believe that all reality is socially constructed and dependent of individuals' perspectives(Collis and Hussey 2003; Saunders, Lewis et al. 2009). As a result, there may be different interpretations about the social world and varied techniques to capture the complexity of social situations from their own point of view. Their behaviours and interaction with society are affected by these different interpretations (Burrell and Morgan 1979; Collis and Hussey 2003; Saunders, Lewis et al. 2009)The strategies that are chiefly employed to acquire a personal understanding of the meanings of social reality are generally qualitative in nature, and these include techniques like interviews or observations. Therefore, this paradigm is based on data collection before inducing theories and concepts. It is 'hypothesis generating' rather than 'hypothesis testing'(Robson 2002).

Realism:According to Saunders and colleagues(2009), realism combines both radical humanist and radical structuralist paradigms. Whereas the radical humanist paradigm emerges from a concern with the subjective perspective that places emphasis on researchers' human consciousness and personal experience of social world, the radical structuralist paradigm analyses the sociology of radical change using an objective standpoint on the social reality. The proponents of the radical humanist paradigm believe that reality can be interpreted in different ways by different people since it is essentially socially constructed;sothis concept is common to that of the interpretive paradigm. In contrast, the radical structuralist approach of this paradigm shares some common features with the functionalist paradigm, such as the aim to provide objective, independent and value-free knowledge and theory(Burrell and Morgan 1979).

Pragmatism:Pragmatists do not see the world as an absolute unity.The pragmatic rulestates that the currentmeaning of an expressionis to be determinedby use of the expression in the world. Truth is what works at the time; it is not based in a dualism between reality independent of the mind or within the mind. Pragmatism uses practical empiricism to determine what works, and also views current truth, meaning, and knowledge as tentative rather than being fixed, and as changing over time. So,

pragmatists emphasise that facts that are obtained in research should be viewed as provisional truths. They believe in an external world independent of the mind as well as the world lodged in the mind. They realise that knowledge of the world is both constructed and based on the reality we experience; however,rather than asking questions about reality and the law of nature,they try to change the nature of subject instead. Pragmatists agree that research always occurs in social, historical, political, and other contexts(Murhpy 1990; Rorty 1991; Cherryholmes 1992; Creswell 2003; Johnson and Onwuegbuzie 2004).

This philosophy focuses on the outcomes of the research such as the actions, situations, and consequences of inquiry rather than antecedent conditions (Creswell 1997). There is a concern with applications(Patton 1990). Thus, instead of a focus on methods, they consider the problem being studied and the research questions as more important aspects of research(Rossman 1985; Tashakkori and Teddlie 1998). Pragmatist researchers look to 'what' and 'how' to research based on the intended consequences; where they want to go with it. Pragmatists decide what they want to research, guided by their personal value system; that is, they study what they think is important to study, in a way that is congruent with their value system, including variables and units of analysis that they feel are most appropriate for answering their research question (Murphy 1990; Cherryholmes 1992; Tashakkori and Teddlie 1998).

There are many forms of pragmatism, since it is not committed to any one system of philosophy and reality. Researchers have a freedom of choice:they are free to choose the methods, techniques, and procedures of research that best meet their needs and purposes. In a similar way, mixed methods researchers look to many approaches for collecting and analysing data rather than subscribing to one way only (i.e. quantitative or qualitative) (Murphy 1990; Cherryholmes 1992; Creswell 2003). Based on these features, Tashakkori and Teddlie (1998)claimed that pragmatism appears to be the best paradigm for justifying the use of mixed method studies.

Pragmatism is considered the most approprate philosophical paradigm for this study. That is because best-value is not an absolute concept but changesover time, and within social, historical, political, and other contexts. It is understood that the knowledge of best-valueis both constructed and based on the reality we experience.The questions and outcomes of the research such as the actions and situations are more important than antecedent conditions or methods. The main interest of this study is the solution of the problems of Korean public building procurement through the application of the concept of best-value. The research subject is selected in order to identify practical method solving the existing problems of Korean government'spublic building procurement system. James and Burkhardt (James and Burkhardt 1975)argued that the pragmatic method is primarily used to settleendless metaphysicaldisputes, and tries to interpret each notion by tracing its respective practical

consequences.

Research approach:The research approach relates mainly to the social level of the research paradigm comprising the use, construction, and verification of theories; the generally adopted approaches being the inductive and deductive approaches. Tashakkori and Teddlie(1998)opine that research may start at any point in the research cycle:it may appear to move from grounded results (facts, observations) through inductive logic to general inferences (abstract, generalisations, or theory), and from general inferences through deductive logic to tentative hypotheses or predictions of particular events/outcomes. Figure 17 shows a visual representation of this chain of reasoning.

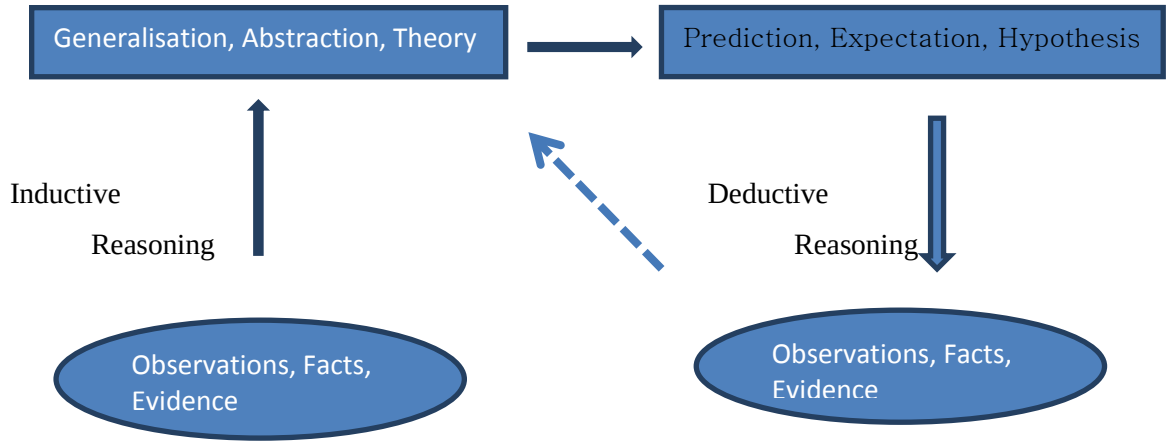


Figure18. The research cycle. Source: Tashakkori (1998)

Researchers explaining a social reality from personal observations and subjective views employ the inductive approach while those who start their research from a generalised theory and clear research questions conduct a deductive approach (Burrell and Morgan 1979).These two approaches are closely related to qualitative and quantitative research.Table 11 shows this relation and the differences between qualitative and quantitativemethods in the social sciences.

Table 11. The dichotomy between quantitative and qualitative social science

	Qualitative	**Quantitative**
Social theory	Action	Structure
Methods	Observation, interview	Experiment, survey
Question	What is X?(classification)	How many X?(enumeration)
Reasoning	Inductive	Deductive
Sampling method	Theoretical	Statistical
Strength	Validity	Reliability

Source:(Pope and Mays 1995)

Table 11 describes the apparent dichotomy between the quantitative methods and the qualitative methods. While quantitative techniques aspire to reliability, this is achieved with the assistance of measuring tools such as regular patterned questionnaires; on the other hand, the qualitative methods aim more for the validity of the information provided by the respondents, especially based on their behaviour and intent, when they describe their experiences, attitudes, perceptions and behaviours(Pope and Mays 1995; Saunders, Lewis et al. 2009). In addition, there also exists a dichotomy between the methods of reasoning. While qualitative work employs inductive reasoning (moving fromobservation to hypothesis), the quantitative methods use hypothesis testing or deductive reasoning(Pope and Mays 1995). This can be explained with the help of methods used in qualitative research. Qualitative methods require theavoidance of*a priori* categories andconcepts from the researcher on to the process of data collection in order to uncover respondent's personalperceptions. Therefore, it becomes important that this type of research should not begin with a research question or a hypothesis without collecting data. It is also better for the researcher to shuttle backwards and forwards between the raw data and the process of conceptualisation than to separate the stages of design, data collection, and analysis (Pope and Mays 1995).

Undoubtedly, both qualitative and quantitative research have merits and demerits, each being appropriate in suitable situations. For example, the major characteristics of quantitative research focus on deduction, confirmation, theory/hypothesis testing, explanation, prediction, standardised data collection, and statistical analysis(Johnson and Onwuegbuzie 2004; Saunders, Lewis et al. 2009). On the other hand, the major characteristics of qualitative research are induction, discovery, exploration and theory/hypothesis generation, with the researcher as the primary instrument of data collection, and qualitative analysis (Johnson and Onwuegbuzie 2004).

Brannen (1992)however claimed that it is not essential to have point to point correspondence between methodology and epistemology. As such, the choice of all the methods being used in the course of research should be in accordance with the problem that is being studied rather than taking into account the disciplinary or methodological leanings of the researcher. It is therefore practical to expect the deductive method in qualitative research(Pope and Mays 1995).

Viewed from this context, mixed methods research often provides a more workable solution and produces a superior result(Johnson and Onwuegbuzie 2004). Mixed methods research is defined as the class of research where the researcher mixes or combines quantitative and qualitative research techniques, methods and approaches into a single study(Johnson and Onwuegbuzie 2004; Saunders, Lewis et al. 2009). An expansive and creative form of research, mixed methods research is an attempt to legitimate the use of multiple approaches in answering research questions, providing the researchers with unrestricted and unconstrained choices. It is inclusive and complementary,

encouraging researchers take an eclectic approach to method selection and the thinking about and conducting of research (Johnson and Onwuegbuzie 2004).

Supporters of the mixed method approach suggest that it generates better results than a mono-method(Tashakkori and Teddlie 1998; Onwuegbuzie and Leech 2004). This may be explained by the fact that adding qualitative interviews to experiments in order to understand the participant'sperspectives can avoid some potential problems in the experimental method (Onwuegbuzie and Leech 2004). In addition, although qualitative research usually requires qualitative observation and interviewing, it will generate better results if it is supplemented with a close-ended technique that determines certain important factors observed by previous researchers. Further improvement of generalisation in both examples may be made by randomly selected sample surveys. If the results of different approaches agree with each other, then the researcher can have more confidence in the findings. However, if the findings are contradictory, then this opens up opportunities for broader research results and modified interpretations. More often than not, mixed-method research aims to collect more and more information(Onwuegbuzie and Leech 2004). According to Bryman(2001)the combination of mixed methods tends to have a leading strategy for beginning the research, and a follow-up strategy for concluding the findings or elaborating the research.

Greene et al.(1989)suggested five main logical reasons to conduct mixed method research: (a) triangulation:convergence and corroborationof the findings from different methods while observing the same phenomenon; (b) complementarity:elaboration, enhancement, illustration, and clarification of the results proposed by other methods; (c) initiation:resettingthe research questionfollowing discovery of contradictions (d) development:supports the other method; and (e) expansion: expansion of the scope of research by using different methods. They also claimed that all mixed methods have one or more of these five purposes.

According to Jonson and Onwuegbuzie (2004),the researcher needs to make two primary decisions to create a mixed-method design: (a) whether the research is largely conducted within one dominant paradigm; or not, and (b) whether the phases are to be conducted concurrently or sequentially. Mixed-method designs are quite similar to conducting a qualitative mini-study and a quantitative mini-study in one study. Nonetheless, in a mixed-method design the findings are mixed or integrated at some point. For instance, a qualitative phase might be sequentially conducted to inform a quantitative phase. Figure 18 illustrates nine mixed-method designs.

Figure 19. Mixed-method designs. Source:(Johnson and Onwuegbuzie 2004)

Paradigm Emphasis Decision		Time order decision: Concurrent	Time order decision: Sequential
	Equal Status	*QUAL + QUAN*	*QUAL→QUAN* *QUAN →QUAL*
	Dominant Status	*QUAL + quan*	*QUAL→quan* *qual →QUAN*
		QUAN+ qual	*QUAN →qual* *quan →QUAL*

Note. "qual" stands for qualitative, "quan" stands for quantitative, "+" stands for concurrent, "→" stands for sequential, capital letters denote high priority or weight, and lower case letters denote lower priority or weight.

The starting point of this research is the observation of the use of terms of value in ordinary life. The next step involves an initial attempt at inductively building a conceptual framework of best-value. Later on, this conceptual framework is used as a basis, in deductive methods, for finding best-value in Korean public building construction. Therefore, the sequential use of both the inductive and the deductive methods in a single research study makes this research approach akin to mixed method research and pragmatism. As stated by Kanbur (2002), the sequencing of the primary and secondary strategies is central to the pragmatic approach.

Philosophically, mixed research is based on pragmatism(Tashakkori and Teddlie 1998). Its logic of inquiry comprises the following three methods: induction that is the discovery of patterns; deduction that is the testing of theories and hypotheses; and abduction that is the uncovering of and relying on the best possible set of explanations for understanding one's results (Onwuegbuzie and Leech 2004). Pragmatists do acknowledge the fact that they will have a choice of inductive and deductive logic in the process of conducting research on a question that needs to be answered (Onwuegbuzie and Leech 2004).According to Johnson and Onwuegbuzie (2004), if the researcher considers the use of pragmatism in the mixed methods approach, research will be productive as pragmatism offers an instant and useful middle position in regard to both philosophy and methodology. Along with this, pragmatism also offers a method that allows methodological mixes which can assist the researcher in answering the research questions in a much better way as well as offeringa practical and result-oriented method(Johnson and Onwuegbuzie 2004).

The research of the concepts of value and best-value involves the observative collection of qualitative data that arethe ideasof people about value and best-value. It is from these observations that the generalised concepts of value and best-value are suggested. As such, the process of generalised conclusion-generating in inductive research incorporates the personal views and subjective judgments

of researchers (Saunders, Lewis et al. 2009).According to Pope and Mays (1995), qualitative research aims at the development of concepts that would assist us in understanding social phenomena in natural rather than experimental settings, and at emphasising the meanings, experiences, attitudes, perceptions, and views of all the participants. The basic concern of the qualitative studies lies in answering questions such as 'What is X and how does X vary in different circumstances, and why?" rather than "How many X are there?" (Pope and Mays 1995) Therefore, it is logical to have qualitative research as the first research stage in this study, since the research questions are primarily: ‘What is value?’ It is logical to have qualitative research as the first research stage in this study, since the research questions are primarily about perception, and the perceptions are generally more complex than the questions of the natural sciences; hence, it will be unsuitable to use experimental and quantitative methods. The process of this first stage are explained in section 3.4.

On the other hand, the research of finding out about best-valued building in the Korean public sector makes use of the deductive approach wherein conclusions are drawn through logical reasoning. The important factors of valuable building are generated through literature reviews. Later on, an empirical scrutiny process is developed which tests the probability of these factors. Based on the results, these factors may be accepted or rejected. (Ghauri and Grønhaug 2005; Saunders, Lewis et al. 2009).

This study has followed a number of important steps. First, the general concept of best-value was developed through observation and interpretation of the practical usage of value in ordinary life. In the second stage, existing literature was used to generate the important factors that a valuable building should have.In the third step, the generated concepts and factors will be tested by survey so as to determine whether the best-value concept works properly or not, whether these factors are considered important or not in Korean public building construction, and what the differencesin prioritising these factors are according to the conditions. Pope and May (1995) also opined that the randomised controlled trial which focuses on hypothesis testing through experiment controlled by means of randomisation is the epitome of the quantitative method.

The survey strategy used here is associated with the deductive approach. Surveys are highly popular in deductive research for the fact that a large amount of data can be collected from a sizeable population in a highly economical way(Fowler 2002; Saunders, Lewis et al. 2009). Apart from this, the survey strategy also permits the collection of quantitative data which can be analysed quantitatively using descriptive as well as inferential statistics(Saunders, Lewis et al. 2009). Moreover, the data collected by the survey strategy can also be used to suggest possible reasons for particular relationships between variables and to produce models of these relationships (Saunders, Lewis et al. 2009).

In conclusion, this study can be described as a sequential and mixed method research which makes use of pragmatism, since the concept of best-value needs to be defined in advance through the qualitative method in order to apply this concept to Korean building construction. The application of the results comes later on conducted by a general survey and an AHP survey following a quantitative approach. The second stage of this research that involves the application of the best-value concept is a form of illustration or explanation of the best-value concept which was defined in stage one. Johnson and Onwuegbuzie claimed that the mixed research designs have particular strengths in a two-stage sequential design where the results of stage one can be used to develop and inform the purpose and design of the stage two component(Johnson and Onwuegbuzie 2004).

4.3 Research Design for data collection and analysis

A research design can be defined as the master plan that works to identify the research methods and the procedures that are needed for the development of study, collection of the data, and analysis of the collected data (Li 2008). As the concept of best-value is already suggested in chapter three by observation and interpretation of the ordinary use of value term as the first stage, the focus of the research design will be on the application of best-value concept to Korean public building.

4.3.1 Identification of needs/criteria of valuable building (Stage 2-1)

In order to deliver a best-valued building it is important to identify the needs and criteria of building, and extensive literature reviews and a pilot survey are conducted for this purpose.

Pilot survey:As identified in chapter three, there are six main needs: functional building, comfortable building, safe building, economical building, artistic building, and environmental building. Through the review of literature, a number of existing and relevant needs and criteria are categorised in the six needs. The list of sub-criteria is identified within each main need and aims to be as comprehensive as possible without being overly lengthy and cumbersome. A pilot survey was first conducted to test the suitability of proposed needs and criteria summarised from the literature, and to examine the clarity of the questionnaire prior to sending it out. This pilot survey is conducted with eight experts of building design including professors, architects and government officials with extensive knowledge and experience of building projects by e-mail.The experts were selected among the experts pool system of KICTEP(Korea Institute of Construction & Transportation Technology Evaluation and Planning) which supervises the construction R&D program of Korea. The experts were presented with the proposed needs and criteria of building. They were invited to review the relevance, coherence, and the clarity of the questionnaire.In addition, the experts translated the terms in questionnaire prudently from English to Korean to reduce nuance. At the end of the pilot study, a number of amendments were made(see section 3.6).

4.3.2 Refine the needs/criteria by general survey(Stage 2-2)

The general survey is used as an instrument: (a) to gather and refine needs/criteria and (b) to prioritise the needs/criteria according to the overall significance in assessment. These priorities are compared with the results of the AHP analysis.

Selection of respondents:Some form of random selection can be used if a representative viewpoint across the target groups is needed. However if the primary aim is to gain an insight into a specific problem or to explore future developments, then experts should be targeted who are particularly knowledgeable or experienced in that specific area (Fowler 2002). In order to decide on the type of respondents in this survey, the nature of building performance assessment techniques can be used. Generally, these techniques fall into two categories: user-based system or expert-based system(Becker and Steele 1990; Chang 2001).The first set of procedures relies chiefly on the responses and the judgments of the occupants of a building as the basis to evaluate the adequacy of a building(Becker and Steele 1990; Chang 2001). The main factor this system takes into consideration is the occupants' satisfaction with different aspects of the building's design. This satisfaction is measured with social science-based tools like interviews, surveys, and systematic observation(Becker and Steele 1990). Here, the aspects of the physical environment as well as the occupants' judgments about the impacts of such physical characteristics on their work behaviour and attitudes are measured, and form the basis of evaluation. Although this system covers only the existing buildings in its preview, the information generated can still be used as part of the briefing process for a new building, as well as forming part of the storehouse of information to generate suggestions about improvements in the buildings' conditions through renovation of the building.

On the other hand, the second set makes use of experts' assessment of building performance and it generally covers a much wider range of considerations including factors like the ability of the building to accommodate changes in occupants' expectations, and organisational changes, as well as space and energy efficiency. The expert assessment can vary considerably but its focus is generally much broader as it takes a wider range of attributes into consideration (Becher and Steele 1990). The main goal of this system is to ensure that important factors are not ignored in assessment and that there is the provision of a common platform for comparing different buildings while using the same criteria. This is a reliable technique as it depends upon the expert's experience that cannot be easily transferred on to others(Becker and Steele 1990).

Both groups of respondents are required for this study. At first, it is important to gather the requirements of the user to achieve best-value in building construction. Stylianopoulos (1989)claimed that since value and end user's requirements are interlinked, value is determined by the owner/user.In addition, since value will vary from person to person depending on the need and desire for

ownership(Kaufman 1989), various stakeholders including end users are included in this survey. They consist of three categories: citizens, government officials, and public building administrators. Each category consists of 30 memebers

Although the best-value concept is deeply related with users-orientedsystems, it would also be a good choice for this study as the expert respondents would have gathered more feedback and experience of what users require in buildings, based on their technical knowledge of buildings. As such, experts system will serve two important purposes. First, their perspectives will form the basis of a holistic evaluation keeping in view a broad range of key factors which can affect the overall evaluation of the building in one way or the other. Second, as most of the building problems call for an interdisciplinary approach, it will be better to include experts from various disciplines (Wilson 1985). In this context, 90 local construction experts in architecture, construction engineers, and academics of building construction,were invited to answer the questionnaire.In the end, the questionnaire were sent to total 180 people.

Sampling: There are a number of sampling techniques available; these are applied to draw representative samples from which valid generalisations can be made(Burns 2000; Fowler 2002).The main concern, however, is that the majority of these techniques fall into the ideal case scenario whereas as far as practical reality is concerned, it is often difficult to obtain truly representative samples because of time and resource constraints (Burns 2000). The stagesampling method was chosen for this research because the population included experts with relevant experience and knowledge in the field of building construction as well as end-users or stakeholders with interest in the value of public buildings. For this purpose, first the population of experts was divided into three categories: architects, academics, and construction engineers. 90 experts in these groups of architecture, construction engineer, academic, who are interested in this survey, were recommended among the expert pool system of KICTEP.

On the other hand, the populations of the user group were selected from among government officials, building administrators, and citizens. The staff of the Ministry of Land, Transport, and Maritimes of Korea were the government representatives since it is they who regulate and control the policies relating to construction procurement and the quality of public buildings as well as using public buildings directly. Therefore, they can bethe most appropriate respondents for identifying the important factors which valuable public buildings should have. In addintion the staff of the Korean Goverment Buildings Management Services have managed public building, also used public buildings. Therefore, they fulfill the standard of being the most appropriate respondents who can identify the important factors which valuable public building should have from a management aspect, since they

have managed the public building of Korea for decades. Third, the citizen users were selected from the staff at the Korea Institute of Construction & Transportation Technology Evaluation and Planning (KICTTEP) because they are interested in the quality of public office buildings since they control the construction researches, including building evaluation research.

A breakdown in the distribution of respondents categorised on the basis of discipline they belong to is presented in figure19. The table also presents the percentages of the different types of respondents in sample group used for this survey;and highlights an important fact that 50% of respondents are stakeholders (government officials, citizens, and building managers) while the rest of the group comprises experts such as academics, architects, and construction engineers. Therefore, it can be said that the sample group is a balanced one as it comprises different types of experts and users in the building industry, thereby making it a multi-disciplinary combination. It is indeed important to have a well-balanced group with all the categories in proportion so as to minimise the possibility of biased responses in the survey due to the different professions that the respondents belong to.

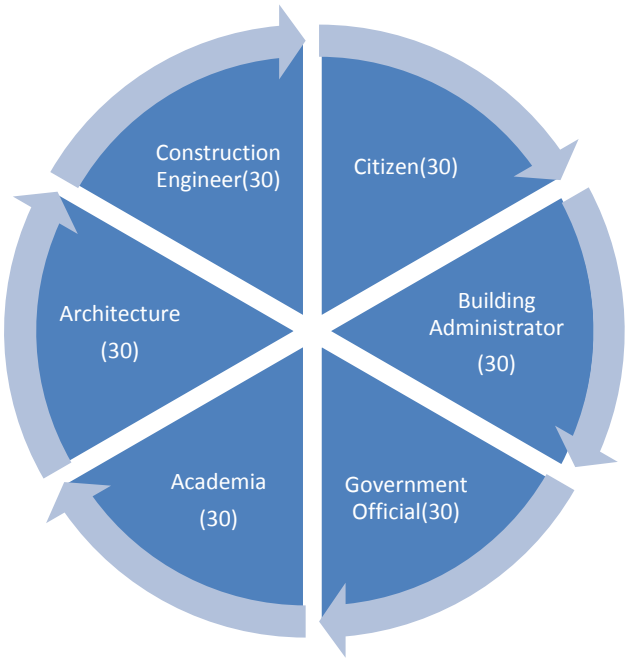


Figure 20. The distribution of respondents

Sample size: : In research, a large sample is preferred since it minimises the risk of error(MacCallum, Widaman et al. 1999); however, this is not to say that a large sample is adequate to guarantee accuracy of results. Although for a given design, a large sample size does increase accuracy, it will not eliminate or reduce any bias in the selection procedure(Burns 2000). Thus, the representativeness of the sample is also important. Therefore, along with a greater sample size it is also important to have committed and experienced participants for the successful completion of the survey.

The sample size of each group is determined 30 according to the number of government official group which is the staff of architecture policy division in the Ministry of Land, Transport, and Maritimes of Korea. The number of them is slightly over the 30. The sample size of other group is fixed in 30 according to the number of government official group since they are the most important decision group in relation to the public building design, which regulates construction procurement and the quality of public buildings of Korea.

Considering all these aspects, the sample group for this research was acceptable as it included experienced participants. Altogether, a sample of 180 experts and stakeholders participated in the survey by e-mail, and the overall response rate was approximately 72% (130 responses out of 180 questionnaires sent out). Though the number of respondents of public building administrator group of public building is just 10, it is possible to accept them as representative of their group, since they are core members of the Korean Goverment Buildings Management Services who directly control the policy of central government building management. In addition, their role in deciding the design of public building is relativerly weak comparing with the other group such as governmentofficial group, designer. Even though the sample size was not too big, it consisted of participants who had in-depth expert knowledge in the subject matter as well as practical experience and interests in the building industry. As such, the inputs provided by them were very significant in this research. In view of this, the size and the composition of the sample was sufficient to yield representative results.

Design of the questionnaire:Before preparing the questionnaire, an in-depth literature review was undertaken to identify needs and criteria relevant to valuable buildings (refer to section 3.5). These needs and criteria formed the basis for the preparation of the questionnaire. After this, a pilot survey was conducted with eight experts from various disciplines to test the suitability and the appropriateness of the proposed needs and criteria as well as to examine the comprehensibility of the questionnaire prior to sending it out. Following the pilot study, the questionnaire was re-designed to incorporate suggestions made to add and weigh the needs and criteria so as to evaluate their contribution to best-valued building. The results obtained would form the basis for determining the relative importance of each need and criteria in a valuable building so that these can be arranged in a hierarchy for further evaluation and reference. The questionnaire comprises of three separate sections (a sample of the questionnaire is attached in Appendix 1).

The first part (questions one to four) of the questionnaire consists of general questions about respondents such as gender and age. The second part consisting of six questions aims to investigate the significance of the various criteria within respective six main criteria of best-valued office building. The results obtained in this section are used to calculate the weights for each criterion which that will indicate the priorities that should be considered in the achievement of the best-valued

building. The last question in Part two (question eleven) invites the respondents to rate the importance of six main criteria. This would give an indication of the priorities placed by the respondents on the six main criteria in the best-valued building achievement.

In order to elicit the crucial criteria, the respondent perceptions will be measured on the interval basis using a five-point Likert scale (where '1' represents 'Not important at all', '2' Unimportant, '3' Neither important nor unimportant, '4' Important, and '5' 'Very important'). The questions were set out this way to provide consistency for scoring each in the same way. A score above 3 on a question represents a favourable opinion of needs. The higher the score above 3, the more favourable the response is towards each criterion. Conversely, a score below 3 represents a negative opinion of each need. In the questionnaire, respondents are also invited to add new criteria if necessary.

4.3.3 Weighting the Criteria by AHP (Stage 2-3)

The priority of criteria in three kinds of building will be evaluated by Analytic Hierarchy Process (AHP) analysis to see how people evaluate the needs and whether AHP was appropriate. It also helps to understand that the design of best-valuedbuilding changes according the type of building. Since best-value changes according to the conditions (refer to sections 3.3 and 3.4) and the kinds of building is oneof important conditions, it is meaningful to study the difference among the buildings. On the other hand, in chapter 5, we will test whetherdemographic change,which is another kind of change in the conditions of the subject,affect best-value or not.

The AHP process invented by Thomas L. Saaty has becomes a dependable instrument at the hands of decision makers and researchers, and it is one of the most widely used multiple-criteria decision-making tools (Vaidya and Kumar 2006)because it specifies the numerical weights representing the respective relative importance of each criterion as well as their associated evaluation criteria with respect to the goal. The AHP technique enables the decision-maker to view a complex problem in the form of a simple hierarchy as well as to evaluate a large number of qualitative and quantitative factors in a systematic manner under multiple criteria. The technique is therefore a logical way for people to make decisions (Saaty 1980a).

Since its introduction, AHP has become the basis of many outstanding and valuable publications in various fields. The fields that most widely apply AHP are, amongst others, planning, selecting best alternative, resource allocations, resolving conflict, and optimisation. AHP has proved to be very useful in taking decisions in a scenario where there are several decision makers with different conflicting objectives and the need is to arrive at a consensus decision (Vaidya and Kumar 2006).This advantage of AHP is also similarly understood in Korea (Sim and Park 2004). The AHP technique has also been successfully used in the field of construction: prioritising maintenance schedules (Shen, Lo

et al. 1998); design and build project assessments (Alhazmi and McCaffer 2000) and contractor selection (Fong and Choi 2000). Al Harbi(2001) applied AHP in the field of project management to select the best contractor.

In Korea, the AHP has been also used widely as the decision-making tool in both the private and public sectors(Park 2000). The survey tool has been used in the field of construction: Priority of design factors (Chin and Lee 2001; Kim, Kim et al. 2009); Contractor selection (Jung and Cho 1999; Choi 2007),and Cost risk analysis (Lee and Kim 2003). AHP is also often used as a useful decision tool in other areas such as Technology selection (Cho 2002), Evaluation of ubiquitous city (Jeong, Park et al. 2008); Analysis of strategies of natural disasters (Lee and Lee 2007), and Site selection (Byun and Suh 1998; Yun 2009). In particular,the Korean government adopted the method as a main decision-makingtools in the pre-feasibility study of public construction project from 2000(Park 2000). Therefore, AHP methods are familar to Korean decision makers.

In particular, the hierarchy structure of the AHP makes it a very useful tool to identify the priority of criteria of best-valued building because of the hierarchical feature of value(Woodruff 1997; Schwartz and Bardi 2001). In section 3.3.4, the hierahchical structure was used to explain the process of value judgement. In addition, the evaluation criteria of best-valued building were also identified within a hierarchical structure in section 3.6. Rokeach (1984) agreed that values are categorised within a "value hierarchy." According to this perception, since the individual's values as mental representations often conflict with each other, it is necessary to priorities them when making decision. The value hierarchy is used to determine which of the values takes precedence in a given situation; the value with the most priority or importance is the one that is used as the criteriion for evaluation(Konty and Dunham 1997).

Saaty (1980a)has described four important stages in AHP:

i) defining the problem, and determining the objective
ii) developing the hierarchy from the top (the objective from a general viewpoint) through the intermediate levels (attributes and sub-attributes on which subsequent levels depend) to the lowest level (the list of alternatives)
iii) employing a simple pair-wise comparison matrix for each of the lower levels
iv) undertaking a test to measure consistency

***Selection of respondents*:**According to Cheng and Li (2002), the AHP method does not require a large sample since it is of a more subjective nature. Therefore, AHP is useful for research that involves focusing on a specific issue where a large sample is not mandatory. The AHP method may prove impractical in surveys that require a large sample size because insincere respondents tend to

provide arbitrary answers, resulting in a high degree of inconsistency. The instances in previous research have established the suitability of the AHP method in the survey with a small sample size. In this context, the researchers invited nine construction experts to undertake a survey to test comparability of critical success factors for construction partnering. Kokin and Xiande (1998) also invited eight experts for a quality-of-teaching survey.In this study, six experts with relevant experience and knowledge in the field of building construction undertook the AHP survey. This is because the research is an empirical enquiry into the matter and this requires logical and analytical thinking which can be provided by only the relevant experts or professionals who have have in-depth knowledge of the field of building construction. Therefore, the experts with relevant experience and expert knowledge in the field of building construction were chosen to be the respondents and AHP as the method to analyse the responses.***Design of the questionnaire:***The basic aim of the AHP survey was to evaluate the comparability of the perceived needs and criteria in different kinds of building. As such, the questionnaire for collecting data will be prepared as per the guidelines of the AHP as proposed by Saaty(1980b).One of the important steps will be the forming of the decision hierarchies in order to design the paired comparison matrices. The hierarchies formed will serve the function of re-affirming the results of the general survey and of depicting the attributes for finding best-valued building where the topmost level is the achievement of best-valued public building followed by the six main criteria and 27 sub-criteria. The nine-point scale proposed by Saaty will be used to rate the relative importance of each criteria in which the levels of relative importance will be indicated as equal, moderate, strong, very strong and extreme by the numerals 1, 3, 5, 7, and 9, respectively, while the numerals 2, 4, 6, and 8 will represent the intermediate values between two adjacent arguments (refer to table 12).

Table 12 The fundamental scale of absolute numbers

Intensity of Importance	Definition	Explanation
1	Equal importance	Two activities contribute equally to the objective
2	Weak or slight	
3	Moderate importance	Experience and judgement slightly favour one activity over another
4	Moderate plus	Favouring one activity over another
5	Strong importance	Experience and judgement strongly favour one activity over another
6	Strong plus	
7	Very strong or demonstrated importance	An activity is favoured very strongly over another; its dominance is demonstrated in practice
8	Very, very strong	
9	Extreme importance	The evidence is of the highest possible order of affirmation

Source: (Saaty 2008)

4.4 Summary

This chapter describes in detail the research methodology that has been used to test the proposed best-value concept. The first step was the identification of the criteria which are needed in best-valued building, and this was done by reviewing the available literature. Based on this a questionnaire was drafted that was subjected to a pilot survey prior to sending it to the respondents. The next step was the selection of appropriate sample groups that could determine the importance and weights of these criteria. Therefore, experts and stakeholders including users were selected as the respondents who were invited to give their perceptions and rate these indicators in the form of a general survey and AHP questionnaire. The results of the general survey can then be analysed in order to identify important criteria, and the AHP result can compute the difference of the weights for the combination of the criteria in three kinds of buildings. This chapter also describes the various methods used for data collection. Data analysis and finding of surveys will be discussed in the following chapters.

Chapter 5 Survey analysis

5.1 Demographic information of respondents

Figure20 provides a breakdown of the valid respondent responses by three demographic backgrounds (gender, age, profession). In the gender category, males comprise 80% Respondents aged 30 to 40, and government officials in profession are predominant groups in each category.Theseconfirm that these groups play an important role in public building procurement.

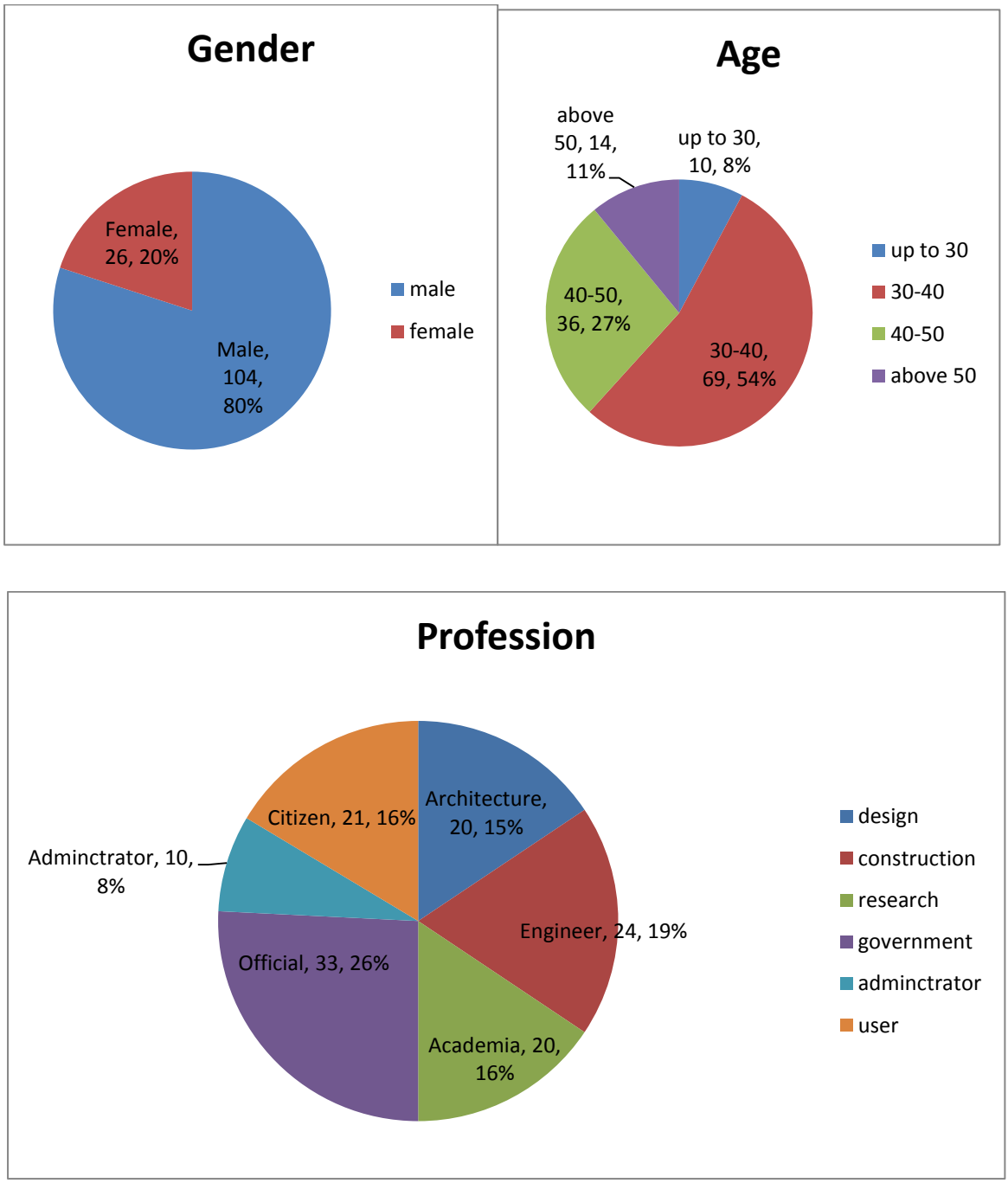


Figure 21. Respondents by demographic groups

5.2 Statistical measure and Analysis methods

After data have been collected, the next step is to process, clean and transform recorded data into information suitable for analysis. A systematic and well-planned procedure helps to ensure that processing errors are minimised. After the collated data have been edited, coded and checked, statistical techniques are used to analyse them. The following sections describe the methods of data analysis employed in this study for different information collated from the survey results.

Five-point Likert scale was selected as it gives unambiguous results and is easy to interpret (Ekanayake and Ofori 2004). In this survey, all items in Part 2 of the questionnaire were measured on an ordinal basis. The respondents' perceptions are measured on the interval basis using a five-point scale, where 1 represented "not important at all", and 5 represented "extremely important". All criteria are first calculated according to their mean score ratings. The mean score rating was calculated using the following Eq. (1)(Ekanayake and Ofori 2004; Wong and Li 2006):

$$Mean = \frac{1(n_1)+2(n_2)+3(n_3)+4(n_4)+5(n_5)}{(n_1+n_2+n_3+n_4+n_5)} \quad (6)$$

Where: n_1, n_2, n_3, n_4, $n_5$represent the total number of responses for criteria as 1 to 5, respectively.

The data collected from the questionnaire survey was analysed using SPSS/PC+TM Version 12 software as well as Microsoft Excel. Descriptive statistics were used to determine standard deviations, maximum and minimum scores of the sample as a whole,and the mean score. The standard deviation is commonly used as a measure of dispersion or variation. It measures the amount by which each degree of importance of each criterion differs from the mean. The degree of importance is arranged in descending order. This helps to determine the criteria that the building experts deem pivotal in the achievement of best-valued building. In order to elicit the important criteria and to identify the differences among the respondents, various techniques were considered. The data analysis methods mainly consist of the following: (i) selection of important criteria among the identified criteria by t-test; (ii) Mann-Whitney U test and Kruskal-Wallis test to confirm whether or not perceptions between different respondents' group relating to the criteria were the same.

Selection of important criteria: A t-test analysis will be conducted in order to check the meanof selected criteria based on whether the population considers the criteria to be significant or otherwise (Ekanayake and Ofori 2004; Wong and Li 2006). If the observed t-value (t_o) of a criterion is larger than the critical t-value (t_c) as shown in Eq. (10), it suggests that the proposed criterion is significant or insignificant. Critical t-values (t_c) of this study are fixed as 1.645 at 95% confidence interval with sample size 130($t_{(129,\ 0.05)}$ =1.645).

$$t_o = \frac{\bar{\chi} - \mu_0}{\widehat{S_D}/\sqrt{n}} \quad (7)$$

$$t_c = t_{(n-1,\alpha)} \quad (8)$$

$$t_o > t_c \quad (9)$$

Where:

$\bar{\chi}$ *: sample mean*

$\widehat{SD}/\sqrt{n}$*: estimated standard error of the mean of different score*

SD : the sampled standard deviation of difference score in the population

n : sample size which was 130 in this study

n-1: degree of freedom

α: significance level which was set at 5% (0.05).

The rule of the t-test is set out as follows: The null hypothesis (H_0: $\mu_1 = \mu_0$) against the alternative hypothesis (H_1:$\mu_1 > \mu_0$) was tested, (Ekanayake and Ofori 2004; Wong and Li 2006). The test value (μ_0) was fixed at '3.5[3]'(Mantel and Greenhouse 1968; Efron 1979; Broadie, Glasserman et al. 1997; Davison and Hinkley 1997). If $t_o$is less than $t_c(1.645)$, since the null hypothesis was accepted, observed criteria were considered as unimportant. If $t_o$is larger than t_c,since the alternative hypothesis (H_1) was accepted, the observed criteria were classified as important (if the t-value is minus, the criteria are considered unimportant) .

Differences among the groups: In addition, the non-parametric Mann-Whitney U Test (for gender) and Kruskal-Wallis test (for age and profession) were undertaken in order to ascertain whether there were statistically significant differences or divergences between each demographic group (gender, age, professions) regarding the relative importance of the criteria in valuable building. The non-parametric

[3]Ordinal scale usually generates data with discrete and non-standard distributions. [2,3]. Since these data does not meet the distributional requirements for parametric methods, conventional statistical advice would suggest that non-parametric methods be used to analyse. However, computer intensive methods such as the bootstrap that make no distributional assumptions may be appropriate for analysing ordinal data. The bootstrap [4,5] is a data based simulation method for analysing data including hypothesis testing (p-values) which involves repeatedly drawing random samples from the original data, with replacement. The bootstrap is mainly used as a method for assessing statistical accuracy. For example, if we are interested in estimating the population mean (from a random sample) it may seem that the best estimator of the mean of the population is the mean of all the bootstrap estimates (Efron, 1993; Davison, 1997; Stephen, 2004). The bootstrap method was used for the t-test since the normality of raw data is not fulfilled. Since the data are modified from discrete random numbers to continuous random numbers, continuity correction was conducted. Although '4' indicates an 'important' criterion in the scale of the questionnaire, the cut-off score was changed from 4 to 3.5 by continuity correction.(Ho: $\mu_1 = 3$, H_1: $\mu_1 \geq 4$ H: oot$\mu_1 = 3.5$, H_1: $\mu_1 > 3.5$). In addition, there are little difference between the results of non-parametric and parametric test.

testing method was employed in this study since the parametric assumptions on normality (p>0.05) and homogeneity (p>0.05) are not fulfilled and the variables are measured by ordinal scale of measurement(Abdel-Kader and Dugdale 2001). If the p-value of in each test was less than 0.05, this means there is a significant difference between the groups. The results of the Kruskal-Wallis test will be interpreted by the Tukey method.

5.3 Findings and Discussion

Respondents were asked to rank the importance of six main criteria and 34 sub-criteria. They were also invited to add new criteria if necessary but no additional meaningful criteria were suggested. The analysis of the survey results are shown in figure 21-28 and table 13- 20.

Main-criteria level: The t-test results of the main criteria (refer to table 13) indicated that five categories were considered as important criteria in best-valued public buildings in Korea. They are serviceability, safety, comfort, environmentally-friendly, and economic-feasibility. Interestingly, artistry including appearance and colour was judged as unimportantat 5% significance level because of its t-value (-1.737).Two main criteria - serviceability and safety were considered as marginally more important than the remaining main criteria; comfort, environment-friendly, economic-feasibility, and artistry (refer to Appendix 3).

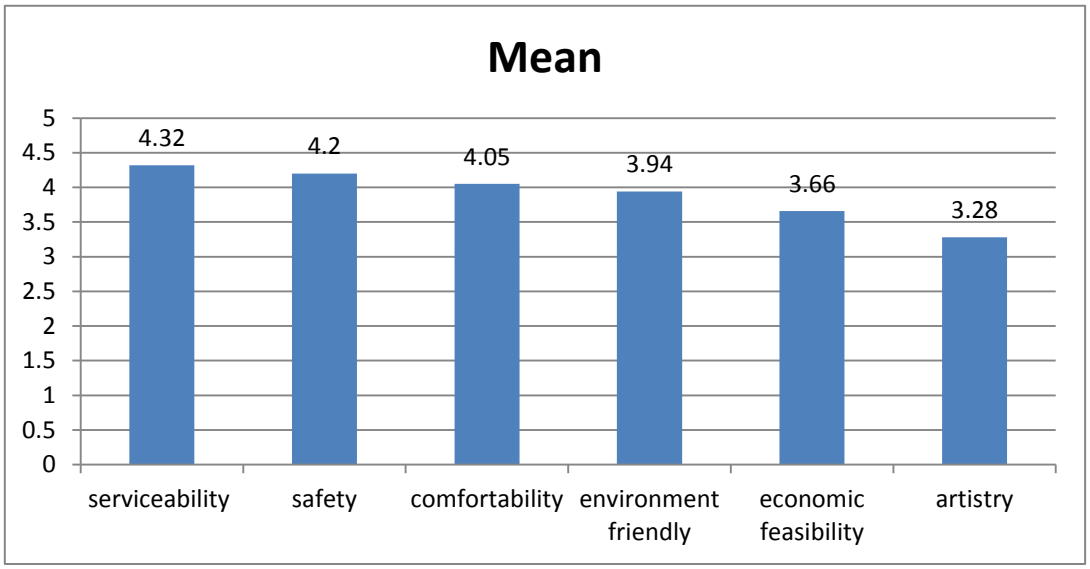


Figure 22. The priority of main criteria by general survey

The highest ranking of ‘serviceability’ in the main criteria level is not surprising. Many building assessment systems such as POE (Post Occupancy Evaluation) and BQA (Building Quality Assessment) suggest the functional aspects of buildings as important factors (refer to section 3.5.1). This supports why serviceability was ranked by the majority of respondents as the most important

criterion in valuable public buildings.On the other hand, safety is also considered as the fundamental factor to the success of the public building,ranked second.

Consistent with the literature, comfortis also considered as an important criterion, ranked third. So and Chan (1999) pointed out that the HVAC (Heating, Ventilating, and Air Conditioning)unit plays an important role to have control over interior surroundings to arrive at a comfortable level so that people who live here work hard and perform better. A similar view is shared by Trankler and Kanoun (2001), give emphasis to the significance of the HVAC system to prevent serious problems in buildings, such as sick building syndrome, which is associated with building-related illnesses and infections. An effective and efficient lighting system also plays an important role in building make up. The light and colour contrast have a direct impact on the well-being, motivation, and work performance of persons residing in these buildings (So and Chan 1999). Amount of noise, sunlight and fresh air also sustain a healthy environment. Providingbuilding occupants with a comfortable and productive working environment pleases their physiological needs (Alcalá, Casillas et al. 2005).These studies explain why comfort is considered as one of the most important standards in public buildings.

Economic-feasibility was ranked fifth. This result is very interesting, since a lot of procurement organisationsfocus on this criterion in real projects.Despite some of the sub-factors in the category such as ‘harmony with surroundingss’are considered as an important factor(table 20), the lowest ranking of artistrywas interesting. While many European countries consider public buildings as cultural assets and elaborate the artistry of public buildings(Kim 2009), the public buildings in Korea may be considered as just functional places of public work. A possible reason for why the importance of artistry was not supported may be that practical aspects such as serviceability and safety are considered more important factors in the Korean society which pursues rapid economic growth in a short period. These results show that manypublic buildingsin Korea focus on practical aspects. This can also explain the reason why purely beautiful public buildings are rare in Korea.

On the other hand, The results of the Mann-Whitney U test and Kruskal-Wallis test indicated that that no significant difference was found among various demographic groups for rating main criteria, except ‘economic-feasibility’($p=0.018$), among age groups. This phenomenon indicated that the importance of most of main criteria in public buildings is not affected by demographic conditions. According to the Tukey test, ‘economic-feasibility’was less important to the 30-40 age group than other age groups.

Table 13.Importance of main criteria

Main criteria	Mean	SD	Rank	t-value (t-test)	Mean rank		Mann-Whitney test	p-value
					Male	Female		
Serviceability	4.32	.647	1	14.299	64.03	71.33	1,503.500	.324
Safety	4.20	.751	2	9.834	62.96	75.67	1,616.500	.092
Comfort	4.05	.729	3	8.050	63.09	75.13	1,602.500	.107
Environment-friendly	3.94	.791	3	6.257	61.76	75.23	1,605.000	.074
Economic-feasibility	3.66	.803	5	2.052	66.68	60.79	1,229.500	.441
Artistry	3.28	1.398	6	-1.737[a]	65.44	65.73	1,358.000	.970

[a]Represent the t-value is less than cutoff t-value(t_c =1.645)

[b] Represent the p-value is less than 0.05

Main criteria	Mean rank				Kruskal-Wallis test	p-value
	Up to 30	30-40	40-50	Above 50		
Serviceability	56.35	70.44	58.90	59.27	4.086	.252
Safety	65.00	62.51	65.31	77.54	2.130	.546
Comfort	57.10	63.57	65.65	76.96	2.314	.510
Environment-friendly	61.50	66.06	64.23	54.12	1.410	.703
Economic-feasibility	73.25	56.46	78.08	68.42	10.103	**.018**[b]
Artistry	68.85	58.78	73.23	72.50	4.943	.176

Degree of freedom for Kruskal-Wallis test =3

Main criteria	Mean rank						Kruskal-Wallis test	p-value
	Architecture	Construction	Research	Procurement	Administrator	Citizen		
Serviceability	62.60	65.90	55.92	67.77	71.05	64.71	2.142	.829
Safety	68.78	63.34	58.20	64.75	68.25	65.64	1.191	.946
Comfort	55.65	73.64	63.00	69.41	64.40	56.05	5.301	.380
Environment-friendly	64.38	67.06	56.62	66.76	57.45	63.21	1.730	.885
Economic-feasibility	63.50	70.70	55.78	63.05	64.40	68.64	2.487	.778
Artistry	64.68	57.32	67.85	67.97	70.00	61.79	1.944	.857

Degree of freedom for Kruskal-Wallis test =5

Sub-criteria level: The descriptive and inferential statistics for the importance of 34 sub-criteria were summarised in table 14-20.In the sub-criteria level, ‘fire resistance’ (4.40), ‘accessibility’ (4.31), ‘operation cost’(4.28), and ‘ventilation’ (4.25) are the top four criteria for valuable public buildings, which have dominant mean scores compared to the other criteria.

First, a total of six sub-criteria in the serviceability category were examined, and the t-test results (refer to table 14) showed that five criteria except flexibility were significant to the evaluation of public buildings since the t-valuesof these five criteria are greater than 1.645. These were accessibility,

layout, IT, parking, and maintenance. The accessibility was accorded as the most important criterion in this category with highest mean score (4.31). This signals the fact that public buildings should be easy to access by people, since these buildings play an important role in the local community. For this reason, most of the public buildings are located in the city centres. In fact, cities have developed around the public buildings. To increase the accessibility to public buildings, the Korean government tries to locate several public buildings in one area(Kim 2009). This result corresponds with the results of previous research. According to the survey commissioned by the Architecture & Urban Research Institute of Korea in 2008, lack of connectivity between public buildings (47.0%) and difficulty in access(21.2%) are selected as the main inconvenient factors in using public facilities(Kim 2009). On the other hand, since the t-value (1.074) of 'flexibility in future change' is less than 1.645, the null hypothesis was accepted; flexibility is categorised as an unimportant criterion.

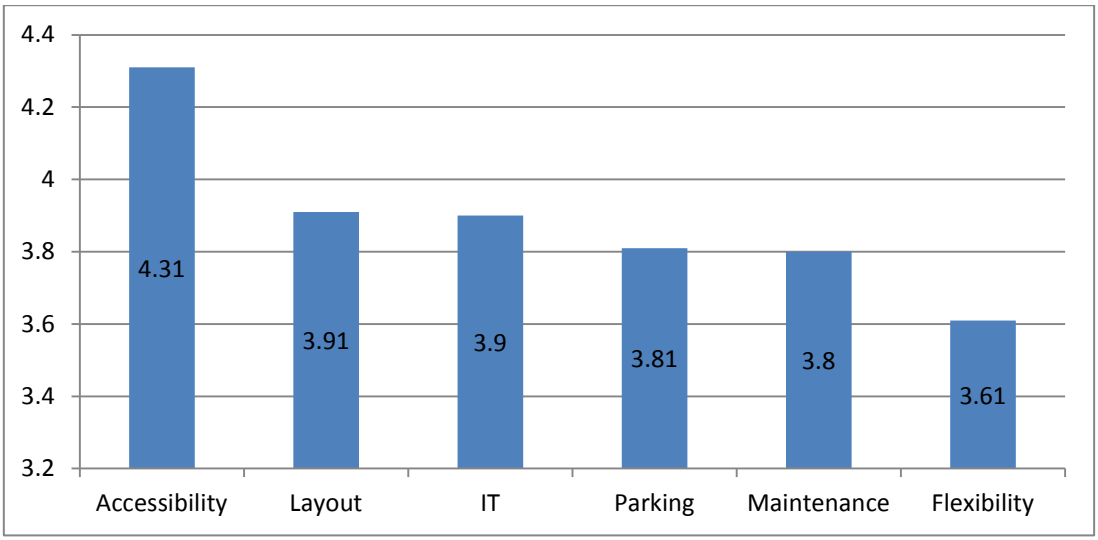


Figure 23. Mean of sub-criteria in serviceability category

The Kruskal–Wallis test showed that only the opinion about accessibilityamongage groups has significant differences (p=0.002). The results of the Tukey test imply that the accessibility to public buildings is much more important to the 30-40 age group than other groups.

Table 14. Importance of sub-criteria in serviceability category

Main criteria	Mean	SD	Rank	t-value (t-test)	Mean rank		Mann-Whitney test	p-value
					Male	Female		
Accessibility	4.31	.808	1	10.805	66.54	58.88	1,180.000	.305
Layout	3.91	.782	2	5.902	65.13	66.96	1,390.000	.810
IT	3.90	.934	2	4.871	64.81	65.75	1,358.500	.903
Parking	3.81	.758	2	4.648	65.68	62.31	1,269.000	.656
Maintenance	3.80	.804	2	4.231	63.86	67.14	1,353.500	.702
Flexibility	3.61	.743	6	1.074[a]	63.90	69.37	1,452.500	.466

Main criteria	Mean rank				Kruskal-Wallis test	p-value
	Up to 30	30-40	40-50	Above 50		
Accessibility	33.70	73.06	59.26	56.19	14.443	.002[b]
Layout	56.60	64.01	64.31	78.73	2.736	.434
IT	66.40	67.91	56.96	65.00	2.322	.508
Parking	67.45	64.90	58.53	76.15	2.664	.446
Maintenance	54.70	61.72	70.87	64.77	2.428	.489
Flexibility	54.35	65.09	67.76	65.04	1.205	.752

Main criteria	Mean rank						Kruskal-Wallis test	p-value
	Design	construction	Research	procurement	administrator	user		
Accessibility	67.95	66.58	60.15	60.16	57.00	70.14	2.243	.815
Layout	70.08	59.54	70.18	61.36	68.85	62.40	2.129	.831
IT	82.90	62.18	52.92	57.06	61.60	70.10	10.377	.665
Parking	72.02	50.06	59.20	65.71	69.75	72.26	7.056	.217
Maintenance	66.25	69.25	52.00	67.34	69.40	56.79	4.560	.472
Flexibility	71.25	52.18	55.58	70.16	65.55	69.36	6.821	.234

Under the heading of safety(refer to table 15), ‘fire resistance’ is considered as the most important criterion. Several building fire incidents that have occurred in Korea have resulted in many casualties and disclosed a building’s susceptibility to fire. This judgment was also reliable with the viewpoint expressed by previous literature (Finley, Karakura et al. 1991; Azegami and Fujiyoshi 1993; Luo and Su 2007). Fire protection in buildings is very important as it makes a major contribution to the success of rescue operations and minimise damages if such incidents occur (Trankler and Kanoun 2001).

The immediate reaction and reliability of fire protection systemsis vital to maintain the safety of the occupants in the public buildings. For this reason, ‘fire resistance’ is assumed to be a more important factor in design and management of public buildings. Increasing emphasis on fire resistanceis being placed on the provision of comprehensive measures to protect the building from fire in Korea.The remaining four sub-criteria were also considered significant in this category since their t-values are greater than 1.645. These criteria are ‘safety of equipment’, ‘durability’, ‘security’, and ‘earthquake-resistence’.

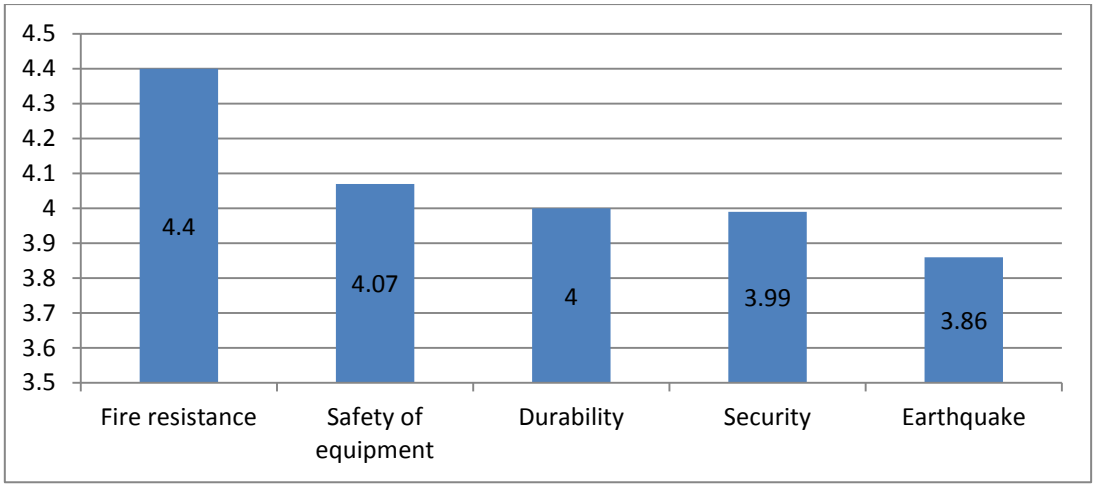


Figure 24. Mean of sub-criteria in safety category

Table 15. Importance of sub-criteria in safety category

Main criteria	Mean	SD	Rank	t-value (t-test)	Mean rank		Mann-Whitney test	p-value
					Male	Female		
Fire resistance	4.40	.677	1	15.167	65.77	64.42	1,324.000	.855
Safety of equipment	4.07	.717	2	9.528	65.16	66.85	1,387.000	.822
Durability	4.00	.816	2	6.868	66.57	61.21	1,240.500	.487
Security	3.99	.818	4	6.258	64.11	66.21	1,289.000	.786
Earthquake	3.86	.869	5	4.937	65.41	65.87	1,361.500	.953

Main criteria	Mean rank				Kruskal-Wallis test	p-value
	Up to 30	30-40	40-50	Above 50		
Fire resistance	57.65	64.26	66.47	70.54	0.942	.815
Safety of equipment	64.15	63.68	65.10	72.50	0.746	.862
Durability	70.30	64.61	58.51	80.96	4.193	.241
Security	66.50	66.78	58.68	62.27	1.427	.699
Earthquake	60.95	62.70	69.67	67.58	1.133	.769

Main criteria	Mean rank						Kruskal-Wallis test	p-value
	Design	Construction	Research	Procurement	Administrator	User		
Fire resistance	60.50	78.62	57.05	57.47	70.70	66.36	7.656	.176
Safety of equipment	67.38	62.36	62.58	55.81	80.25	71.88	5.608	.346
Durability	69.52	60.70	62.62	59.55	59.95	75.74	3.820	.576
Security	70.75	52.22	55.78	64.83	64.20	75.14	7.328	.197
Earthquake	77.18	52.74	56.02	64.00	65.10	74.98	8.550	.128

Table 16 represents the importance ofsub-criteria in the category of comfort. Ventilation was considered as the most significant criterionin this category. Other sub-criteria including heatingandcooling, noise, sanitation, and lighting were also considered as significant sub-criteria.

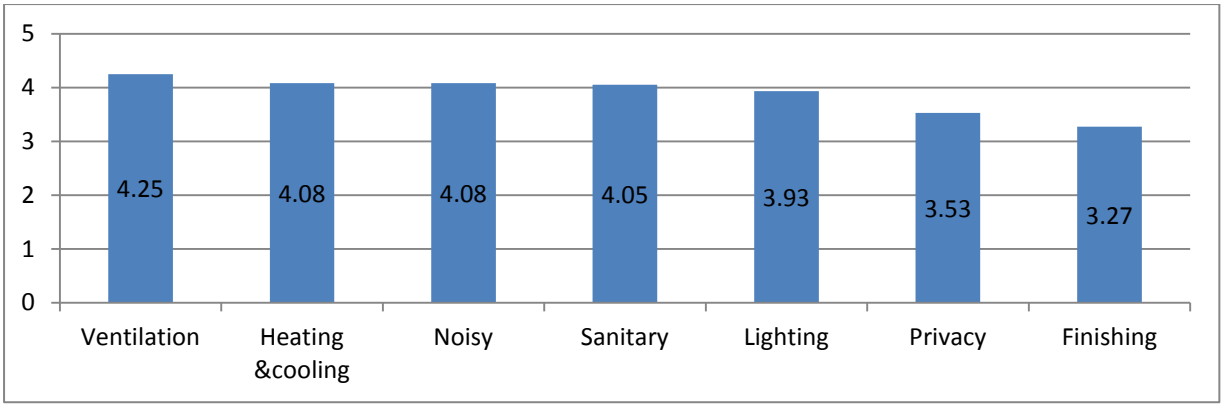


Figure 25. Mean of sub-criteria in comfort category

It is, however, difficult to say that there is statistical difference among three criteria; heating and cooling, level of noisy, sanitationbased on the results of the paired t-test: their t-values (0.122, 0.420, 0.341) are less than 1.645 (refer to Appendix 3). The remaining two criteria,'privacy' and 'finishing' were adjusted as insignificant criteria. On the other hand, there is no statistical difference of the importance of sub-criteria in this category among the demographic groups since the p-valuesof all criteria in this category are greater that 0.05.

Table 16 Importance of sub-criteria in comfort category

Main criteria	Mean	SD	Rank	t-value (t-test)	Mean rank		Mann-Whitney test	p-value
					Male	Female		
Ventilation	4.25	.727	1	10.710	64.81	68.25	1,423.500	.648
Heating&cooling	4.08	.817	2	7.826	64.03	71.37	1,504.500	.332
Noisy	4.08	.813	2	7.508	64.20	70.71	1,487.500	.391
Sanitation	4.05	.672	2	9.565	64.44	67.34	1,358.500	.691
Lighting	3.93	.640	5	7.009	64.86	65.54	1,353.000	.923
Privacy	3.53	.911	6	0.051[a]	62.45	75.12	1,602.000	.101
Finishing	3.27	.778	7	-3.800[a]	64.21	68.30	1,382.500	.588

Main criteria	Mean rank				Kruskal-Wallis test	p-value
	Up to 30	30-40	40-50	Above 50		
Ventilation	61.85	63.60	69.10	63.62	0.746	.862
Heating&cooling	52.20	67.67	67.25	54.23	3.284	.350
Noisy	48.40	65.98	72.03	53.04	5.454	.141
Sanitation	65.45	64.09	66.04	61.69	0.198	.978
Lighting	55.55	63.82	68.70	63.73	1.441	.696
Privacy	83.55	63.25	64.07	57.69	3.570	.312
Finishing	80.28	62.91	60.64	72.85	3.424	.331

Main criteria	Mean rank						Kruskal-Wallis test	p-value
	Design	Construction	Research	Procurement	Administrator	User		
Ventilation	61.32	71.30	56.20	66.64	60.45	66.00	2.724	.742
Heating&cooling	63.58	75.58	67.42	60.33	52.60	61.43	4.729	.450
Noisy	56.15	67.28	64.85	70.02	57.85	63.57	2.602	.761
Sanitation	52.92	70.32	62.72	65.35	60.05	68.12	3.890	.565
Lighting	71.40	66.26	65.53	59.69	65.90	58.55	2.586	.764
Privacy	67.37	53.84	57.48	66.81	53.75	79.86	8.551	.128
Finishing	59.50	57.94	64.15	65.05	64.65	73.50	2.924	.712

The importance of sub-criteria in the ‘environment-friendly’ criteria were presented in table 17.‘Traffic effect’ is the predominant elementin the category. This reflects the fact that traffic congestion is a critical issue of urban life in Korea. The Korean government has forced building owners to consider traffic effect when planning a public building which is above a certain standard in size. Other sub-criteria including ‘eco-system’, ‘green-gas emission’, and ‘contaminant’ were also considered as significantalthough there is no statitstical differencein importance among them (refer to Appendix 3). Since the t-value (-0.957) of recycling is less than the critical t-value (1.645), recycling was considered as an unimportant criterion.On the other hand, there is no difference inthe importance of sub-criteria in this category among the demographic group. All p-values are over 0.05.

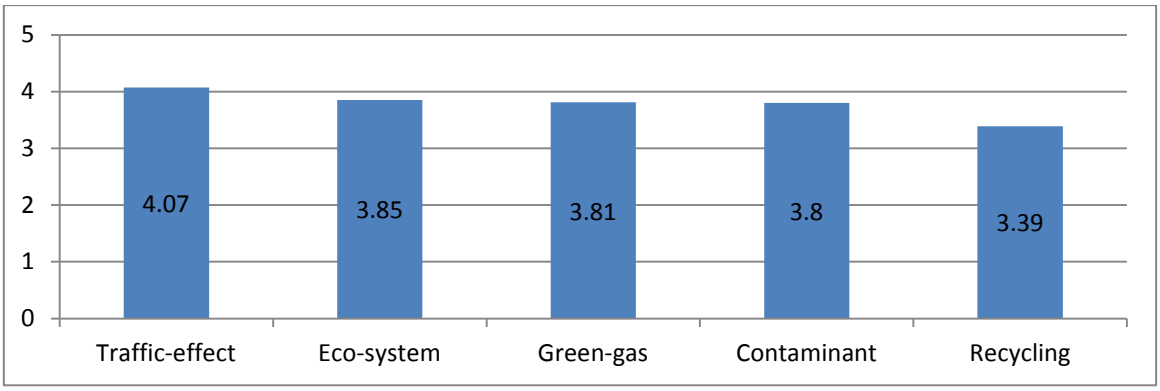


Figure 26. Mean of sub-criteria in environment-friendly category

Table 17 Importance of sub-criteria in environment-friendly category

Main criteria	Mean	SD	Rank	t-value (t-test)	Mean rank		Mann-Whitney test	p-value
					Male	Female		
Traffic-effect	4.07	.891	1	7.517	65.04	67.35	1,400.000	.766
Eco-system	3.85	.910	2	4.313	64.79	68.33	1,425.500	.649
Green-gas	3.81	.899	3	4.014	64.59	69.13	1,446.500	.556
Contaminant	3.80	1.465	4	2.073	66.10	63.26	1,289.500	.701
Recycling	3.39	.840	5	-0.957[a]	65.71	64.65	1,330.000	.890

Main criteria	Mean rank				Kruskal-Wallis test	p-value
	Up to 30	30-40	40-50	Above 50		
Traffic-effect	48.80	69.86	64.89	51.58	5.388	.145
Eco-system	47.80	66.16	71.78	53.23	5.264	.153
Green-gas	60.15	63.56	69.28	64.65	0.851	.837
Contaminant	59.30	63.23	67.75	71.31	1.063	.786
Recycling	64.95	62.92	70.69	60.46	1.465	.690

Main criteria	Mean rank						Kruskal-Wallis test	p-value
	Design	construction	Research	procurement	Administrator	user		
Traffic-effect	65.75	67.72	60.60	62.61	52.65	71.71	2.644	.755
Eco-system	56.18	74.22	55.95	64.45	69.00	66.93	4.525	.477
Green-gas	60.35	71.10	57.20	64.91	72.80	62.98	2.698	.746
Contaminant	58.78	68.74	60.75	59.17	76.20	71.02	3.682	.596
Recycling	61.02	64.16	61.02	65.34	67.10	69.00	0.857	.973

Regarding the economic-feasibility category referred to in table 19, survey results suggested that ‘initial cost’ is ranked third within this category and follows the criteria of ‘operation costs’ and ‘maintenance costs’. In addition, it is surprising that initial cost is considered as an unimportant criterion,because ‘initial cost’ was traditionally considered as a decisive factor for the selection of building and construtiondesign (Scott, Molenaar et al. 2006; Wong and Li 2006) as well as in the Korean construction procurement market(Lee 2006b). Particularly in the low-bid system prevalent worldwide including in Korea, the ‘initial cost’plays a role as a key factor. This inconsistency implies that the low-bid system which focuses on price cannot guarantee best-valued buildings.

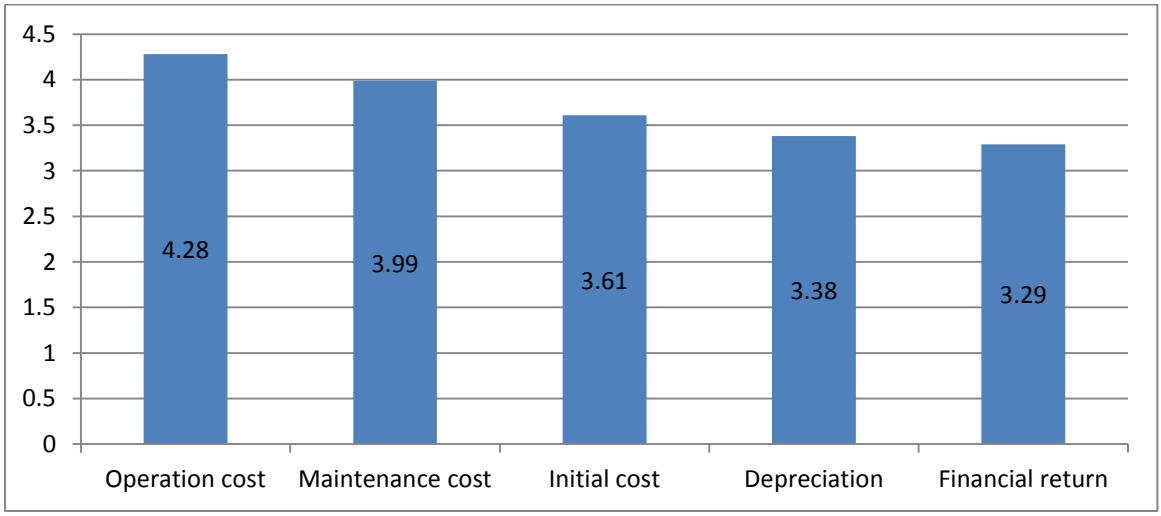


Figure 27. Mean of sub-criteria in economic-feasibility category

Consequently, ‘operation costs’and ‘maintenance costs’are considered the most important criteria in this category. This result explains the reason why many countries try to use Life Cycle Cost which includesthese two criteria in the evaluation list of the contractor in a construction project (Boussabaine and Kirkham, 2008; David, 1997).The capital cost of a building is usually less than its operational costs. Minor problems like narrow corridors or inadequate sunlight may save some capital cost, but will have a negetive impact on the business or education as well as on the health of the people living in the facility over the life cycle (Cook 2007).

As far as ‘maintenance cost’ is concerned, however, there is some confusion between survey results and the literature. While maintenance costsare more important than initial costs in the survey, previous results claimed the opposite. Fuller (2010)claimed that operating, maintainance and repair costs are generally more complex to budget for as compared to other building expenses,since standards of maintainance and operating schedules differs from building to building; even for the buildings of the same type and age there is a vast difference in these costs. However, according to the roughly estimated sample (referred to figure28), the ratio of maintenance costs (including replacement costs) is just 7% compared to 43% of initial costs.

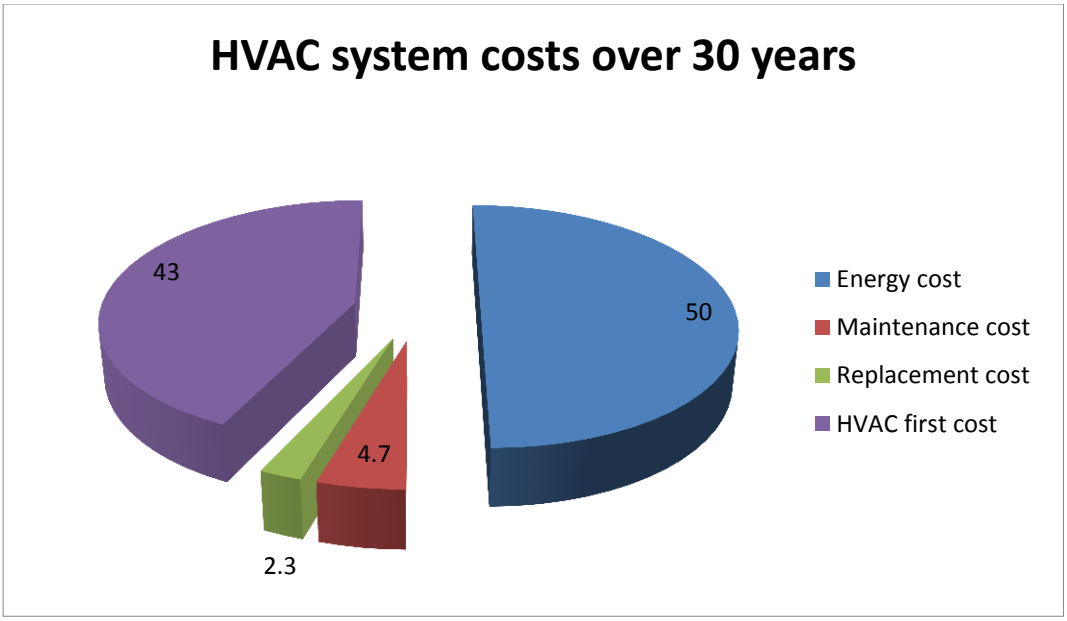


Figure28.The cost of building facility.

Source: Washington State Department of General Administration (2010)

On the other hand, the t-test also suggested that other sub-criteria including depreciation and ‘financial return’ had low levels of significance. This may be due to the tendency of the Koreans to assume that the public sector should focus more on service than profits. In addition, there is no significantdifference inthe importance of sub-criteria in the category among the demographic group. All p-values are over 0.05.

Table 18. Importance of sub-criteria in economic-feasibility category

Main criteria	Mean	SD	Rank	t-value (t-test)	Mean rank		Mann-Whitney test	p-value
					Male	Female		
Operation cost	4.28	.797	1	10.508	65.79	63.62	1,303.000	.755
Maintenance cost	3.99	.831	2	6.104	64.42	69.81	1,464.000	.483
Initial cost	3.61	.831	3	1.071[a]	66.09	63.13	1,290.500	.701
Depreciation	3.38	.686	5	-2.228[a]	64.12	71.00	1,495.000	.350
Financial return	3.29	1.009	5	-2.009[a]	64.75	66.06	1,326.500	.868

Main criteria	Mean rank				Kruskal-Wallis test	p-value
	Up to 30	30-40	40-50	Above 50		
Operation cost	49.50	66.15	68.96	59.77	2.913	.405
Maintenance cost	53.55	65.82	66.81	64.38	1.227	.747
Initial cost	47.80	67.89	61.03	73.69	4.180	.243
Depreciation	55.25	65.83	69.21	56.38	2.354	.502
Financial return	65.25	64.67	66.31	58.00	0.543	.909

Main criteria	Mean rank						Kruskal-Wallis test	p-value
	Design	construction	Research	procurement	Administrator	user		
Operation cost	54.50	77.10	55.68	64.64	60.45	69.14	7.055	.217
Maintenance cost	63.50	75.84	54.40	59.52	65.20	68.83	5.413	.368
Initial cost	60.78	63.72	61.72	68.55	60.15	67.52	1.129	.951
Depreciation	59.25	65.00	69.18	60.75	62.70	71.02	2.162	.826
Financial return	63.20	73.20	61.58	63.62	53.40	61.62	2.864	.721

Regarding to artistry,figure28 and table 19showed that while ‘harmony with surroundingss’, ‘appearance’, and ‘symbolism’ were considered as important in the category, other sub-criteria including uniqueness,colour, and tradition were considered as insignificant. The data of p-value imply that there is some difference of opinion among respondents according to profession as to whether uniqueness is important or not;however,the Tukey test shows that it is too small to figure out the difference in statistics.

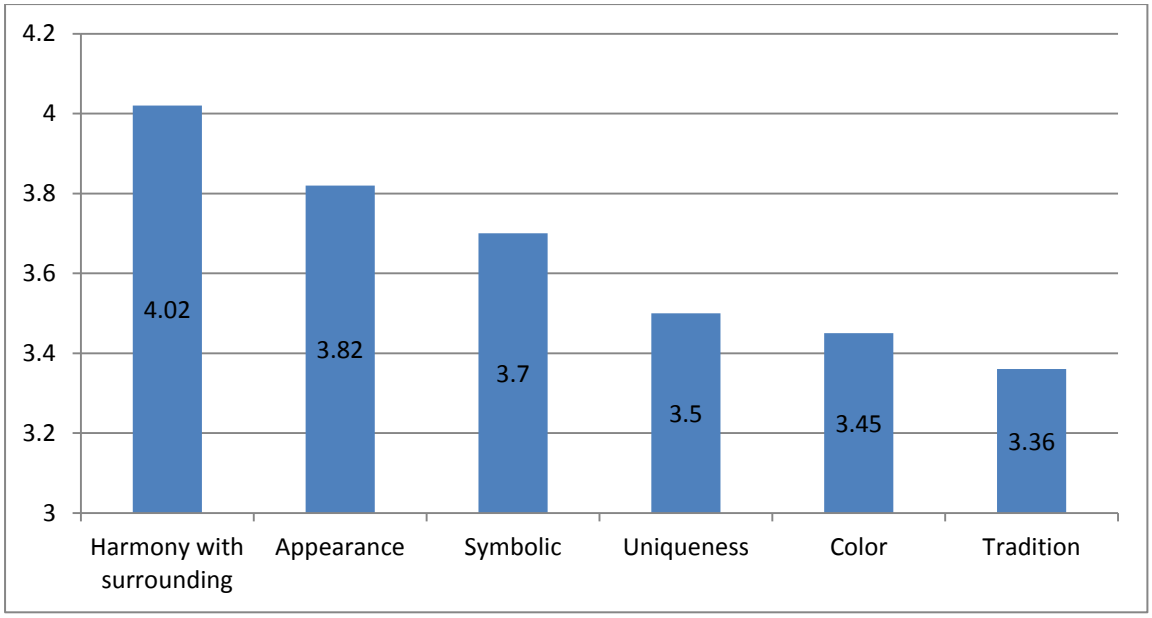


Figure 29. Mean of sub-criteria in artistry category

Table 19. Importance of sub-criteria in artistry category

Main criteria	Mean	SD	Rank	t-value (t-test)	Mean rank		Mann-Whitney test	p-value
					Male	Female		
Harmony with surroundings	4.02	.838	1	6.567	64.63	66.48	1,377.500	807
Appearance	3.82	.802	2	4.370	63.68	72.77	1,541.000	.234
Symbolism	3.70	.920	2	2.389	66.07	63.21	1,292.500	.715
Uniqueness	3.50	.865	4	-0.162[a]	65.12	67.04	1,392.000	.804
Color	3.45	.808	5	-1.100[a]	63.44	73.73	1,566.000	.178
Tradition	3.36	.854	6	-2.125[a]	68.09	55.13	1,082.500	.092

Main criteria	Mean rank				Kruskal-Wallis test	p-value
	Up to 30	30-40	40-50	Above 50		
Harmony with surroundings	55.25	65.00	71.29	50.15	4.420	.220
Appearance	69.60	65.41	67.60	52.08	2.200	.532
Symbolism	70.10	62.09	71.92	57.62	2.603	.457
Uniqueness	67.35	61.77	72.29	60.38	2.436	.487
Color	64.10	64.74	69.24	55.35	1.564	.668
Tradition	67.00	58.91	75.82	66.31	5.658	.129

Main criteria	Mean rank						Kruskal-Wallis test	p-value
	Design	construction	Research	procurement	Administrator	user		
Harmony with surroundings	69.80	70.64	56.00	56.61	56.50	72.67	5.921	.314
Appearance	56.00	72.96	61.00	67.00	50.00	68.95	5.262	.385
Symbolism	62.72	73.18	63.00	61.25	57.55	65.55	2.279	.809
Uniqueness	77.10	64.06	54.45	75.12	53.80	51.50	11.178	.048[b]
Color	64.80	68.26	63.25	68.56	59.50	57.12	1.958	.855
Tradition	55.00	.69.66	62.65	67.17	72.00	61.52	2.935	.710

5.4Summary

The first part of the analysis aims at identifying criteria for value-based public buildings in Korea. The arithmetic means and rank orders of the identified criteria were derived from the total sample to determine the level of importance. Criteria with means exceeding '3.5' are recognised as the important criteria in this study. The significance levels derived from the t-testare also included in tables13-19. The results confirm that six main criteria and 24 sub-criteria were selected as important criteria. Although the artistry category in the main criteria is not considered as an important criterion, it is included because of its sub-criteria. The remaining 10 sub-criteria not included in the important category are:'flexibility' in serviceability:'privacy' and 'finishing' in comfort:'recycling' in environment-friendly:'initial cost', 'depreciation', and 'financial return' in economic-feasibility:and 'uniqueness', 'colour', and 'tradition' in artistry. Since these 10 factors are not statistically significant, they are considered as unimportant criteria in this survey. Table 20 represents six main criteria and 24 sub-criteria.

Table 20. The important criteria through thegeneral survey

Main criteria(rank)	Sub-criteria (rank)
Serviceability(1)	Accessibility(1), Layout(2), IT(2),Parking(2), Maintenance(2)
Safety(2)	Fire resistance(1), Safety of equipment(2), Durability(2),Security(4), Earthquake(5)
Comfort(3)	Ventilation(1), Heating&cooling(2), Noisy(2), Sanitation(2), Lighting(5)
Environment-friendly(3)	Traffic-effect(1), Eco-system(2), Green-gas(2), Contaminant(2)
Economic-feasibility(5)	Operation cost(1), Maintenance cost(2)
Artistry(6)	Harmony with surroundings(1), Appearance(2), Symbolism(2)

On the other hand, generally, there are rare significant differences in the importance of criteria for the general public buildings among the demographic groups such as gender, age, and profession. This can be interpreted as that there is a consensus relating to public building design regardless of gender, age, or occupation.

Chapter 6 AHP analysis

6.1 Data collection

The main purpose of this AHP survey is to find any differences of weight on the criteria among various public buildings. The buildings are National Assembly Building, Sungnam City Hall, Central Police Office Building.

Pilot test: Before conducting the survey, a pilot test was conduted with two senior members of staff from the Ministry of Land, Transportation, and Maritime of Korea by phone and e-amil.The questionnaire was modified and some additional criteria were added. First of all, three buildings to be tested were selected through the discussion. Kim (2004)divided public office buildings into three categories; National Authority Offices, Local Government Offices, and Other Public Buildings. Each selected building represents one of these categories. National Assembly building is one of the most representative National Authority Ofiices in most nations. In Korea, National Assembly building is main building of nation, but there are some debate on its design such as appreance, color, size, etc. Sungnam City Hall constructed in 2009 was selected as representative of local government office since it caused intense criticism on account of its excessively luxurious appreance and inefficiency in energy use. Central police building is selected for other public building category. Considering its role, location, size, two expert conducting pilot test suggested that central police building can represent other public building category. On the other hand, although 24 sub-criteria are elicited as important criteria through the general survey, three criteria were included through the pilot test. At first, since 'initial cost' has beenused as a critical criterion in most construction projects, it was added to the important criteria group, though it achieved a low score in the general survey. In addition, flexibility within serviceability and tradition within artistry were also added. 'Flexibility in future change' is suggested as an important criterion by two experts because of frequent organisational renovation despite its low rank in the general survey. This criterion was also considered as important in other research (Brandon 1984; OGC 2002; Yasin and Egbu 2009). The addition of 'tradition' is the result of consideration of the recent conflict over the design of Seoul City Hall. The new design of Korea'sCapital City Hall was rejected by the Architecture Council in 2008 due to its lack of the consideration of tradition. Therefore 27 criteria (represented in figure 29are tested in the AHP survey.

Respondents: The questionnaire is presented in Appendix 2.The resulting questionnaire was e-mailed to the six selected respondents.The experts were chosen from four different disciplines: architecture (1), academia (1), construction engineering (1), and government officials (3). Their demographic information established that all these respondents were highly knowledgeable and had more than 10 years of experience in the building construction field. To increase the credibility of the results, the detailed explanation about the AHP questionnaire was conducted to the respondents by phone in

advance. The reason that the number of the government officials is more than the respondents from other disciplines is that the opinion of government officials plays a critical role in deciding the policy and procurement of public building.To guarantee the knowledge of experts, six experts were recommended by PCAP(Presidential Commission on Architecture Policy of Korea) which reviews the important architectural policy of Korea.They are predominant experts with over 15 years experience in architecture and have deep interest in the quality of public building. In addition, they have an experience in AHP analysis at least once over. The answers were collected by e-mail.

6.2 Mechanics of AHP

The AHP method consists of three distinct phases, which are derived from three principles: 1) the principle of ‘constructing hierarchies’; 2) the principle of ‘establishing priorities’; and 3) the principle of ‘logical consistency’(Saaty and Alexander 1989).

Constructing hierarchies:Constructing hierarchies is based on the results which show how the human mind discerns objects and concepts, and distinguishes relations existing between them when information is elaborated. The mind of a human being cannot comprehend all aspects which are affected by an action and their connections all at the same time. Hence it is necessary to break down complex systems into simple structures. This breaking down of complex issues can be done with the help of a logical process which looks at the construction of appropriate hierarchies. Hierarchies are great tools to help the human mind to tackle complex issues such as decision-making problems or even constructing a plan encompassing many various elements, which are classified but related as well. Saaty (1988)describes a hierarchy thus:

> A hierarchy is a particular type of system, which is based on the assumption that the entities, which we have identified, can be grouped into disjoint sets, with the entities of one group influencing the entities of only one other group, and being influenced by the entities of only one group

The important criteria for the appropriate combination in best-valued public building were confirmed based on the general survey results (refer to table 20) and pilot test for AHP (refer to section 6.1), and then were proposed as a three-level hierarchical conceptual model as in figure29.The top level is the best-valued public building as a goal, and following level is composed of six main criteria. The last level comprises the 27 sub-criteria expanded from the main criteria.

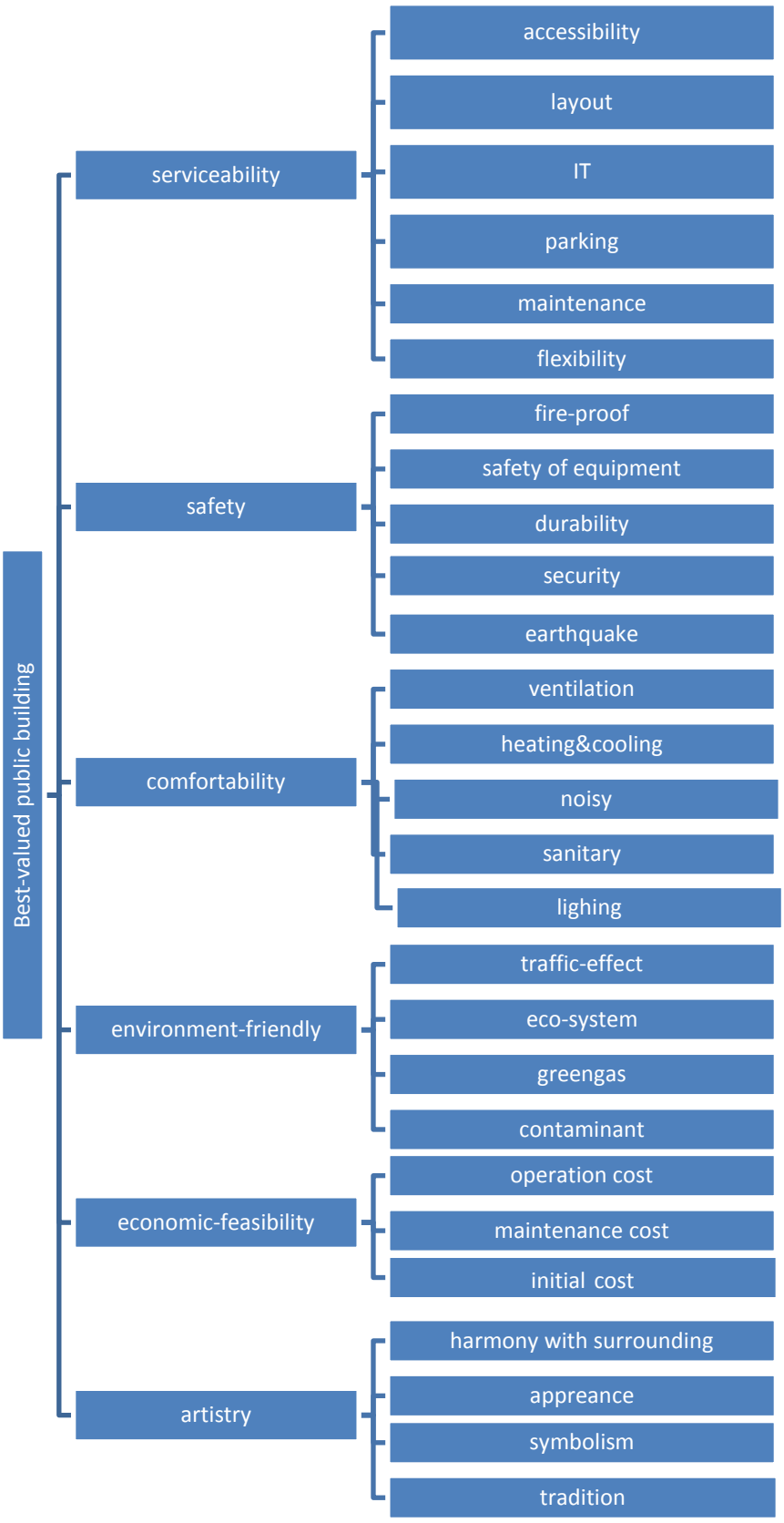


Figure 30. The decision hierarchy for best-valued building

Establishing priorities: To analyse the survey findings, the judgment matrices were pair-wise compared and computed via Microsoft Excel.There are 21 pairwise comparison matrices in all: three for the main criteria with respect to the goal, which are shown in tables21, 28, 35in each building, andthe remaining 18 for the sub-criteria, the first matrics for the sub-criteria comparison under serviceability category in National Assembly Building: accessibility, layout, IT, parking, maintenance, and flexibility, given in table 22The rest were respresented in turn in tables23 to 41.

The local priority weights of all main criteria and sub-criteria of three buildings were first calculated (referr to tables21- 41), and then combined with all successive hierarchical levels in each matrix to obtain a global priority weight(refer to table 44). The higher the mean weight of global priority vector, the greater the relative importance. This helps to distinguish the more important elements from the less important ones(Wong and Li 2008).

In particular, for each criterion **C,** a *n*-by-*n* matrix **A** of pairwise comparisons is constructed. Thecomponents *aij* (*i, j* = 1, 2, …, *n*) of the matrix **A** are numerical entries, which express (by the pairwisecomparison scale) the relative importance of the element *i* over the element *j* with respect to thecorresponding element in the next higher level. Thus the matrix **A** has the form(Montis, Toro et al. 2000):

$$A = \begin{bmatrix} \mathrm{a}_{12} & \cdots & an_1 \\ \vdots & \ddots & \vdots \\ an_1 & \cdots & ann \end{bmatrix} \qquad (10)$$

where: $a_{ii}=1$, $a_{ij}=a_{ji}^{-1}$, $a_{ij}\neq 0$

In order to calculate relative priorities among the *n* elements of the matrix **A**, the 'principaleigenvector' of the matrix is computed. Then this eigenvector is normalised obtaining the 'priority vector'(**v**, with Σvi=1), which expresses the priorities among the elements belonging to the same node (*localpriority*). To obtain an overall priority among options (*global priority*), it is necessary to aggregate all thelocal priorities. In this way it is possible to obtain a ranking for a discrete number of options(Montis, Toro et al. 2000). Geometric mean is used to incorporate the evaluation of six respondents(Aczél and Saaty 1983; Cho 2002).

$$\overline{a_{ij}} = \prod_{k=1}^{n} (a_{ijk})^{1/n} \qquad (11)$$

where : $\overline{a_{ij}}$ *is each element of incorporated matrix*

a_{ijk} *is the evaluation score on* a_{ij} *of the respondent k*

National Assembly Building

Table 21. Pairwise comparison matrix of the main criteria with respect to the goals

Total	Serviceability	Safety	Comfort	Environ friendly	Econo feasibility	Artistry	*WEIGHT*
Serviceability	1.0000	0.8023	1.2009	1.4678	1.6984	0.9410	0.181(2)
Safety	1.2464	1.0000	2.1398	2.7495	2.5873	1.6984	0.282(1)
Comfort	0.8327	0.4673	1.0000	1.3480	1.3077	0.8909	0.145(4)
Environ friendly	0.6813	0.3637	0.7418	1.0000	1.2599	0.7799	0.118(5)
Econo feasibility	0.5888	0.3865	0.7647	0.7937	1.0000	0.5503	0.102(6)
Artistry	1.0627	0.5888	1.1225	1.2822	1.8171	1.0000	0.171(3)

Table 22.Pairwise comparison matrix of the sub-criteria with respect to the serviceability category

Serviceability	*Accessibility*	*Layout*	*IT*	*Parking*	*Maintenance*	*Flexibility*	*WEIGHT*
Accessibility	1.0000	1.5874	1.6984	3.3604	3.4270	3.2031	0.321 (1)
Layout	0.6300	1.0000	1.4422	1.9194	2.0137	2.4183	0.213 (2)
IT	0.5888	0.6934	1.0000	2.2209	1.4969	1.7818	0.173 (3)
Parking	0.2976	0.5210	0.4503	1.0000	0.8909	0.9806	0.094 (6)
Maintenance	0.2918	0.4966	0.6680	1.1225	1.0000	1.1447	0.105 (4)
Flexibility	0.3122	0.4135	0.5612	1.0198	0.8736	1.0000	0.094 (5)

Table 23.Pairwise comparison matrix of the sub-criteria with respect to the safety category

Safety	Fire resistance	Safety of equipment	Durability	Security	Earthquake	*WEIGHT*
Fire resistance	1.0000	2.0536	2.7982	2.1822	4.2628	0.391 (1)
Safety of Equipment	0.4870	1.0000	1.0000	0.9347	1.9921	0.171 (3)
Durability	0.3574	1.0000	1.0000	0.7783	2.7495	0.166 (4)
Security	0.4582	1.0699	1.2849	1.0000	2.8845	0.197 (2)
Earthquake	0.2346	0.5020	0.3637	0.3467	1.0000	0.075 (5)

Table 24. Pairwise comparison matrix of the sub-criteria with respect to the comfort category

Comfort	Ventilation	Heating & Cooling	Noisy	Sanitation	Lighting	*WEIGHT*
Ventilation	1.0000	1.0000	1.2599	1.8171	1.5131	0.249 (2)
Heating & Cooling	1.0000	1.0000	1.2222	1.9064	1.6475	0.254 (1)
Noisy	0.7937	0.8182	1.0000	1.3991	1.5131	0.207 (3)
Sanitation	0.5503	0.5246	0.7148	1.0000	1.0699	0.143 (5)
Lighting	0.6609	0.6070	0.6609	0.9347	1.0000	0.147 (4)

Table 25. Pairwise comparison matrix of the sub-criteria with respect to the environment-friendly category

Environ friendly	Traffic-effect	Eco-system	Green-gas	Contaminant	*WEIGHT*
Traffic-effect	1.0000	1.1856	2.4495	1.1776	0.324 (1)
Eco-system	0.8434	1.0000	2.0137	1.2009	0.285 (2)
Green-gas	0.4082	0.4966	1.0000	0.5612	0.138 (4)
Contaminant	0.8492	0.8327	1.7818	1.0000	0.253 (3)

Table 26. Pairwise comparison matrix of the sub-criteria with respect to the economic feasibility category

Economic	Operation cost	Maintenance cost	Initial cost	*WEIGHT*
Operation cost	1.0000	3.0531	2.7495	0.591 (1)
Maintenance cost	0.3275	1.0000	0.8327	0.189 (3)
Initial cost	0.3637	1.2009	1.0000	0.221 (2)

Table 27. Pairwise comparison matrix of the sub-criteria with respect to the artistry category

Artistry	Harmony with surroundings	Appearance	Symbolism	Tradition	*WEIGHT*
Harmony with surroundings	1.0000	1.5131	0.7274	2.1314	0.291 (2)
Appearance	0.6609	1.0000	0.7937	2.1398	0.241 (3)
Symbolism	1.3747	1.2599	1.0000	2.6854	0.343 (1)
Tradition	0.4692	0.4673	0.3724	1.0000	0.124 (4)

Central Police Office

Table 28. Pairwise comparison matrix of the main criteria with respect to the goals

Total	Serviceabilit	Safety	Comfort	Environ friendly	Econo feasibility	Artistry	*WEIGHT*
Serviceability	1.0000	0.8327	1.9064	2.5099	1.7627	4.8239	0.247(2)
Safety	1.2009	1.0000	3.2031	3.9149	2.4495	5.2525	0.336(1)
Comfort	0.5246	0.3122	1.0000	2.4019	0.9701	3.7719	0.148(3)
Environ friendly	0.3984	0.2554	0.4163	1.0000	0.6177	1.4142	0.079(5)
Econo feasibility	0.5673	0.4082	1.0309	1.6189	1.0000	2.7682	0.138(4)
Artistry	0.2073	0.1904	0.2651	0.7071	0.3612	1.0000	0.051(6)

Table 29. Pairwise comparison matrix of the sub-criteria with respect to the serviceability category

Serviceability	Accessibility	Layout	IT	Parking	Maintenance	Flexibility	*WEIGHT*
Accessibility	1.0000	1.1776	1.4142	3.0862	2.7495	3.4200	0.287 (1)
Layout	0.8492	1.0000	1.2599	2.7982	1.7100	2.5873	0.231 (2)
IT	0.7071	0.7937	1.0000	1.9194	1.2540	2.2209	0.180 (3)
Parking	0.3240	0.3574	0.5210	1.0000	0.7418	1.2009	0.092 (5)
Maintenance	0.3637	0.5848	0.7974	1.3480	1.0000	1.5131	0.126 (4)
Flexibility	0.2924	0.3865	0.4503	0.8327	0.6609	1.0000	0.083 (6)

Table 30. Pairwise comparison matrix of the sub-criteria with respect to the safety category

Safety	Fire resistance	Safety of equipment	Durability	Security	Earthquake	*WEIGHT*
Fire resistance	1.0000	2.1169	2.4233	0.5612	3.9572	0.271 (2)
Safety of equipment	0.4724	1.0000	1.5131	0.3749	2.3762	0.151 (3)
Durability	0.4127	0.6609	1.0000	0.2887	2.1398	0.116 (4)
Security	1.7818	2.6672	3.4641	1.0000	4.4571	0.394 (1)
Earthquake	0.2527	0.4208	0.4673	0.2244	1.0000	0.067 (5)

Table 31. Pairwise comparison matrix of the sub-criteria with respect to the comfort category

Comfort	Ventilation	Heating & Cooling	Noisy	Sanitation	Lighting	*WEIGHT*
Ventilation	1.0000	1.0491	1.2822	1.3480	1.9442	0.250 (2)
Heating & Cooling	0.9532	1.0000	1.4142	1.6688	1.6984	0.255 (1)
Noisy	0.7799	0.7071	1.0000	0.9532	1.3719	0.182 (3)
Sanitation	0.7418	0.5992	1.0491	1.0000	1.4422	0.180 (4)
Lighting	0.5144	0.5888	0.7289	0.6934	1.0000	0.134 (5)

Table 32. Pairwise comparison matrix of the sub-criteria with respect to the Environment-friendly

Environ friendly	Traffic-effect	Eco-system	Green-gas	Contaminant	*WEIGHT*
Traffic-effect	1.0000	1.3719	2.3762	1.1776	0.332 (1)
Eco-system	0.7289	1.0000	1.5874	0.7071	0.225 (3)
Green-gas	0.4208	0.6300	1.0000	0.4292	0.137 (4)
Contaminant	0.8492	1.4142	2.3300	1.0000	0.306 (2)

Table 33. Pairwise comparison matrix of the sub-criteria with respect to the conomic feasibility category

Economic	Operation cost	Maintenance cost	Initial cost	*WEIGHT*
Operation cost	1.0000	3.2031	1.8171	0.535 (1)
Maintenance cost	0.3122	1.0000	0.5144	0.161 (3)
Initial cost	0.5503	1.9442	1.0000	0.304 (2)

Table 34. Pairwise comparison matrix of the sub-criteria with respect to the artistry category

Artistry	Harmony with surroundings	Appearance	Symbolism	Tradition	*WEIGHT*
Harmony with surroundings	1.0000	2.0396	1.2599	4.0632	0.396 (1)
Appearance	0.4903	1.0000	1.0699	3.3604	0.252 (3)
Symbolism	0.7937	0.9347	1.0000	3.1623	0.268 (2)
Tradition	0.2461	0.2976	0.3162	1.0000	0.084 (4)

Sungnam City Hall

Table 35. Pairwise comparison matrix of the main criteria with respect to the goals

Total	Serviceabilit	Safety	Comfort	Environ friendly	Econo feasibility	Artistry	*WEIGHT*
Serviceability	1.0000	1.0699	1.8171	3.0468	1.1650	4.1602	0.252(2)
Safety	0.9347	1.0000	2.2894	3.3019	1.6984	4.1407	0.278(1)
Comfort	0.5503	0.4368	1.0000	2.4019	0.9532	3.1408	0.159(4)
Environ friendly	0.3282	0.3029	0.4163	1.0000	0.5612	1.5131	0.082(5)
Econo feasibility	0.8584	0.5888	1.0491	1.7818	1.0000	3.2951	0.173(3)
Artistry	0.2404	0.2415	0.3184	0.6609	0.3035	1.0000	0.056(6)

Table 36. Pairwise comparison matrix of the sub-criteria with respect to the serviceability category

Serviceability	Accessibility	Layout	IT	Parking	Maintenance	Flexibility	*WEIGHT*
Accessibility	1.0000	2.2209	4.0793	3.5954	2.9417	3.0468	0.374 (1)
Layout	0.4503	1.0000	2.5698	2.0758	1.6984	1.7627	0.202 (2)
IT	0.2451	0.3891	1.0000	1.0699	0.7647	0.9806	0.094 (6)
Parking	0.2781	0.4817	0.9347	1.0000	0.7937	1.0699	0.099 (5)
Maintenance	0.3399	0.5888	1.3077	1.2599	1.0000	1.4422	0.128 (3)
Flexibility	0.3282	0.5673	1.0198	0.9347	0.6934	1.0000	0.102 (4)

Table 37. Pairwise comparison matrix of the sub-criteria with respect to the safety category

Safety	Fire resistance	Safety of equipment	Durability	Security	Earthquake	*WEIGHT*
Fire resistance	1.0000	1.8860	2.2894	2.8536	4.1602	0.384 (1)
Safety of equipment	0.5302	1.0000	1.1650	1.2354	2.4495	0.197 (3)
Durability	0.4368	0.8584	1.0000	1.9064	3.1408	0.207 (2)
Security	0.3504	0.8094	0.5246	1.0000	2.0000	0.136 (4)
Earthquake	0.2404	0.4082	0.3184	0.5000	1.0000	0.075 (5)

Table 38. Pairwise comparison matrix of the sub-criteria with respect to the comfort category

Comfort	Ventilation	Heating & Cooling	Noisy	Sanitation	Lighting	*WEIGHT*
Ventilation	1.0000	1.1776	2.2209	1.5131	1.9442	0.282 (1)
Heating & Cooling	0.8492	1.0000	2.2209	1.6688	2.0000	0.272 (2)
Noisy	0.4503	0.4503	1.0000	0.4673	0.9347	0.116 (5)
Sanitation	0.6609	0.5992	2.1398	1.0000	1.4422	0.196 (3)
Lighting	0.5144	0.5000	1.0699	0.6934	1.0000	0.131 (4)

Table 39. Pairwise comparison matrix of the sub-criteria with respect to the environment-friendly category

Environ friendly	Traffic-effect	Eco-system	Green-gas	Contaminant	*WEIGHT*
Traffic-effect	1.0000	1.3719	2.3762	1.0491	0.322 (1)
Eco-system	0.7289	1.0000	2.0137	0.8909	0.253 (3)
Green-gas	0.4208	0.4966	1.0000	0.4454	0.131 (4)
Contaminant	0.9532	1.1225	2.2449	1.0000	0.294 (2)

Table 40. Pairwise comparison matrix of the sub-criteria with respect to the economic feasibility category

Economic	Operation cost	Maintenance cost	Initial cost	*WEIGHT*
Operation cost	1.0000	3.2598	1.9442	0.543 (1)
Maintenance cost	0.3068	1.0000	0.4582	0.152 (3)
Initial cost	0.5144	2.1822	1.0000	0.305 (2)

Table 41. Pairwise comparison matrix of the sub-criteria with respect to the artistry category

Artistry	Harmony with surroundings	Appearance	Symbolism	Tradition	*WEIGHT*
Harmony with surroundings	1.0000	2.3348	2.4662	4.3943	0.473 (1)
Appearance	0.4283	1.0000	1.5431	3.4200	0.257 (2)
Symbolism	0.4055	0.6481	1.0000	2.4495	0.185 (3)
Tradition	0.2276	0.2924	0.4082	1.0000	0.084 (4)

Logical consistency:One of the advantages of the AHP is that it provides consistency checking on judgments. According to Saaty (1988), consistency is defined as when "the intensities of relations among ideas or objects based on a particular criterion justify each other in some logical way". The consistency test is one of the essential features of the AHP method which aims to eliminate the possible inconsistency revealed in the criteria weights through the computation of consistency level of each matrix (Cheng and Li 2002). In the AHP approach, the "maximum orprincipal eigenvalue" (called λmax) of each matrix of pairwise comparisons is computed to check thedegree of inconsistency. If inconsistency is too high, it is necessary to reformulate the judgements bymeans of new pairwise comparisons (Montis, Toro et al. 2000).

The inconsistency is measured by first estimating the consistency index (CI). The inconsistency can be represented as the difference between number of criteria (n) and λmax. The CI is defined in Eq. (13)(Saaty 1980b).

$$CI = \frac{\lambda max - n}{n-1} (13)$$

Then, the CI is divided by the random consistency index (see table 43) to obtain the consistency ratio (CR). If the CR is greater than a certain value, the pairwise comparison results should be rejected(Saaty 1980b; Lin, Wang et al. 2008). In the end, the consistency ratio (CR) was used to determine and justify the inconsistency in the pair-wise comparison made by the respondents. Saaty (1994), and Cheng and Li (2002) have set the acceptable CR values for different matrices' sizes: (1) the CR value is 0.05 for a 3x3 matrix; (2) 0.08 for a 4x4 matrix; and (3) 0.10 for larger matrices. If the CR value is lower than the acceptable value, the weight results are valid and consistent. In contrast, if the CR value is larger than the acceptable value, the matrix results are inconsistent and will be exempt from further analysis.

Table 42. Random consistency index(RC)

Number of criteria	1	2	3	4	5	6	7	8	9
RC	0	0	0.58	0.90	1.12	1.24	1.32	1.41	1.45

By evaluating the consistency level of the collected questionnaires in this study, all questionnaires appeared to have acceptable consistency (table 43) and can be entered into analysis.

Table 43.The consistency index

Matrix set	Respondent					
	1	2	3	4	5	6
NABSe (6x6)	0.0419	0.0246	0.0421	0.0546	0.0310	0.0358
NABSa (5x5)	0.0049	0.0171	0.0155	0.0377	0.0078	0.0519
NABCo(5x5)	0.0236	0.0171	0.0091	0.0046	0.0025	0.0200
NAB En (4x4)	0.0171	0.0153	0.0697	0.0083	0.0328	0.0552
NABEc (3x3)	0.0092	0.0046	0.0046	0.0269	0.0092	0.0194
NABAr (4x4)	0.0069	0.0452	0.0329	0.0692	0.0163	0.0578
NABTo (6x6)	0.0246	0.0246	0.0246	0.0440	0.0427	0.0447
SCHSe (6x6)	0.0246	0.0246	0.0110	0.0276	0.0716	0.0673
SCHSa (5x5)	0.0049	0.0171	0.0091	0.0293	0.0444	0.0405
SCHCo (5x5)	0.0091	0.0171	0.0171	0.0307	0.0388	0.0532
SCHEn (4x4)	0.0171	0.0153	0.0035	0.0069	0.0158	0.0202
SCHEc (3x3)	0.0269	0.0046	0.0046	0.0371	0.0194	0.0435
SCHAr (4x4)	0.0171	0.0103	0.0265	0.0202	0.0547	0.0508
SCHTo (6x6)	0.0246	0.0327	0.0246	0.0359	0.0251	0.0481
CPOSe (6x6)	0.0207	0.0246	0.0162	0.0603	0.0507	0.0550
CPOSa (5x5)	0.0066	0.0171	0.0171	0.0672	0.0652	0.0366
CPOCo (5x5)	0.0353	0.0171	0.0171	0.0147	0.0091	0.0252
CPOEn (4x4)	0.0171	0.0153	0.0035	0.0035	0.0082	0.0190
CPOEc (3x3)	0.0270	0.0046	0.0046	0.0046	0.0018	0.0371
CPOAr (4x4)	0.0162	0.0035	0.0445	0.0406	0.0644	0.0000
CPOTo (6x6)	0.0227	0.0246	0.0600	0.0378	0.0615	0.0623

Note: (1) The six respondents are assigned with No. 1–6; (2) Acceptable CR values (Saaty 1980b): 0.05 or below for a 3X3 matrix, 0.08 or below for a 4X4 matrix; 0.1 or below for matrices larger than 5X5; (3) ‘NAB’ means National Assembly Building, ‘SCH’ means Sungnam City Hall, ‘CPO’ means Central Police Office. ‘Se’; serviceability, ‘Sa’; safety, ‘Co’; comfort, En; environment friendly, Ec; economical feasibility, Ar; artistry, To; total

6.3 Findings and Discussion

To analyse the survey findings, the judgment matrices were pair-wise compared and computed via the use ofthe MS Excel 2010 program. Theglobal priorityvector helps todistinguish the more important elements from the lessimportant ones and the differencesin the importance of the criteria among three buildings. As can be seen intable 45and figures30-36, some interesting findings on the importance of the criteria were identified.

Overall result: The distributive summary in table 44 and figure30 suggests that each group of criteria has different priorities according to the mean weight assigned to each criterion by the respondentsrelating to the different buildings. This AHP survey further confirms the significance of all selection criteria by experts who have a high level of experience in building construction. The local

weight of the main criteria in the three buildings ranges from the lowest of 0.056 to the highest of 0.336; and the sub-criteria from the lowest, 0.005 to the highest, 0.133. Findings relating to relative importance of selection criteria and sub-criteria are summarised below.

Table 44. The results of the AHP analysis

Main criteria (rank in general survey)	Local weight(rank)			Sub-criteria (rank in general survey)	Local weight(rank)			Global weight(rank)		
	NAB	CPO	SCH		NAB	CPO	SCH	NAB	CPO	SCH
Serviceability (1)	0.181(2)	0.247(2)	0.252(2)	Accessibility (1)	0.321 (1)	0.287 (1)	0.374 (1)	0.05800 (4)	0.07107 (4)	0.09432 (2)
				Layout (2)	0.213 (2)	0.231 (2)	0.202 (2)	0.03861 (10)	0.05715 (5)	0.05094 (7)
				IT (3)	0.173 (3)	0.180 (3)	0.094 (6)	0.03134 (15)	0.04462 (7)	0.02375 (19)
				Parking (4)	0.094 (6)	0.092 (5)	0.099 (5)	0.01695 (26)	0.02280 (17)	0.02503 (17)
				Maintenance (5)	0.105 (4)	0.126 (4)	0.128 (3)	0.01903 (24)	0.03118 (12)	0.03213 (11)
				Flexibility (6)	0.094 (5)	0.083 (6)	0.102 (4)	0.01704 (25)	0.02044 (20)	0.02579 (16)
Safety (2)	0.282(1)	0.336(1)	0.278(1)	Fire resistance (1)	0.391 (1)	0.271 (2)	0.384 (1)	0.11027 (1)	0.09117 (2)	0.10679 (1)
				Safety of equipment (2)	0.171 (3)	0.151 (3)	0.197 (3)	0.04827 (7)	0.05096 (6)	0.05488 (5)
				Durability (3)	0.166 (4)	0.116 (4)	0.207 (2)	0.04693 (8)	0.03898 (9)	0.05751 (4)
				Security (4)	0.197 (2)	0.394 (1)	0.136 (4)	0.05561 (5)	0.13268 (1)	0.03783 (10)
				Earthquake (5)	0.075 (5)	0.067 (5)	0.075 (5)	0.02125 (20)	0.02267 (18)	0.02094 (21)
Comfort (3)	0.145(4)	0.148(3)	0.159(4)	Ventilation (1)	0.249 (2)	0.250 (2)	0.282 (1)	0.03610 (13)	0.03705 (11)	0.04470 (8)
				Heating & Cooling (2)	0.254 (1)	0.255 (1)	0.272 (2)	0.03681 (12)	0.03780 (10)	0.04311 (9)
				Noisy (3)	0.207 (3)	0.182 (3)	0.116 (5)	0.02996 (16)	0.02696 (13)	0.01831 (23)
				Sanitation (4)	0.143 (5)	0.180 (4)	0.196 (3)	0.02080 (22)	0.02666 (14)	0.03112 (12)
				Lighting (5)	0.147 (4)	0.134 (5)	0.134 (4)	0.02131 (21)	0.01980 (22)	0.02128 (20)
Environment friendly (4)	0.118(5)	0.079(5)	0.082(5)	Traffic-effect (1)	0.324 (1)	0.332 (1)	0.322 (1)	0.03843 (11)	0.02616 (15)	0.02638 (15)
				Eco-system (2)	0.285 (2)	0.225 (3)	0.253 (3)	0.03374 (14)	0.01775 (23)	0.02074 (22)
				Green-gas (3)	0.138 (4)	0.137 (4)	0.131 (4)	0.01639 (27)	0.01084 (26)	0.01070 (25)
				Contaminant (4)	0.253 (3)	0.306 (2)	0.294 (2)	0.02994 (17)	0.02416 (16)	0.02412 (18)
Economic feasibility (5)	0.102(6)	0.138(4)	0.173(3)	Operation cost (1)	0.591 (1)	0.535 (1)	0.543 (1)	0.06050 (2)	0.07391 (3)	0.09419 (3)
				Maintenance cost (2)	0.189 (3)	0.161 (3)	0.152 (3)	0.01930 (23)	0.02232 (19)	0.02638 (14)
				Initial cost (3)	0.221 (2)	0.304 (2)	0.305 (2)	0.02258 (18)	0.04202 (8)	0.05284 (6)
Artistry (6)	0.171(3)	0.051(6)	0.056(6)	Harmony with surroundings (1)	0.291 (2)	0.396 (1)	0.473 (1)	0.04977 (6)	0.02013 (21)	0.02661 (13)
				Appearance (2)	0.241 (3)	0.252 (3)	0.257 (2)	0.04125 (9)	0.01283 (25)	0.01447 (24)
				Symbolism (3)	0.343 (1)	0.268 (2)	0.185 (3)	0.05855 (3)	0.01361 (24)	0.01042 (26)
				Tradition (4)	0.124 (4)	0.084 (4)	0.084 (4)	0.02126 (19)	0.00429 (27)	0.00474 (27)

Main criteria level:The results of two surveys revealed that the priority of the selected main criteria in AHP survey is slightly different from those of the general survey, but they have some similar features. In the general survey, the respondents considered two main criteria, serviceability and safety, as more important than the remaining main criteria:comfort, eco-friendliness, economic-feasibility, and artistry. This result is the same here.

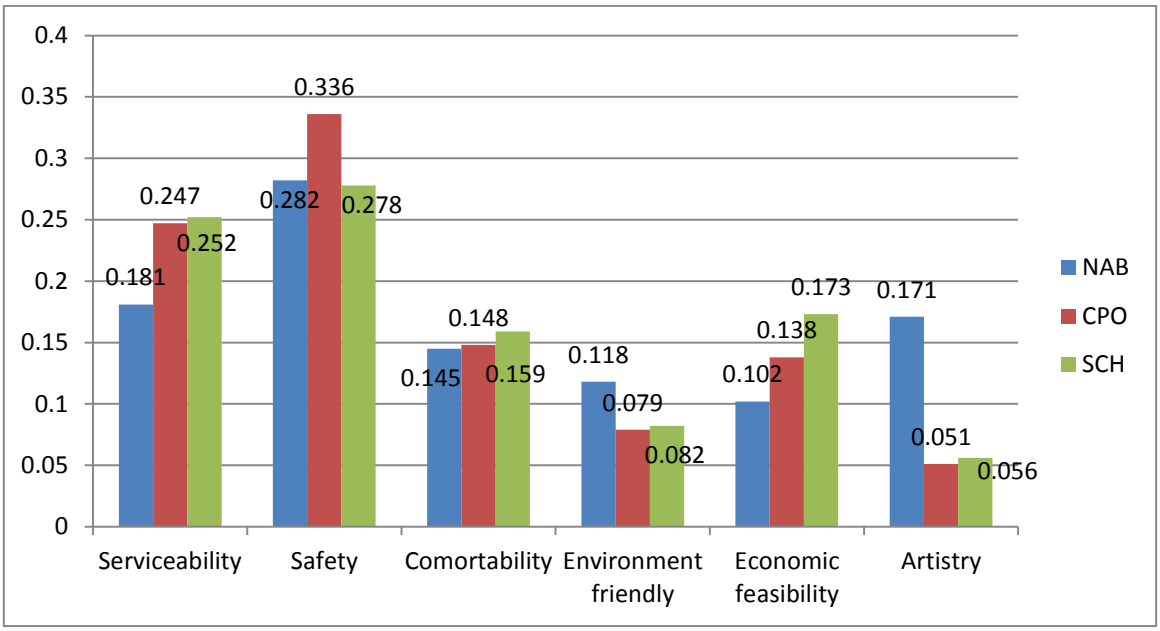


Figure 31. The local weight of main criteria

On the other hand, there are also interesting reaults about the difference between the general survey and among the three buildings (refer to table 44, figure 30). The most interesting result is that artistry ranks third in the National Assembly Building,whereas in the general survey, artistry is ranked as the last criterion with a mean of 3.28 among the six main criteria, implying that it is not considered as an important criterion. Furthermore,artistry also ranks last in the two other buildings (Sungnam City Hall and Central Police Office). This implies that when designing the National Assembly Building, the artistic aspect should be considered as an important factor. Actually, since the National Assembly Building is the most popular representative landmark architecture of the country, it is natural that it be beautifully designed .

In addition, it is also meaningful to state the priority of economic-feasibility in Sungnam City Hall. In the general survey, economic-feasibility is just fifth. However, in this specified building survey it is ranked third. This may reflect as a critique of the recent inclination of the local government buildings towards luxury. In general, the local government of Korea has low financial independence. They should be concerned about their financial state. On the other hand, the importance of environment-friendly is evaluated a little low in priority compared to the survey results.

Sub-criteria level (local weight):In the sub-criteria level, the differences of priority among the buildingsis more diverse than that among main criteria(refer to figure31-36, table 45). In the serviceability category, accessibility and layout are still the most important factors across the three buildings (refer to figure 31). The priorities of the other criteria in this category differ.

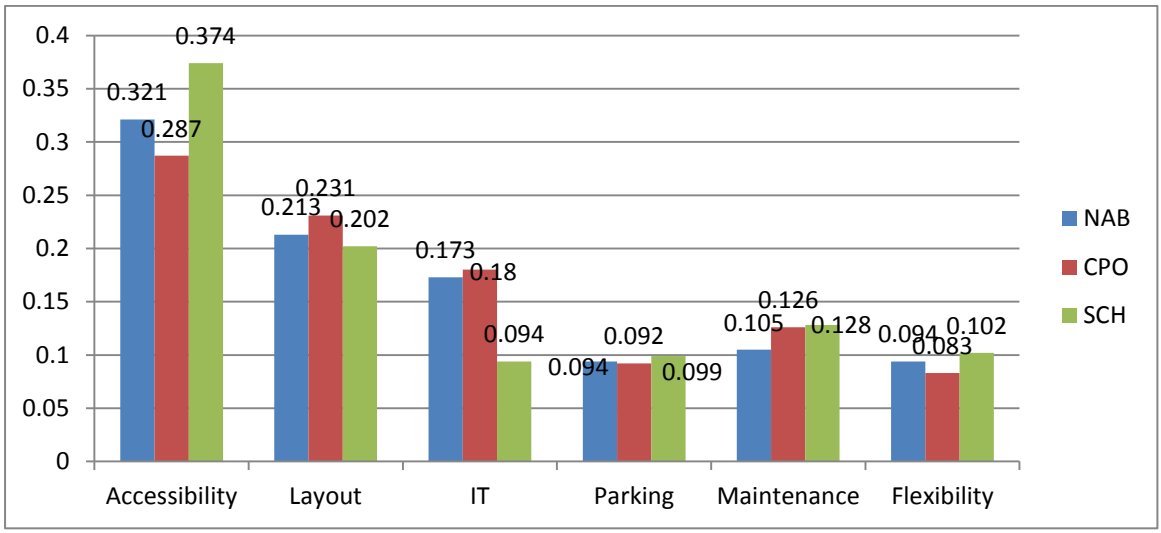


Figure 32. The local weight of sub-criteria in the serviceability category

In the category assessing safety, whether or not a building is fire resistance is still considered an important criterion (refer to figure 32). In the Central Police Office, however, security is the most important factor despite its low rank (fourth) in the general survey. Security is also ranked highly (second) in the survey for the National Assembly Building. This can be correlated with the high-security, top-secret and confidential nature of work this building is used for, as compared to other public buildings. The building's ability to resist an earthquake is still considered as a less important factor across all buildings, which is compatible with the results of the general survey.

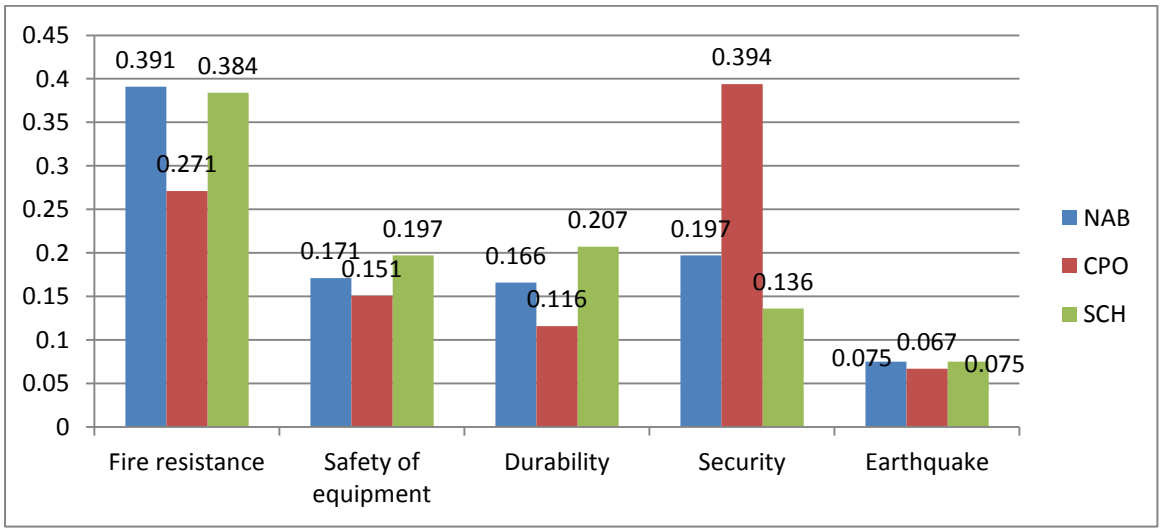


Figure 33. The local weight of sub-criteria in safety category

In the area of comfort levels of the building (refer to figure 33), the distribution of weight over sub-criteria is regular in general compared to other criteria. Ventilation, and heating and cooling are considered as the most important factors similar to the results of the general survey across three buildings. The priority of the remaining criteria depends on the features of each building.

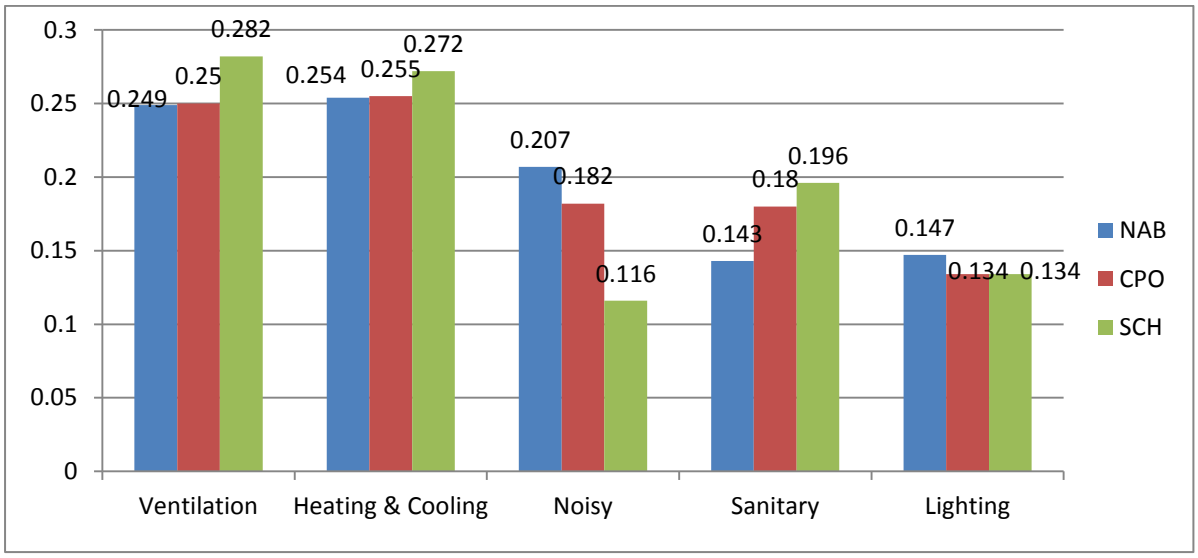


Figure 34. The local weight of sub-criteria in comfort category

In considering the environment-friendly aspect (refer to figure 34), 'traffic-effect' is the most important criterion. This is in line with the results of the general survey. This result highlights the importance of traffic issues in urban areas of Korea. Interestingly, green gas emissions are considered the least important criterion across the three buildings compared to other criteria. The opposite, however, is true in the case of the 'contaminant'criterion, whichis third in the general survey results. This result implies that the experts consider practical factors such as traffic and contaminants as more important factors when designing public buildings in Korea.

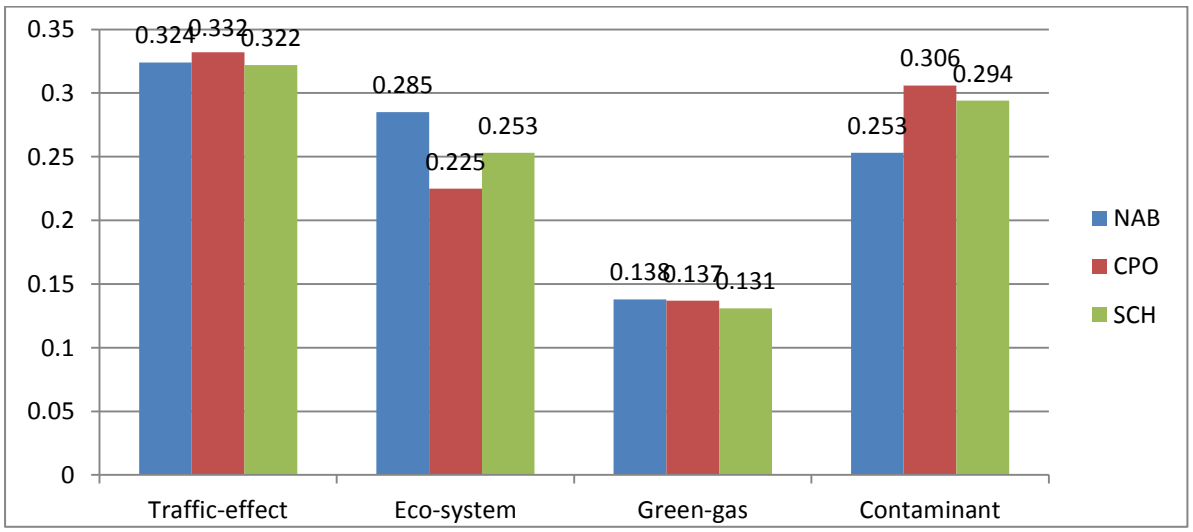


Figure 35.The local weight of sub-criteria in environment-friendly category

In the area of economic-feasibility (refer to figure 35), the ‘operation cost’ in all three buildings is considered as a critical factor as shown by the results of the general survey. The ‘initial cost’ is given more importance than the ‘maintenance cost’, although this is in contrast with the general survey result, where initial cost has a big effect on the decision of the design of a public building. This result is compatible with previous literature (Fuller 2010) and also explains the phenomenon where local governments are criticised for their luxurious and excessively ornamental city hall building.

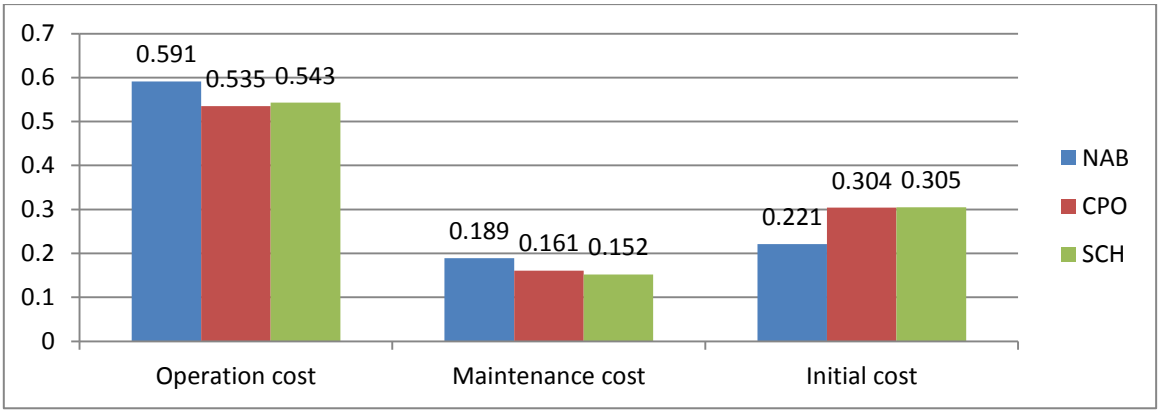


Figure 36.The local weight of sub-criteria in economic-feasibility category

In the aspect measuring preference for artistry (refer to figure 36), tradition is the last criterion across three buildings, which is thesame as the resultsfrom the general survey shows. In other criteria, however, the response is diverse. ‘Harmony with surroundingss’ is considered as important in general. In the case of Sungnam City Hall this criterion is the dominant factor. This is natural considering its role in local society. The interesting thing is that symbolism, which is evaluated as the least important factor in the general survey, is considered as the most important factor in the National Assembly Building survey, in this category. As the most represented public building in Korea, the symbolism of the National Assembly Building is necessary.

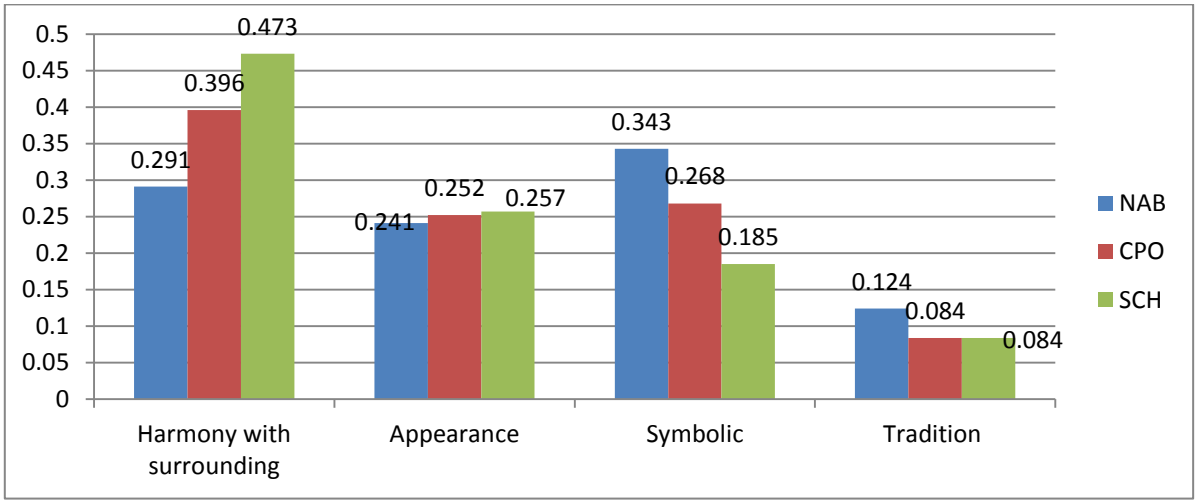


Figure 37. The local weight of sub-criteria in artistry category

Sub-criteria level (global weights):Comparedto the other two buildings, the National Assembly Building had small differences in distribution and between maximum weight and minimum weight (refer to table 44): the National Assembly Building (1^{st} 0.110. 27^{th} 0.016), the Central Police Office (1^{st} 0.132, 27^{th} 0.004), and the Sungnam City Hall (1^{st} 0.106, 27^{th} 0.004). This implies that many factors should be considered in designing the National Assembly Building than other two buildings.

The top five criteria in each building are presented in table 45.Overall, the sub-criteria including fire resistance, security, durability, and safety of equipment related to safetyare regarded as important criteria. Consistent with the results of the general survey, criteria such as fire resistanceing, accessibility, and operation cost were ranked as the top five sub-criteria across three buildings. This implies that these three criteria can be the most important criteria in Korean public buildings regardless of the kind of building.

Table 45. Top Five Criteria

Building	1^{st} (weight)	2^{nd} (weight)	3^{rd} (weight)	4^{th} (weight)	5^{th} (weight)
National Assembly Building	Fire resistance (0.11027)	Operation cost (0.06050)	Symbolism (0.05855)	Accessibility (0.05800)	Security (0.05561)
Central Police Office	Security (0.13268)	Fire resistance (0.09117)	Operation cost (0.07391)	Accessibility (0.07107)	Layout (0.05094)
Sungnam City Hall	Fire resistance (0.10679)	Accessibility (0.09432)	Operation cost (0.09419)	Durability (0.05751)	Safety of equipment (0.05488)

Some criteria represented the uniqueness of each building. The criterion of the building being symbolism ranked third in National Assembly Building while this is one of the least important criteria in the other buildings; the Central Police Station ranked 24th andthe Sungnam City Hall ranked 26th. Perhaps the reason why people rank the symbolism value of the National Assembly Building so high is because it is a building that represents the country; the National Assembly Building of each country has been the most famous and most representative public building for this reason.

In addition, security is considered the most important criteria in the Central Police Office despite its low priority in the general survey (fourth out of five in the safety category). The uniqueness of police affairs reflects the reason why security (1st) and sound proofing (13th) command a relatively high rank. Since police deal with a lot of secret information, this result is acceptable. The experts also suggest that security should be considered as an important criterion (5th) in the National Assembly Building.

On the other hand, the seven criteria that attracted a low ranking are presented in table 46.The Building shares five common criteria with the Central Police Office and Sungnam City Hall. These criteria are eco-system effect, symbolism, appearance, green-gas emission, and tradition;however, the National Assembly Building has just one criterion among these five criteria. This also shows the uniqueness of the National Assembly Building.

Table 46. Seven criteria rankedlow

Rank	National Assembly Building		Central Police Office		Sungnam City Hall	
	Criteria	**Weight**	**Criteria**	**Weight**	**Criteria**	**Weight**
21th	Lighting	0.02131	Harmony with surroundingss	0.02013	Earthquake	0.02094
22th	Sanitation	0.02080	Lighting	0.01980	Eco-system	0.02074
23th	Maintenance cost	0.01930	Eco-system	0.01775	Noisy	0.01831
24th	Maintenance	0.01903	Symbolism	0.01361	Appearance	0.01447
25th	Flexibility	0.01704	Appearance	0.01283	Green-gas	0.01070
26th	Parking	0.01695	Green-gas	0.01084	Symbolism	0.01042
27th	Green-gas	0.01639	Tradition	0.00429	Tradition	0.00474

All four sub-criteria in the artistry category are included in the seven low-ranked criteria; in the case of the Central Police Office, these are harmony with surroundingss, symbolism, appreance, and tradition. For Sungnam City Hall, three sub-criteria except that of harmony with surroundingss are included in the same less important group. This phenomenon indicates that artistry is not considered as an important factor in public buildings such as police offices and local government buildings. This result is compatible with the general survey results. Since these kinds of building are relatively common and perform practical administrative affairs, practical factors such as safety and serviceability are more important than formal factors such as environment friendliness, and artistry. However, the artistry factors in the National Assembly Building are not included in these low-ranked factors. This implies that artistry is important in the National Assembly Building as the representative public building. On the other hand, earthquake resistance is ranked as a low priority similar to the results of the general survey where it ranks 20thin the National Assembly Building, 18thin the Central Police Office, and 22ndin the Sungnam City Hall.

6.4 Summary

In this chapter, the AHP survey was conducted for evaluating the importance of the six main criteria and their corresponding sub-criteria according to the kind of building. The results obtained were then compared with the general survey results and the differences in the three kinds of buildings were identified. The survey facilitated the judgment on whether or not the kind of the building influences the best-value concept. At first, the results pointed to the fact that the gap among the levels of importance of criteria in the general survey was not so big when compared to that in the AHP survey. Therefore, the AHP test is better than the general survey to deal with detailed data. Radar charts (figure 37 - 40) were used to compare performance of different entities against the same set of criteria. It is easy to understand the difference among the different buildings and to compare these with the results of the general survey.

In the main criteria the level of AHP resultsfor the Central Police Office and Sungnam City Hall are are quite similar in terms of importance of criteria; however, those for the National Assembly Building are a little different (refer to figure 38).This implies that respondents thought that while the function of two buildings, the CPO and the SCH is similar, it is not the same for the NAB .

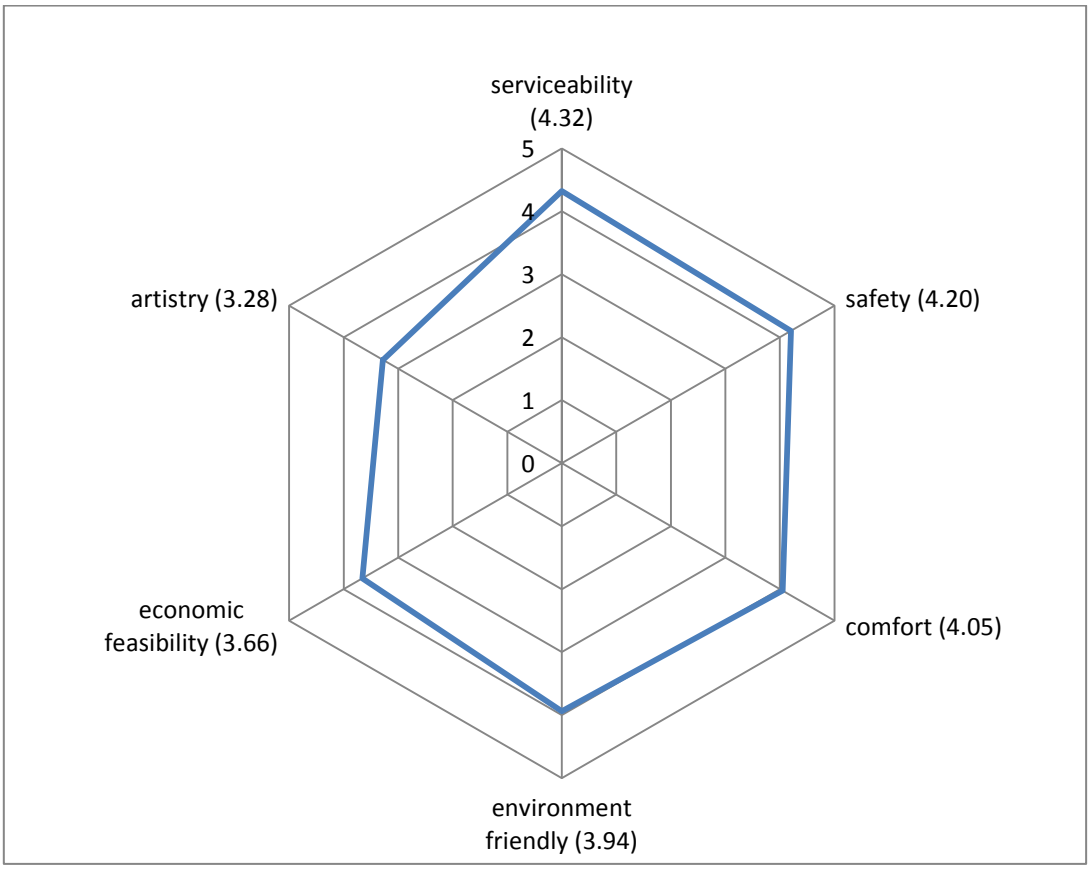


Figure 38. The mean of the main criteria in the general survey

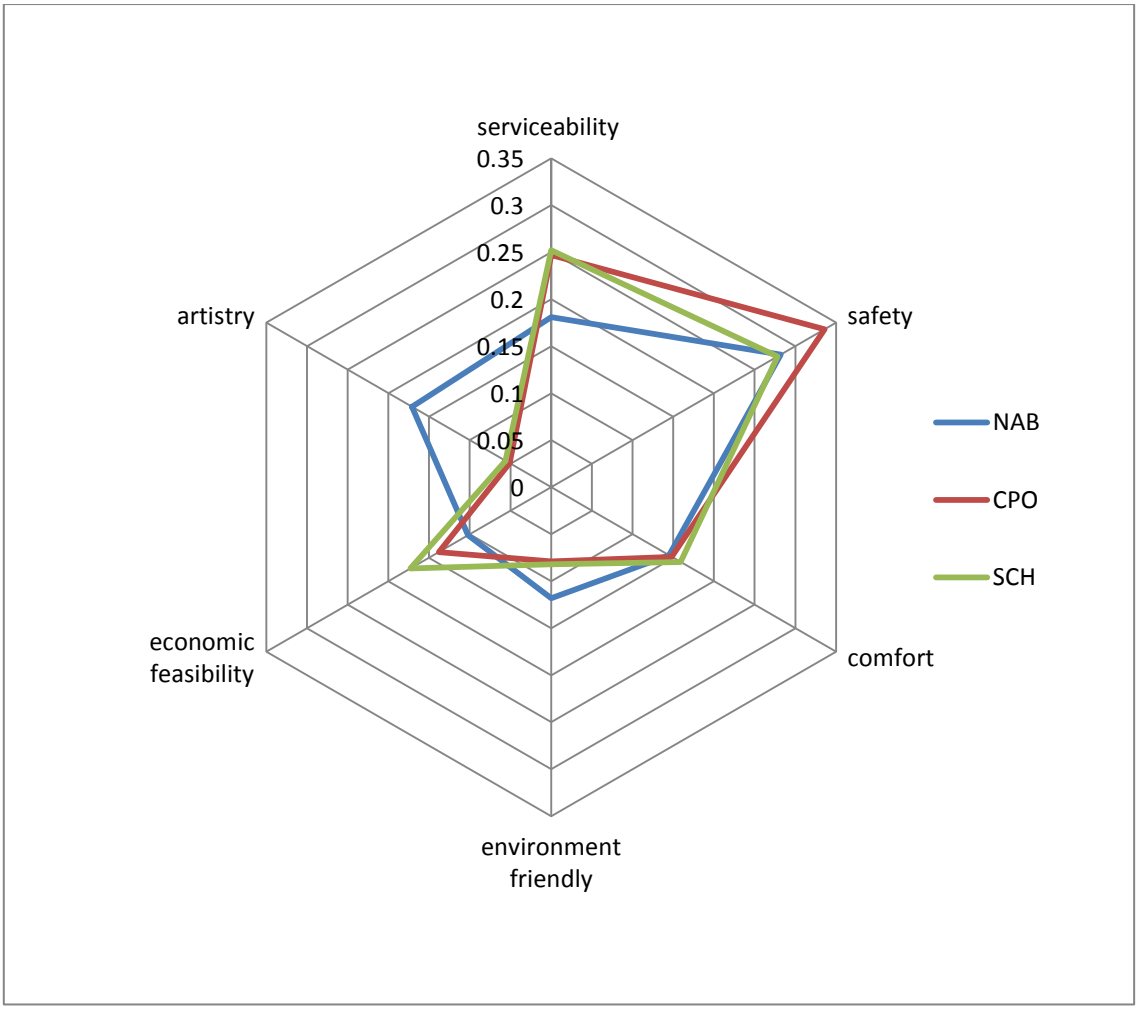


Figure 39. The weight of the main criteria in the AHP survey

In the sub-criteria level, although fire resistance, accessibility and operation costs are considered as important criteria in all buildings,the priority is a little different. In other criteria, it is difficult to find common features (refer to figure 40).

Finally, the result imply that important criteria and weightings change according to the kind of building concerned. That is, best-valued building changes according to the kind of building. As such, it is necessary to find the criteria and weightings according to the purpose and character of the building in order to identify best-valued public buildings(Love, Skitmore et al. 1998; Best and De Valence 1999; Winch 2008).The research of Construction Industry Council (CIC) can support this conclusions. CIC (CIC, 2011) suggested that the weighting of criteria are different according to the kind of building. The case studies applying DQI(Design Quality Indicator) on the 5 public buildings(The Birtish Library Center for conservation, Paliament Hill School, Doha Embassy, Chennai Embassy, Peckham Pulse Healthy Living Centre) show that importance of building criteria such as access, use, space are changed by the purpose/kind of building.

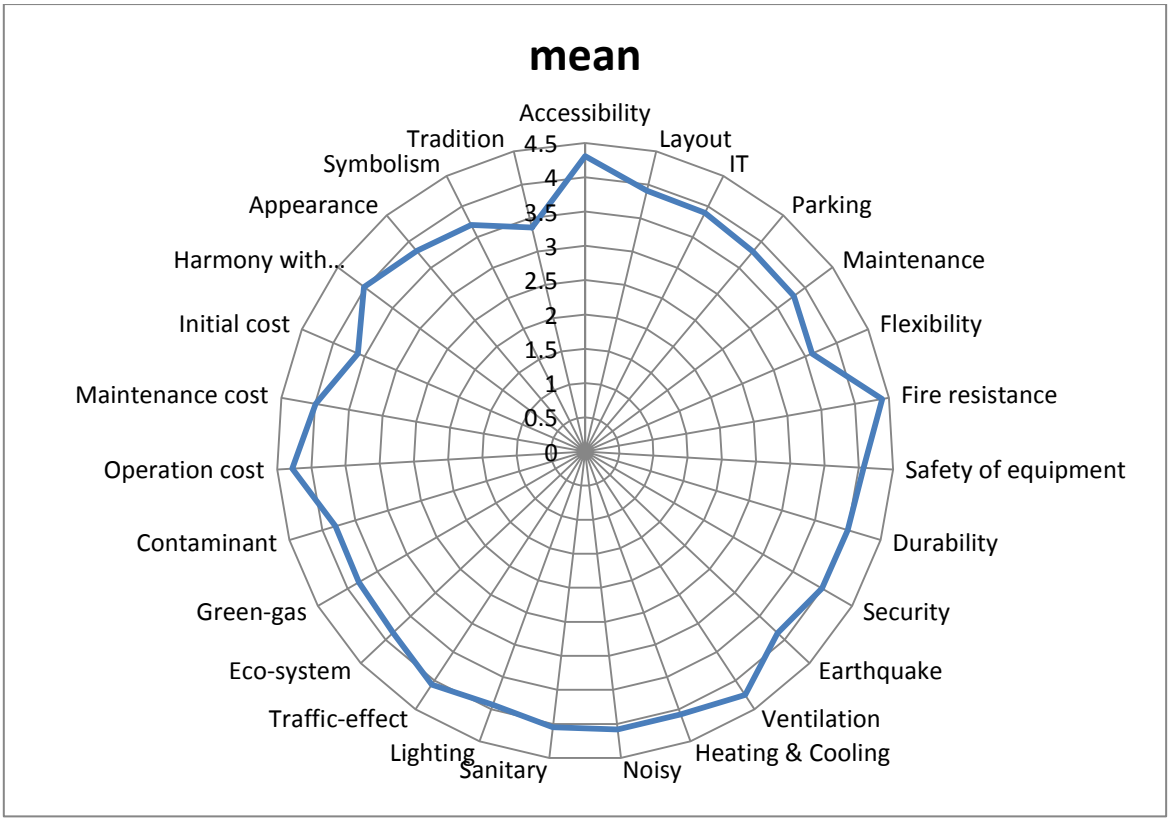


Figure 40. The mean of the sub-criteria in the general survey

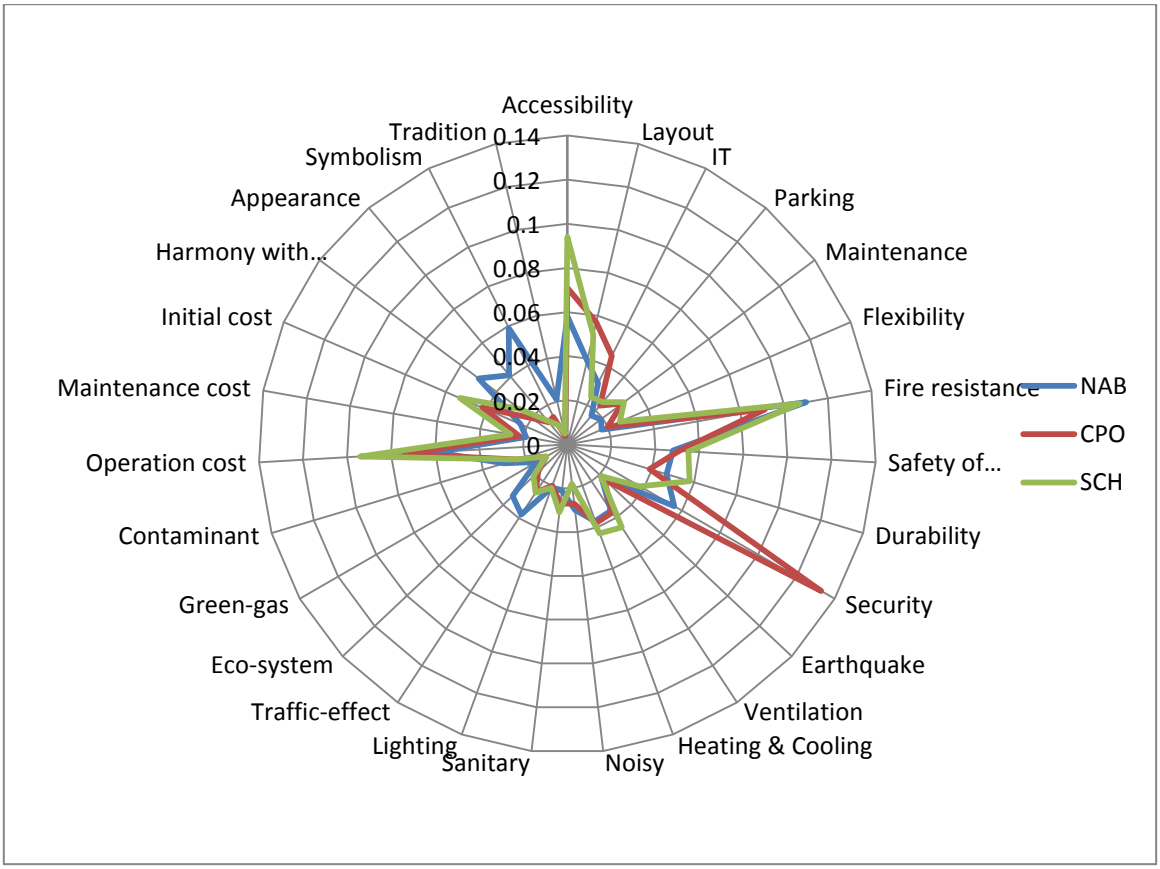


Figure 41.The global weight of the sub-criteria in the AHP

Chapter 7Conclusion

7.1 Introduction

This study investigates the best-value in Korean public building construction. The study starts with the critique of Korean public building construction, particularly focusing on studies relating to the problem of the low-bid system and the quality of public building, in chapter 2. As a result of these criticisms, the need for a study on the best-value in Korean public building construction are suggested. However, there are arguments about the concept of best-value and how to implement its principles. This thesis focused on these arguments as well as their application, asking ‘what is best-value’ and ‘how can best-value be achieved in Korean public building construction?’. Based on this structure, this study adopted a sequential approach since the concept of best-value should be defined in advance in order to apply this concept to Korean public building construction. The first research question is concerned with what is best-value in building construction. However, the concept of best-value is not clear in previous literatures and this comes from the ambiguity of the value concept itself. Therefore the research question traced back from the concept of value in turn. The first question identified two sub-research questions. Observation and interpretation of the practical usage of value in ordinary life is conducted to identify these questions as a qualitative research method in chapter 3. The questions in the first stage are:

i) What is best-value in building construction?

- What is value?
- What is best-value?

Based on Korean public building policy, the second question asked how best-value can be achieved in Korean public buildings. The study of the first question about best-value developed and refined the second question as a feature of mixed method research. The concept of best-value in building construction suggested four sub-questions for the second research question.

ii) How can best-value be achieved in Korean public building construction?

- What are the factors required for best-valued building?
- How can these factors be gathered and analysed?
- What is the difference of the evaluation of the important criteria according to the demographic background?
- What is the difference of the weight on the criteria according to the kinds of building?

Thesesecond research questions were investigated in Korea by quantitative research methods - a general survey and an AHP survey (chapters 4 and 5): general survey for the selection of important criteria of public building; and AHP survey for the weighting the criteria selected by general survey.

The surveys have shown that the evaluation criteria for best-valued building change according to the kind of building because value depends on the needs of subject.

This chapter summarises the main conclusions on the research topics that were reached by drawing on the findings of the study. Next, the chapter considers the contribution of the thesis to the study of best-value in public building construction. Finally, there is a consideration of its limitations, and a discussion of possibilities for further research in this area of study.

7.2 The Main Conclusion on the research topics

This thesis has dealt with the following three research topics through the observation/interpretation on the use of value termin ordinary life and two surveys in Korea: the definition and key factors of value and best-value; the important criteria of best-valued public buildings in Korea; and the differences of these criteria according to conditions such as demographic background and kinds of building.

The definition and key factors of value and best-value: As a first stage of this study, one of the key findings is the new definition and key factors of value and best-value. The explanatory results suggest that the definition of value in economical use is the degree of need about object (X) to subject (Y) in certain conditions; value depends on the state of object and the condition of subject, as described in the equation below. From this concept, it can be confirmed that the identification of the state of object and the conditions of subject can be key processes in value judgement. This mechanism can help to understand the process of value judgement. If the state of object and the conditions of subject are found, decision maker can evaluate the value of the object.

Value of X= F (state of X, conditions of Y)

On the other hand, the term values in philosophical usage was defined as virtues (X) that are needed to human beings (Y) in certain conditions. In other word, values are virtues needed by human beings in certain conditions. Human beings as subject can be expanded to the organization such as nation, company, school which are consisted of human beings.

X (values) = Virtues needed to Y = F (conditions of Y)

The concept of best-value is also defined. The economical definition of value was used for define best-value. The best-valued object is defined as the most needed object in certain conditions. The best-value can be achieved through the best combination of the needs of the subject in certain conditions.This implies that the identification and combination of the needs of the subject are key processes for achieving best-value. Decision makers can use this process as a reference when they select evaluation criteria and weight priorities of selected criteria for the best-value procurement. This

application can be also used as guide for best-value selection in other decision areas.

$$\text{Best-valued Object} = f(\omega_1 N_1,\ \omega_2 N_2, \dots, \omega_n N_n) = f(\omega_i C_i(N_1), \omega_i C_i(N_2), \dots, \omega_i C_i(N_n))$$

where:

ω : weighting, N : need, C : criteria that represent needs

$\omega_i C_i(N_1)$: weighting on one of criteria that represent Need$_1$

The important criteria for best-valued public buildings in Korea: The concept of best-value of building construction is in line with the above definitions. Best-value in building construction describes the best-valued or most-needed building in certain conditions. A best-valued building is one that has the best combination of criteria representing the needs of the subject under certain conditions. This implies that identifying and combining the needs of the subject are critical processesin the achieving of best-value. Initially, 6 main criteria and 27sub-criteria were suggested (refer to table 47) as important criteria in Korean public building construction through two surveys.

Table 47. Important criteria of Korean public building

Main criteria	Sub-criteria
Serviceability	Accessibility, Layout, IT, Parking, Maintenance, Flexibility
Safety	Fire resistance, Safety of equipment, Durability, Security, Earthquake
Comfort	Ventilation, Heating & cooling, Noisy, Sanitation, Lighting
Environment-friendly	Traffic-effect, Eco-system, Green-gas, Contaminant
Economic-feasibility	Operation costs, Maintenance costs, Initial costs
Artistry	Harmony with surroundingss, Appearance, Symbolism, Tradition

From the two surveys, it is possible to suggest that practical aspects such as serviceability, safety, fire resistance, accessibility, operation cost, and ventilation are considered more important criteria than environment-friendly or artistry in Korean public building. In particular, artistry is not considered as an important criterion in this study. The possible explanation for this phenomenon would be that practical aspects are the main concern in Korean society which has pursued rapid economic growth over a short period. It can also explain the reason why purely beautiful public buildings are rare in Korea. On the other hand, economic-feasibility was ranked in fifth among six main criteria. This result is interesting, since a lot of procurement organisation focuses on this criterion in real projects. This result can give a hint of an understanding that the low-bid system which focuses on the lowest price cannot meet the requirements of Korean,which is the reason why the Korean government has tried to replace the low-bid system with the best-value system.

The difference of criteria according to conditions (demographic background, kinds of building):

This research examined the priority of the criteria by pair-wise comparison of AHP after deriving the important criteria of a public building from the general survey. The results show the difference of importance of criteria among the respondents and the kinds of buildings. At first, the general survey results suggested that there is no significant statistical difference among the demographic groups such as gender, age and profession when respondents evaluate the importance of the criteria of the public buildings. This can be interpreted as that there is a consensus on the important criteria of Korean public building design regardless of the gender, age or occupation of the respondents.

The AHP survey was conducted to evaluate the importance of the six main criteria and their corresponding sub-criteria according to the kinds of buildings. The three buildings investigated in this study are theNational Assembly Building, the Central Police Office, and the Sung-nam City Hall in Korea. The AHP survey facilitated the judgment on whether or not the kind of the building influences the best-value concept. The interesting result is that security is considered as the most important criterion in the Central Police Office despite its low rank in the general survey. This is similar to the case of artistry in the National Assembly Building. Artistry ranks third in the National Assembly Building despite the fact that it ranked last in the general survey and in the two other buildings. This implies that when designing the National Assembly Building, the artistic aspect should be considered as an important factor. In the sub-criteria level, although fire resistance, accessibility and operation cost are considered as important criteria in all buildings, the priorities differ slightly. In other criteria, it is difficult to find common features. Finally, the results imply that important criteria and weightings change according to the kinds of building. That is, best-valued building changes according to the kind of building. As such, it is necessary to identify the criteria and weightings according to the purpose and character of the building in order to achieve best-valued public buildings.

7.3 Contributions of the Research

The thesis has explained the concept of value and best-value and has examined the important criteria and their priority in Korean public buildings. The word value has been used by almost everyone at almost any time. Uejima (2009) is of the opinion that the meaning of value in related to various concepts such as deserving, material, money, behaviour, magnitude, quanity and number. He also claimed that when people use value as a word, people internalise the meaning and relate it to a concept deep in their sub-consciousness. However there is no clear explanation on the reason why these concepts are related to value and the mechanism how those concepts are connected with value. Value studies have had to face a number of discrepancies for a long time. The definition of value in this study can be a breakthrough for reducing the discrepancies among value studies and connecting value with other concepts (refer to chapter 3).

The most important aim of the thesis, despite some limitations, is the logical explanation that the

needs of the subject is the key factor to define value and achieve best-value. This thesis has contributed to an understanding of why the needs and the priorities of the subject are important to best-value by explaining the concept of value and the process of value judgement. Many studies (Adams, Phillips et al. 2000; Scott, Molenaar et al. 2006; Rushcliffe 2011)suggested that best-value is realised by the combinedneeds of the subject such as price, quality, and so on;however, there is no explanation about why the consideration of this requirement is best-value(Darlymple 2002; Scott, Molenaar et al. 2006; Lee 2006a). This thesis has contributed to an understanding of the reason why the needs of thesubject should be identified and combined properly to achieve best-value.

This study suggested the methods to identify the needs of subject and their priorities. The needs of subject were suggested by general survey since needs are various according to stakeholders and projects. General survey is appropriate method to gather diverse requirements of stakeholder including endusers. On the other hand, AHP was conducted to identify the priority of those needs since experience and knowlodge about relevant realm is important for the identification of priority on various needs. Decision-makers can use this method to verify best-value of their project or judgement. In short,the result of this study can be used as an decision making tools such as selection, procurement. People and organizations can select best-valued something through the following process and methods: 1) to find the needs of subject based on the the conditon of subject by general survey, 2) to identify evaluation criteria which represent the needs, 3) to identify the priority of criteria (needs) by AHP.

This thesis has also examined the consequences of the application of the concept of best-value to the Korean public building design. It has shown that the practical aspects such as serviceability and safety were considered as important criteria in Korean public buildings. The study identified that the priority of criteria differs according to the kind of building; for example safety in the Central Police Office, or artistry in the National Assembly Building. This is the first study to suggest the priority of the holistic criteriain best-valued public building in Korea. Decision-makers can use the criteria and prioritiesidentified in this study for reference in their building construction projects. This study also asked the decision-makers to select the criteria and priorities considering the characteristics of their projects to achieve best-value since best-value differs according to the needs of the subject, based on their condition.

7.4. Limitations of the Study and Suggestions for Future Research

A number of limitations which may affect the generalisation of the findings of this study are disscused in this section, from which suggestions and recommendations for future best-value research are generated.

Further work is needed to extend this study by gathering more criteria, grouping the criteria independently, and specifying the criteria in order to apply them for practical evaluation.

The current hierarchy framework of the criteria of the best-valued public building is not complete as it is difficult to confirm that this framework includes every important criterion. In addition, as indicated earlier, criteria cannot be understood in isolation from the others. For example, lighting is related with serviceability, comfort, economic-feasibility and artistry. This ambiguityof boundary tend to provide arbitrary results in AHP analysis. In addition for the practical evaluation in a real project, much more detailed and quantified criteria are needed. As an example, the IT (Information Technology) criteria can be divided into computers and related equipment, power in the workplace, telecommunications core, cable plant, and coolingcriteria (ICF 2006).

A survey with asufficiently large sample is needed to identify the differences.

Though the total sample size of 130 in the general survey is not considered too small, the number of respondentsis small to represent the population, which is divided into several groups in order to find the difference among the demographic groups such as gender, age, and profession. The small sample size may bias the results of the analyses and dismiss potential effects. In addition, although the research question was meaningful for identifying the differencesin prioritiesof criteria evaluation among the expert groups in the AHP test, it could not be confirmed because of the small number of respondents. This would be a useful question in identifying best-value systems in future studies.

Itwould prove meaningful to compare the differencesin needs and priorities among other cultures and countries.

It is also expected that differencesin perception between developed countries exist, since the concept of best-value tends to change according to the condition of the subject such as culture, climate. However, it is also expected that there will be common features of best-valued building across cultures. From the comparison, decision makers can pursue the appropriate public building construction policy based on the concept of best-value.

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Appendix 1. The questionnare of General survey

Questionnaire

Subject : Development of needs to achieve Best-value in public building construction

Researcher: Junhong Park MPhil student, School of Management, University of Southampton

Email : parkjh1000@hanmail.net

Dear Sir/Madam

This academic questionnaire is to investigate key factors of public building to achieve best-value procurement. The Korean government has often used design-build method in public building procurement due to many problems with the low bid system. However, design-build method has also some problems such as inappropriate evaluation criteria, lack of transparency in evaluation, etc. For this reason, even though the government has tried to find alternatives such as best-value procurement, there is still not a concrete and clear comprehension of best-value.

This research tries to define the concept of Best-value and apply it to public building procurement in order to provide a decision model for achieving the Best-value. For this, it is necessary to investigate the features that a valuable building should have. Though the features of valued buildings are different according to the type of buildings and conditions, this questionniare requires you to respond from the general viewpoint as per your experiences. After compiling the general features of public buildings from the survey results, the research will examine the priority of features through pair-wise comparison used in AHP (Analytic Hierarchy Process). Each owner can use this research as a reference when they make evaluation criteria and priority of each criteria. In this study, features that are needed in valued buildings are categorized into six divisions: functionalality, comfort, safety, economic feasibility, artistry, environment-friendly.

It is sincerely requested that you spend a few minutes to complete the questionnaire and return to me at your earliest convenience. No personal or corporate information will be made public. Please be assured that your answers will be kept in strict confidence. Please take the time to fill out this questionnaire as accurately as possible. Your help is crucial to this research. I deeply appreciate your cooperation.

Yours faithfully

Instruction: please check (v) the option that comes closest to your opinion or write out the answer in the space provided, where required.

Part 1 : General information

1. Gender : Male ( ), Female ( )

2. Age : Below 30 ( ), Above 30~below 40 ( ), Above 40~ Below 50 ( ), Above 50 ( )

3. Which professional background do you belong to?

Design company ( ), Construction company ( ), Academia ( ), Government Official ( ), Building administrator ( ), Citizen ( )

4. How many years of experience have you had in your industry?(except user)

Below 5 years ( ), Above 5~Below 10 years ( ), Above 10 ~ below 20 years ( ), Above 20 years ( )

Part 2 : Importance of sub-criteria that is needed in best-valued buildings

The below table shows the features (needs) that is needed in best-valued buildings. If there are other features which are not included in this table, please write down and check the degree of importance.

Main Needs(Criteria)	Sub-criteria	Degree of Importance				
		Very Low	Low	Medium	High	Very High
Functional building (Functionality)	Accessibility					
	Lay out					
	Parking					
	IT (Information Technolgy)					
	Flexibility					
	Easy Maintenance					
Comfortable building (Comfort)	Finishes					
	Lighting(including sunshine)					
	Heating and Cooling					
	Noisy and vibration					
	Ventilation					
	Sanitation					
	Privacy					
Safe building (Safety)	Durability					
	Fire resistance					
	Safety of building equipment such as lift, electric					
	Earthquake-Resistance					
	Security					

Continue

Main Needs (Criteria)	Sub-criteria	Degree of Importance				
		Very Low	Low	Medium	High	Very High
Economical building (Economics)	Initial Cost					
	Operating Cost including energy efficiency					
	Maintenance cost					
	Depreciation					
	Financial return					
Artistic building (Artistry)	Appearance					
	Color					
	Uniqueness					
	Harmony with Surroundings					
	Symbolism Role					
	Tradition					
Environmental building (Environment)	Contaminants Emission					
	Effects on local ecosystems					
	Traffic Effects					
	Recycling material use					
	Reduce waste					
	Emission of greenhouse gases					

Part 3 : Importance of main needs (criteria)

The below table shows 6 divisions of features (needs) that is needed in best-valued buildings. If there are other division and features which are included in this table, please write down and check the degree of important.

Main Needs(Criteria)	Degree of Importance				
	Very Low	Low	Medium	High	Very High
Functional building (Serviceability)					
Comfort building (Comfort)					
Safe building (Safety)					
Economical building (Economics)					
Artistic building (Artistry)					
Environmental building(Environment)					

Thank you for help

Appendix 2. The results of bootstrap t-test (test value 3.5)

Criteria	Test Value = 3.5			
	t	df	Sig. (2-tailed)	Mean Difference
Accessibility	10.805	114	.000	.830
Layout	5.902	114	.000	.439
Parking	4.648	114	.000	.326
IT	4.871	114	.000	.422
Flexibility	1.074	114	.285	.074
Maintenance	4.231	114	.000	.309
Finishing	-3.800	114	.000	-.274
Lighting	7.009	114	.000	.430
Heating	7.826	114	.000	.596
Noisy	7.508	114	.000	.570
Ventilation	10.710	114	.000	.743
Sanitation	9.565	114	.000	.552
Privacy	.051	114	.959	.004
Durability	6.868	114	.000	.526
Fire resistance	15.167	114	.000	.917
Equipment	9.528	114	.000	.604
Earthquake	4.937	114	.000	.404
Security	6.258	114	.000	.483
InitialCost	1.071	114	.286	.083
OperationCost	10.508	114	.000	.787
MaintenanceCost	6.104	114	.000	.483
Depreciation	-2.228	114	.028	-.143
FinancialReturn	-2.009	114	.047	-.196
Appearance	4.370	114	.000	.317
Color	-1.100	114	.274	-.083
Uniqueness	-.162	114	.871	-.013
Surroundings	6.567	114	.000	.500
Symbolism	2.389	114	.019	.204
Tradition	-2.125	114	.036	-.170
Contaminant	2.073	114	.040	.291
Ecosystem	4.313	114	.000	.361
TrafficEffect	7.517	114	.000	.604
Recycling	-.957	114	.340	-.074
GreenGas	4.014	114	.000	.326
Serviceability	14.299	114	.000	.848
Comfort	8.050	114	.000	.535
Safety	9.834	114	.000	.683
EconomicFeasibility	2.052	114	.042	.152
Artistry	-1.737	114	.085	-.230
EcoFriendly	6.257	114	.000	.439

Appendix 3. The results of bootstrap paired t-test

Paired criterta		Paired Differences	t	df	Sig. (2-tailed)
		95% Confidence Interval of the Difference			
		Upper			
Pair 1	Accessibility - Layout	.565	4.916	128	.000
Pair 2	Accessibility - Parking	.671	5.772	127	.000
Pair 3	Accessibility - IT	.570	4.586	127	.000
Pair 4	Accessibility - Flexibility	.873	7.742	127	.000
Pair 5	Accessibility - Maintenance	.676	5.151	126	.000
Pair 6	Layout - Parking	.230	1.346	128	.181
Pair 7	Layout - IT	.187	.086	128	.932
Pair 8	Layout - Flexibility	.453	3.981	128	.000
Pair 9	Layout - Maintenance	.287	1.221	127	.224
Pair 10	Parking - IT	.086	-.992	127	.323
Pair 11	Parking - Flexibility	.354	2.912	127	.004
Pair 12	Parking - Maintenance	.177	.092	126	.927
Pair 13	IT - Flexibility	.477	3.261	127	.001
Pair 14	IT - Maintenance	.297	.925	126	.357
Pair 15	Flexibility - Maintenance	-.059	-2.868	126	.005
Pair 16	Finishing - Lighting	-.512	-8.977	127	.000
Pair 17	Finishing - Heating	-.663	-9.886	128	.000
Pair 18	Finishing - Noisy	-.657	-9.850	128	.000
Pair 19	Finishing - Ventilation	-.812	-11.707	128	.000
Pair 20	Finishing - Sanitation	-.639	-10.415	127	.000
Pair 21	Finishing - Privacy	-.081	-2.934	127	.004
Pair 22	Lighting - Heating	-.033	-2.512	128	.013
Pair 23	Lighting - Noisy	-.011	-2.140	128	.034
Pair 24	Lighting - Ventilation	-.180	-4.567	128	.000
Pair 25	Lighting - Sanitation	.016	-1.760	127	.081
Pair 26	Lighting - Privacy	.554	4.739	127	.000
Pair 27	Heating - Noisy	.133	.122	129	.903
Pair 28	Heating - Ventilation	-.029	-2.406	129	.018
Pair 29	Heating - Sanitation	.177	.420	128	.675
Pair 30	Heating - Privacy	.747	5.860	128	.000
Pair 31	Noisy - Ventilation	-.043	-2.652	129	.009
Pair 32	Noisy – Sanitation	.158	.341	128	.734

Paired criterta		Paired Differences	t	df	Sig. (2-tailed)
		95% Confidence Interval of the Difference			
		Upper			
Pair 33	Noisy - Privacy	.719	6.458	128	.000
Pair 34	Ventilation - Sanitation	.309	3.323	128	.001
Pair 35	Ventilation - Privacy	.892	8.321	128	.000
Pair 36	Sanitation - Privacy	.679	6.676	127	.000
Pair 37	Durability - Fire resistance	-.273	-6.227	129	.000
Pair 38	Durability - Equipment	.069	-.988	129	.325
Pair 39	Durability - Earthquake	.297	1.729	129	.086
Pair 40	Durability – Security	.184	.289	127	.773
Pair 41	Fire resistance– Equipment	.442	5.896	129	.000
Pair 42	Fire resistance - Earthquake	.685	7.258	129	.000
Pair 43	Fire resistance - Security	.576	5.795	127	.000
Pair 44	Equipment - Earthquake	.349	2.911	129	.004
Pair 45	Equipment - Security	.252	1.338	127	.183
Pair 46	Earthquake - Security	.039	-1.485	127	.140
Pair 47	InitialCost - OperationCost	-.507	-8.161	129	.000
Pair 48	InitialCost - MaintenanceCost	-.228	-4.866	129	.000
Pair 49	InitialCost - Depreciation	.367	3.070	129	.003
Pair 50	InitialCost - FinancialReturn	.503	3.174	128	.002
Pair 51	OperationCost - MaintenanceCost	.395	5.088	129	.000
Pair 52	OperationCost - Depreciation	1.033	12.571	129	.000
Pair 53	OperationCost - FinancialReturn	1.188	9.591	128	.000
Pair 54	MaintenanceCost - Depreciation	.729	9.915	129	.000
Pair 55	MaintenanceCost - FinancialReturn	.899	6.852	128	.000
Pair 56	Depreciation - FinancialReturn	.258	.976	128	.331
Pair 57	Appearance - Color	.505	5.812	129	.000
Pair 58	Appearance - Uniqueness	.487	3.911	129	.000
Pair 59	Appearance - Surroundings	-.038	-2.439	128	.016
Pair 60	Appearance –Symbolism	.286	1.493	129	.138
Pair 61	Appearance – Tradition	.622	5.691	129	.000
Pair 62	Color - Uniqueness	.098	-.702	129	.484
Pair 63	Color - Surroundings	-.422	-7.765	128	.000
Pair 64	Color - Symbolism	-.086	-2.993	129	.003
Pair 65	Color - Tradition	.236	1.106	129	.271
Pair 66	Uniqueness - Surroundings	-.351	-6.319	128	.000
Pair 67	Uniqueness - Symbolism	-.050	-2.632	129	.010
Pair 68	Uniqueness - Tradition	.295	1.746	129	.083
Pair 69	Surroundings - Symbolism	.490	3.913	128	.000

Paired criterta		Paired Differences	t	df	Sig. (2-tailed)
		95% Confidence Interval of the Difference			
		Upper			
Pair 70	Surroundings - Tradition	.814	7.931	128	.000
Pair 71	Symbolism - Tradition	.494	4.316	129	.000
Pair 72	Contaminant - Ecosystem	.194	-.380	129	.705
Pair 73	Contaminant - TrafficEffect	-.024	-2.172	129	.032
Pair 74	Contaminant - Recycling	.669	3.082	129	.003
Pair 75	Contaminant - GreenGas	.242	-.061	129	.951
Pair 76	Ecosystem - TrafficEffect	-.067	-2.826	129	.005
Pair 77	Ecosystem - Recycling	.614	5.598	129	.000
Pair 78	Ecosystem - GreenGas	.196	.482	129	.631
Pair 79	TrafficEffect - Recycling	.855	7.505	129	.000
Pair 80	TrafficEffect - GreenGas	.424	3.185	129	.002
Pair 81	Recycling - GreenGas	-.269	-5.621	129	.000
Pair 82	Serviceability - Comfort	.401	3.715	129	.000
Pair 83	Serviceability– Safety	.243	1.795	129	.075
Pair 84	Serviceability-EconomicFeasibility	.815	8.021	129	.000
Pair 85	Serviceability– Artistry	1.310	7.555	129	.000
Pair 86	Serviceability - EcoFriendly	.524	5.382	127	.000
Pair 87	Comfort - Safety	-.020	-2.291	129	.024
Pair 88	Comfort - EconomicFeasibility	.559	4.657	129	.000
Pair 89	Comfort - Artistry	1.026	6.163	129	.000
Pair 90	Comfort– EcoFriendly	.270	1.515	127	.132
Pair 91	Safety - EconomicFeasibility	.690	7.033	129	.000
Pair 92	Safety - Artistry	1.187	6.910	129	.000
Pair 93	Safety - EcoFriendly	.400	3.911	127	.000
Pair 94	EconomicFeasibility - Artistry	.622	3.210	129	.002
Pair 95	EconomicFeasibility - EcoFriendly	-.095	-3.079	127	.003
Pair 96	Artistry - EcoFriendly	-.412	-5.325	127	.000

Appendix4.The questionnare of AHP survey and response

Evaluation Criteria	***9***	***8***	***7***	***6***	***5***	***4***	***3***	***2***	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***	Evaluation Criteria
Accessibility																		Layout
Accessibility																		IT
Accessibility																		Parking
Accessibility																		Maintenance
Accessibility																		Flexibility
Layout																		IT
Layout																		Parking
Layout																		Maintenance
Layout																		Flexibility
IT																		Parking
IT																		Maintenance
IT																		Flexibility
Parking																		Maintenance
Parking																		Flexibility
Maintenance																		Flexibility

Evaluation Criteria	***9***	***8***	***7***	***6***	***5***	***4***	***3***	***2***	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***	Evaluation Criteria
Fire resistance																		Safety of equipment
Fire resistance																		Durability
Fire resistance																		Security
Fire resistance																		Earthquake
Safety of equipment																		Durability
Safety of equipment																		Security
Safety of equipment																		Earthquake
Durability																		Security
Durability																		Earthquake
Security																		Earthquake

Evaluation Criteria	***9***	***8***	***7***	***6***	***5***	***4***	***3***	***2***	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***	Evaluation Criteria
Traffic-effect																		Eco-system
Traffic-effect																		Green-gas
Traffic-effect																		Contaminant
Eco-system																		Green-gas
Eco-system																		Contaminant
Green-gas																		Contaminant

Evaluation Criteria	***9***	***8***	***7***	***6***	***5***	***4***	***3***	***2***	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***	Evaluation Criteria
Ventilation																		Heating&Cooling
Ventilation																		Noisy
Ventilation																		Sanitation
Ventilation																		Lighting
Heating&Cooling																		Noisy
Heating&Cooling																		Sanitation
Heating&Cooling																		Lighting
Noisy																		Sanitation
Noisy																		Lighting
Sanitation																		Lighting

Evaluation Criteria	***9***	***8***	***7***	***6***	***5***	***4***	***3***	***2***	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***	Evaluation Criteria
Operation cost																		Maintain cost
Operation cost																		Initial cost
Maintain cost																		Initial cost

Evaluation Criteria	***9***	***8***	***7***	***6***	***5***	***4***	***3***	***2***	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***	Evaluation Criteria
Harmony with surroundings																		Appearance
Harmony with surroundings																		Symbolism
Harmony with surroundings																		Tradition
Appearance																		Symbolism
Appearance																		Tradition
Symbolism																		Tradition

Evaluation Criteria	***9***	***8***	***7***	***6***	***5***	***4***	***3***	***2***	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***	Evaluation Criteria
Serviceability																		Safety
Serviceability																		Comfort
Serviceability																		Environ friendly
Serviceability																		Econo feasibility
Serviceability																		Artistry
Safety																		Comfort
Safety																		Environ friendly
Safety																		Econo feasibility
Safety																		Artistry
Comfort																		Environ friendly
Comfort																		Econo feasibility
Comfort																		Artistry
Environfriendly																		Econo feasibility
Environfriendly																		Artistry
Economic feasibility																		Artistry