Chapter 2

Literature Review

Since the research problem is the lack of evaluation information of building functional quality by the Dong Da users, the main aim of this chapter is to find out a method for an evaluation of the buildings, which is suitable to evaluate functional quality of the building by the users. This chapter's content is the approach to research methodology and is divided into three main sections:

- Firstly, from the clarification and comparison of the building evaluations in a Framework of Building Performance Evaluation, Post-occupancy Evaluation (POE) was considered for users' evaluation of functional quality of the Dong Da apartment complex.
- Secondly, after a classification of POE to identify the type of POE and its scope, the Indicative POE is selected for the POE Dong Da. Then, the review of POE guidelines provided a POE procedure, which have been approved by the government and will be used as Indicative POE. Next, by clarification, 10 steps of POE procedure of Wener (1994) are adapted for this research procedure of Dong Da POE. However, the 10 steps of Wener (1994) did not mention detail content in steps of Data Collection, Data Analysis and Results.

- Finally, the third section is the review of POE procedure in 10 parts that are according to the 10 steps of POE procedure of Wener (1994). Besides, reviews of five relevant researches and others POE researchers' suggestion add more details to the procedure of the POE, which were not mentioned by Wener (1994). The content of the third section aims:
    - To select questionnaire for the instrument of the POE
    - To show that user satisfaction is measurement of the POE
    - To identify 27 aspects of the building function for the POE
    - To classify three statistical objectives in the POE
    - To identify three results of the POE which are the outcome of the statistic

In addition, the summary, which contains selected details of the approach of the research methodology, is the conclusion of this chapter.

2.1 Building Evaluation

In a general definition, a building evaluation is to determine the value of a building; find the strengths and weaknesses, (Voordt, 2004). In another definition, Kernohan (1992) stated that the target of a building evaluation is to study the benefits/or disadvantages of building to users/clients; this definition had the same target of evaluative research in Environment-Behavior Research, the interactions between building environment and user. Thus, the results of a building evaluation should be both the building quality and the users' behavior toward that building (such as, attitude, satisfaction, preference, like, dislike).

In order to obtain a suitable type of building evaluation for the case of the Dong Da complex, this section was separated into two main parts. The first part is the introduction of an integrative framework of the building evaluation including motivation why this particular evaluation was chosen. The second part of the summary is the reasons that why POE was selected for the case of Dong Da.

2.1.1 Integrative Framework of Building Performance Evaluation

In the widely spread field of building evaluation, many researches and institutes have developed tools of evaluating buildings for different purposes. Vischer,(2001) developed Healthy Building Quality to assessed impact of building design to the users' health; Medical Architecture Research Unit (MARU) proposed PIR (*Post Implementation Review) and* PCR (*Post Completion Review*) for project planner when he wants to know how well the buildings of project outcomes were matched to the actual needs that the project aimed to fulfill. Ministry of Land, Infrastructure, and Transport Japan has designed Housing Performance Indication system of to help a homebuyer's housing selection and to promote improvements in the housing performance. As the same reference, the above three developed methods are related to the reference of framework of the building evaluation of Presier (1989).

In widely dissemination, in their reviewing of building evaluation as a product evaluation, Preiser (1989) created an integrative framework for building performance evaluation, and proposed an evaluation and review stance of the life cycle of a building (Figure 2-1). This framework is dominant in the area of building evaluation (Watson & Thomson, 2004)

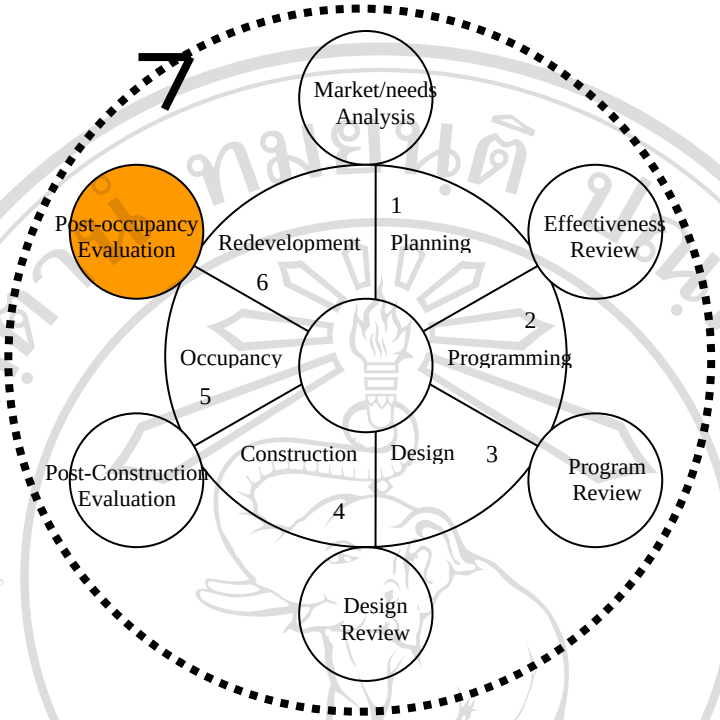

Figure 2-1: A cycle of integrative framework for building performance evaluation; Source: adapted from Preiser (1989)

This framework includes six major phases of a building in use, which are followed in the lifecycle of buildings:

The first phase is the Planning of the new building: starting with the strategic plan, which establishes present and long term needs of society through market needs analyses. This phase includes an effectiveness review of the outcomes of strategies that aim to get users/clients for the new building.

The second phase is the Programming Design of building: processing of the information, setting out design directions that will accommodate the needs of users

and other stakeholders and limiting conditions. This phase refers to a program review involving clients and other stakeholders, such as what are demands of users/clients? How many bedrooms are in the building? Normally, a group of designers will organize schemes of building functions in this phase.

The third phase is the Design of building: from the first sketch ideas to construction documents. Phase 3 refers to design, i.e. 'before event'-assessment or pre-occupancy evaluation of the effects of design decisions from various perspectives. In other words, this pre-occupancy evaluation is the evaluation of the users/clients on the schemes of designers in the second phase.

The fourth phase is the Construction of the building, which did get a high acceptance by users/clients in the third phase; this phase includes administration and quality control to assure contractual compliance. Phase 4 includes post-construction evaluation, which results in punch lists of items that need to be completed prior to commissioning and acceptance by the clients.

The fifth phase is Occupancy: during this phase, move-in and start-up of the facilities occur, as well as fine-tuning by adjusting the facilities and its occupancy evaluation, providing feedback on what 'works' and what doesn't. Post-occupancy evaluation (POE) may be used to test hypotheses and expectations, to identify problems in the performance of the building environment and ways to solve them. Thus, POE is the name of evaluative research for buildings involving users/occupants or residents, while the functional quality of building is the usability of the building in practice, are evaluated by users/occupants (Vrielink, (1987). Therefore, all researchers have used POE to evaluate the aspects of building function (Voordt, 2004).

The sixth phase is the Redevelopment of the building after a long time of using; recycling of the building to similar or different users, redesign of public areas, adding new functions or demolishing buildings. Phase 6 includes market/needs analysis that aims to identify and to rearrange users/clients for the new building project. In the other words, this phase is the last phase of a life cycle of a building. This phase could connect to a new life cycle that but that depends on users/clients' evaluation, the governmental managements and investors.

2.1.2 Summary of the Review of Building Evaluation

Although many researchers have developed building evaluation, Preiser (1989) gave a strong integrative framework of building evaluation. Among the tools of Building Evaluation between phases of the building performance, Post-occupancy Evaluation is an evaluation of the building redevelopment that links to phase 6 of the building redevelopment; hence, there occurred a consideration of POE for the evaluating functional quality of the Dong Da complex by the users. As reasons to select POE, the three reasons below are a confirmation of the suitability of POE in case of the Dong Da:

- First, the Dong Da apartment complex closes the phase of the building redevelopment that will improve the quality for the building after over 25years of use/ occupancy, and no researcher had done POE before.
- Second, POE is an international name of the tool for building evaluation (Vischer, 2001, Watson & Thomson, 2004). This assures a high

application of POE to the project planner of the Dong Da, and widely application to other redevelopment projects of old subsidized apartments.

- The POE involved the user/ occupants, who could correctly evaluate the functions of the building after their occupancy and using (Voordt, 2004; Vrielink, 1987). This is strong evidence to state that POE could fulfill the information from the users' evaluation of functional quality of the Dong Da apartment complex.

In short, thanks to the integrative framework of the building evaluation of Presier (1989), it gave a name of the POE for the case of Dong Da. For more detail of the POE, this research needs to review more POE researches to conduct a procedure of POE Dong Da.

2.2 Post-occupancy Evaluation (POE)

In fact, POE is the name of an evaluative research for buildings in a period of occupancy/use, which involves users, occupants, residents or clients. Therefore, POE is as an open method for next researches to develop their procedure to a specific study area. To follow this section's contents of conducting a procedure of the POE, three below steps is the content of this section:

- First, before conducting the research procedure, the classifying types of POE by Presier (1994) makes it clear for the researchers to identify the scope and the type of POE research. Then, researcher identifies that the Indicative POE is suitable for the POE Dong Da

- Second, from reviewing the Indicative POE, the 10-step procedure of POE conducting of Wener (1994) was selected.
- Finally, a summary of POE procedures briefly showed the lack of procedure details of Wener (1994), which became the reason for the next section of reviewing relevant researches.

2.2.1 Classification of POE

As mentioned, POE is an open method of evaluative research. Based on objectives of researchers, each research has different approaches of POE. However, based on the specific objective level of POE, Preiser (1994) summarized POE on three types that are Indicative, Investigate and Diagnostic POE. Table 2-1 shows more detail on objectives of three types of POE

For example of the different levels of specific objective, the POE researches of Leifer (1998) and Altas & Ozsoy (1998) had two different specific levels of POE objective. As Indicative POE, Leifer (1998) studied the evaluating user satisfaction on the office buildings and his work was a demonstration of research method in the office buildings in Australia. In his works, Leifer (1998) had to develop his research method from a governmental guideline of Queensland, Canada and his first case study is the office building of University of Auckland. Thus, the POE objective of Leifer (1998) is general. Contrarily, in more detail objectives of Diagnostic POE, aim to find the most flexible apartment with the highest satisfaction of the users, Altas and Ozsoy (1998) compared user satisfaction level on aspect of spatial flexibility of four different apartment types of 2-bedroom in Istanbul, Turkey.

Table 2-1: The Classification of POE (adapted from Presier, 1994)

Type of POE	Objective
Indicative (wide ranging application)	- Indicates major strengths and weaknesses of a particular building's performance and provides data that supports the need for or against further in-depth evaluation; - Compares "big picture" of building performance against existing criteria, design intent and the program
Investigative (more detailed approach)	- Performed after an indicative POE indicates that the building performance requires more in depth evaluation. - Monitors specific aspects of building performance over a period of time and compares to existing criteria and design intent and evaluates these factors. - Process uses more resources, more sophisticated data collection and analysis methodologies than an indicative POE
Diagnostic (extremely detailed and focused study)	- Performed post-investigative POE if further data collection or analysis is required to take corrective actions or instead of an investigative POE if major design or operational flaws are discovered in the indicative phase POE - Comprehensive and high level investigation involving data collection and comparison of many variables for a single facility or across facilities with similar function

In using guidelines of POE, Presier (1994) suggested that the Indicative POE should be done before to guide the specific objectives for the Investigative and Diagnostic POE. Beside, an Indicative POE method should be developed from approved methods of institutes or governments, such as Leifer (1998) had developed Works Canada Office User Satisfaction Survey Instrument to apply in Australia.

As Leifer (1998), the selected case of POE Dong Da also attempts to be a demonstration of POE method to find out a wider range of application for

redevelopment projects throughout Vietnam. Therefore, the Indicative POE should be firstly implemented in the Dong Da apartment complex before proceeding of the others in more detail of the POE in Vietnam. Besides, developing research method from an approved POE by institutes or governments is more confident for the widely application of POE Dong Da.

2.2.2 The Review of Indicative POE:

Since the POE of Dong Da relates to the Indicative POEs, which have been approved and used by institutes in Australia, Canada, South East Wales, Scotland, United States; they were selected for a review to find out the POE procedure for POE Dong Da (Table 2-2)

In comparison between procedures of the Indicative POE, as similarity, the questionnaire is often used for the data collection. Then, the interview could be used to identify detail comments of the users, which could explain the reasons of the problems between user and the building design and facility. Besides, the interview of the management and authorities is necessary to provides more information that sometimes was not motioned by the users. However, as the limitation of Indicative POE, in their guidelines of the POE procedure were not detailed because they wanted to keep the application open for the next researcher to further developing the details of the procedure.

Table 2-2: The reviewed guidelines of the POE procedures

Approved Government	Procedure of POE	Author
Developed for Scotland Government	- The report has a clear layout, focus on recommendations for improvement and accurately reflects opinion - The process gives authorities the opportunity to observe interviews and collaborate on recommendations - The process is clear and simple - The single person contact with the evaluation consultant and empathy with users is valuable	Watson & Thomson (2004)
National Institute of Corrections, America	- Step 1: Describe area of study and role of institutional team - Step 2: Determine instrument - Step 3: Survey situation - Step 4: Modify instrument - Step 5: Data collection - Step 6: Data processing - Step 7: Data analysis - Step 8: On-site data collection to focus attention - Step 9: Result presentation - Step 10: Suggestion & report writing	Wener (1994)
Queensland Government, Canada and adapt to Australia and New Zealand	- Identifies areas of deficiency - Allows the facility manager to be proactive and respond when the parametric results indicate that a perceived satisfaction is outside the normal expected range. - Offers an objective scale to which complaints can be referred. - Using the survey reinforces user's perception of a caring management.	Leifer, (1998)
The Royal Institute of Chartered Surveyors, South East Wales	- Identify the building users. - The method chosen is a combination of questionnaire, forum and interview in that order - Relatively straightforward operation achieved by site observations - Informal interview with the manager responsible for the day-to-day activities that take place within the case study building	Bowler & Hughes (1996)

Among the Indicative POE procedures, the 10 step of Wenner, (1994), which were designed with assistances from the National Institute of Corrections, America, are remarkable because of their clarification as an academic research and including guidelines of the other reviewed POE researches, such as Survey Situation, Data Collection, Data analysis, Result presentation, Suggestions. In addition, an important step of POE is the interview with project manager and planner. This step could help researcher understand more situations of the building management and which results of POE are more applicable for the planners and managers. In short, the ten step of

Wener (1994) is a straightforward POE procedure to be developed as a research approach and is suitable procedure for the POE Dong Da to develop.

2.2.3 Summary of Reviewed POE Guidelines

Among three types of POE that are Indicative, Investigative, and Diagnostic POE, the Indicative POE is suitable for the POE Dong Da because of its general and governmental method. Then, among different Indicative POEs that were used in Scotland, Canada-Australian, and South East Wales, United States, the 10 steps of Wener (1994) are selected for the case of the POE Dong Da because of its clarification as academic research procedure. However, Wener (1994) did not specifically mention the detail POE procedure of questionnaire designing, analysis technique and results. Among these procedures of the POE, when statistical analysis of the various data is undertaken, a complete picture of the performance of the building will be outlined (Hassanain, 2006). Thus, in review of the 10 steps of the POE procedure of Wener (1994), next sections will discuss more detailed how to design the POE questionnaire and which technical analysis and what results were the outcome.

2.3 Review of the POE Procedures

Based on the suggestions of Wener (1994), this section presents the ten steps of POE procedure in 10 parts of reviewed POE. This section also reviews 5 relevant POE researches, Erkip & Kaya, (2001), Leifer (1998), Liu, (1999), Nasar, (2000), Sugur (1998) (Table 2-3), and other researchers' discussions to describe more detailed procedures of the POE. The five relevant POE researches are different types of POE

(Indicative, Investigative, and Diagnostic POE).Aim the review of different POEs is to gain a general view of a POE method that is sufficient for the POE Dong Da. In addition, to complete the ten step of Wener (1994), part 2 of this section will discus the questionnaire design as an instrument; and part 7 of this section classifies the three statistical techniques of the data analysis that were applied in POE and part 9 classifies the three POE results.

Table 2-3: The five reviewed relevant researches

Name of Research	Research Objective	Measurement of User Evaluation	Data Collection	Types of Statistic Analysis	Reference
Evaluating user satisfaction: Case studies in Australasia	- to evaluating user satisfaction on Building Health parameters (thermal comfort, air, noise, lighting, privacy, and overall satisfaction	User Satisfaction	Questionnaire with 5 grade scale,	Average and find min max, t-test (the significant between the means)	Leifer (1998)
Satisfaction on a Dorm building	- investigate the different levels of satisfaction between groups of users	User Satisfaction	Questionnaire with nominal data(Yes & No)	Chi-square test of contingency	Erkip & Kaya, (2001)
Effects of housing morphology on user satisfaction	-to investigate the relationship between housing morphology and user satisfaction and different groups of users	User Satisfaction	Questionnaire with 5 grade scale,	Average and find min max, Correlation	Sugur (1998)
Post Occupancy evaluation COSI building	- to understand effectiveness of COSI building, which are the advantages and disadvantages of the COSI	User Satisfaction	Questionnaire with 7 grade scale, interview, photo capture	Average and find min max, percentage	Nasar, (2000)
Residential satisfaction in housing estates: a Hong Kong perspective	- to perceive factors of dissatisfaction amongst the public and private housing occupant - to find predictive model of overall satisfaction of user by aspects of building function	User Satisfaction	Questionnaire with 5 grade scale	Factor analysis, and Multiple Regressions	Liu, (1999)

2.3.1 Describe Area of Study and Role of Institutional Team

Aim of this step is to describe the people or organizations/institutes that are involved in the building. Then, they could become participants in the POE research. Besides, allowing the survey by the administrator is necessary for the implementation of a POE.

2.3.2 Instrument Determining

Craig Zimring, (1980) mentioned that questionnaire and interview are two main instruments of POE; however, the questionnaire is more economical and convenient than the interview in an Indicative POE study of numerous samples/users. Wener (1994) and the five relevant reviewed researches (Erkip & Kaya, 2001; Leifer 1998; Liu, 1999; Nasar, 2000; Sugur, 1998) also mentioned that a questionnaire is formally used for data collection of the POE. In a guideline of questionnaire designing, to determine the aspects or factors for the evaluating research is important because we need to focus to obtain research questions for each criterion of the evaluation of users, (Kerlinger & Lee, 2000). For questionnaire designing of POE, Sugur (1998) suggested that the user information in these questionnaires could be divided into two types of parameters of the evaluation aspects that are the parameters of user and parameters of the building:

- Parameters of user: normally are: age, gender, period time of occupancy, address. These parameters help the research to identify and separate the groups of user. Erkip & Kaya (2001) used the criterion of gender to

classify the groups of users when he wants to know differences between user groups of male and female; while Liu (1999) focuses on the property right of user when he want to find differences between users of private house and users of public house in Hong Kong. Thus, the user parameters could be set up by researchers' purpose when he wants to know difference between groups of users.

- Parameters of building aspect: as mentioned by Voordt, (2004), all researches have used POE to evaluate the aspects of building function. In his research on aspects of building function, Voordt (2004) synthesized nine main aspects of functional quality of buildings from criteria of 14 methods of building assessment of international measuring instruments. Although many researchers used POE to evaluate the functional quality of buildings, the nine main aspects of Voordt (2004) are used as aspects of the building quality assessment in Netherlands and cover the aspects of the building function of the other researches (Appendix 2). Following Voordt (2004), the functional quality of a building can be classified into nine main aspects, which include 27-sub-aspects (table 2-4). Among 27 sub-aspects, Voordt (2004) suggested that the sustainability aspect of building is as the overall aspects for a building. Beside, the nine main aspects that include the sub-aspects will help the researcher have a general evaluation for the sub-aspects in results discussion.

Table 2-4: The aspects of building functional quality (Voordt, 2004)

Main aspects of The building functional quality	No	Sub-aspects of building functional quality
1-Parking	1	Reachability
	2	Parking Facilities
2-Accessibility	3	The Physical accessibility
	4	The Psychology accessibility
3-Efficiency	5	Location
	6	Adequate access arrangements
	7	Efficient layout
	8	Sufficient floor area
	9	Sufficient vertical dimensions
3-Efficiency	10	Functional use of colors and materials
	11	Adequate equipment and arrangement
4-Flexibility	12	Flexibility
	13	Adaptable
5-Safety	14	User ergonomics safety
	15	Public safety
	16	Fire safety
	17	Constructional safety
	18	Traffic safety
	19	Chemical safety
6-Spatial orientation	20	Identity, Sign
	21	Harmony of façade
7-Privacy and Social contact	22	Privacy
	23	Social contact
8-Health and Physical well-being	24	Noise
	25	Light
	26	Interior climate
9-Sustainability	27	Sustainability

As an important part of questionnaire designing, the measuring of user satisfaction for building aspects has been used for the POE from early study of building evaluation as POE. As a relative process of the measuring of user satisfaction and POE development, Schorr, (1966) described studies of residential satisfaction and reports that a number of housing characteristics for the evaluation show to be related to housing satisfaction. Frencescato, (1979) suggested that the evaluation of housing should occur from the perspective of the user. Campbell, (1976) looked at housing

satisfaction as one of the domains of life experience, where satisfaction with that domain might contribute to a person's quality of life as well as building quality. Leifer (1998); Liu, (1999), Nasar, (2000), Sugur, (1998), used the user satisfaction as a measurement criterion of the POE. In their questionnaire design of POE, users have rated their satisfaction from 1to 5 or 1 to 7 grade scale where the grading in the score would vary from very dissatisfied to very satisfied on parameters of building function. Thus, as an indispensable component of POE, user's satisfaction has been established along with POE development.

In short, the second step initially setups the parameters or variables for the data collection. In particular, the questionnaire has two main parameters. First, to identify the groups of users, researcher determines parameters of users that are as criteria to classify the groups of user. The determine parameter of the user is as hypothesis of the different between groups of users. The second parameters are aspects of the building function, which could be referred to the 27 sub-aspects of the 9 main aspects in Voordt, (2004). These aspects will be exposed in the questionnaire designing, and then the users can evaluate each aspects of building functions by the level of the user's satisfaction. In addition, the comment part where user could write more about their opinion on their building is also designed in the questionnaire form. This step of the POE procedure drafts the questionnaire; then the 3rd step of Instrument testing will check and correct this questionnaire form.

2.3.3 Situation Survey and Instrument Testing

Aim of this step is to check the difference between the database and the real situation; therefore, research should consider these aspects in the results discussion.

Beside, the questionnaire test aims to find out mistakes or unsuitable questions for the next step of the questionnaire's modification (step3). In addition, this step also records the attitude of users and the building/community leader in participating in the research because a non-cooperative attitude can cause many problems.

2.3.4 Modify Instrument

Based on the previous step 3, this step deletes irrelevant questions; describing more meaning of the questions that are not understood by testers in step 3 of instrument testing. Beside, local language translation and questionnaire-form adjustment for a good visual arrangement should be included in this step. Aim of this step is the revision of the questionnaire before a formal delivery to users (Wener, 1994).

2.3.5 Data Collection

The aim of this step is to get sufficient data on the questionnaire form for the data analysis step. This step had two main processes, which are:

a. Sample/Users Identifying

Normally, the probability or random samplings is used for Indicative POE of a large size of population. However, with aim to get sufficient samples to investigate information of user groups in a significant statistic, researchers could allocate the sample in proportion, (Brown, Cozby, Kee & Worden, 1999). In their POE research, Erkip & Kaya, (2001), Leifer (1998), Nasar, (2000), Sugur, (1998) used the quota sampling of non-probability in sampling. For example, Erkip & Kaya, (2001) proportionally allocated the questionnaire between groups of gender (male and

female) and user groups of different floors (1st floor, 2nd floor, 3rd floor, 4th floor and 5th floor). In short, the quota sampling is convenient for POE researches when they want sufficient sample for a data analysis of differences between groups of user in a building.

b. Questionnaire Delivering and Receiving

By quota sampling, Erkip & Kaya (2001), Leifer (1998), Nasar (2000), Sugur (1998) had to meet directly with the user in their household to identify the condition of sample, such as gender, floor location; then the appointment to receive questionnaire will be set up by the users and the researcher. Wener (1994) also mentioned that this way of questionnaire delivering would establish more sympathy from the users.

2.3.6 Data Processing

Aim of this step is to prepare and arrange data for the analysis step conveniently to conduct the output data. This step includes:

- Input data from questionnaire to the statistical software
- Classify the noted comments of the questionnaire and the interview to find out the most frequent responses of the users in the next step
- To identify type of data for the data analysis, Keller, (2001) categorized type of data into Interval data, Nominal data and Ordinal data, which are three types of data that are very useful in applied statistical techniques. In reviewed POE of Leifer (1998), Liu (1999), Nasar (2000) and Sugur (1998), the parameters of users and their comments were seen as nominal

data; and the levels of user satisfaction on aspects/parameters of building function were seen Interval data.

In short, this step is a preparation of data for the test and statistical technique for step 7

2.3.7 Data Analysis

The Indicative POE is a general evaluation that has many objectives, then, it will identify the specific future POE research Presier (1989); therefore, its method has to use many statistics/analysis that could infer answers for the hypothesis and posed questions of the research objectives. However, Presier (1989) and Wener (1994) did not mention detailed analytical techniques in their guidelines and suggestion. To conduct detailed procedure of POE method, this part reviews technical analysis of five main relevant POE researches (Erkip & Kaya (2001), Leifer (1998), Liu (1999), Nasar (2000) and Sugur (1998) in table 2-3). Based on the guideline of three statistical objectives of Keller, (2001) and the objectives of reviewed POE, three ways of statistical technique in reviewed POE are classified. For detail, below sub-parts discuss three statistical techniques of POE that conduct three type objectives of the POE.

a. Analytical Techniques to Identify Disadvantages and Advantages of a Building

The basic form of POE is to assess the building's successes or failures of the building from the viewpoint of the occupants (Brenda, 2006).Thus, since the user’s satisfaction reflects the quality of the resident’s environment, the level of user satisfactions is representative for the functional quality of the building. After having

found the averages of user's satisfaction level of each aspect of a building, Nasar (2000), Leifer (1998) and Sugur (1998) found disadvantages and advantages of the building that are according to a minimum and maximum scale of user's satisfaction of the aspects of a building. Besides, the frequency of comments of the user described more the advantages and disadvantages of the building. In short, the descriptive statistics (mean, ranking and frequency) of the population describing was applied to find the advantages and disadvantages of the building.

b. Analytical Techniques to Identify the Differences of User Satisfaction between Groups of Users

In a group of users, normally, there are different sub-groups that could have different opinions/satisfaction. This could be the problem when we need a consensus among them (Schorr, 1966). Therefore, most of POE researches not only study on the quality aspects of the building but also find differences of the user satisfaction level on aspects of the building function. Such as Nasar (2000), found different satisfaction on building function between the staff and the visitors in a museum building, Altas & Ozsoy (1998) found a different satisfaction between four user groups of different apartment types, Sugur (1998) found different satisfaction between male and female in a campus dormitory.

In statistical techniques, firstly, Nasar, (2000) and Altas & Ozsoy, (1998) applied t-test (the significance of differences between the means) to identify different levels of user's satisfaction. However, Erkip & Kaya, (2001) used Chi-squared test of contingency to identify different significance between male and female because he used the user satisfaction as nominal data. In addition, Keller, (2001) suggested that

researchers could use the ANOVA (analysis of variance) test to find the significance of the difference between the user groups. Then, to identify the user group's higher or low satisfaction, the researchers compared means of the user satisfaction level. By this way, Erkip & Kaya, (2001) found the user group of the 5th floor is more satisfied than the user group of 1st floor in aspects of building privacy.

In short, the different significances test (T-test, ANOVA or Chi-squared Test of Contingency) and mean comparing are two step to identify the different satisfaction between user groups in the reviewed POE. Thus, the objective of POE that is the different satisfaction between groups of user could be inferred from results of comparing of different population in statistical techniques.

c. Analytical Techniques to Identify the Relationship between the Users' satisfactions on the Aspects of Building Function

As related POE of Environment- Behavior research that study on the interaction between human/user and the environment aspects/ building aspects, the relationship of users and building aspects are the interesting topics for many researchers. In most preferred aspects, the overall satisfaction that related the next decision of user was seen as a dependent variable in relationship-prediction studding, Joseph, Robert & David, (2000). Obviously, the POE also has this objective of prediction.

Erkip, (2001) used the Chi-squared Test of contingency test to find a negative correlation between floor heights and user satisfaction on the aspect of privacy. However, Erkip, (2001) claimed that this results of case study aim to only confirm the hypothesis of previous research. In higher application of a significant POE study on

the overall satisfaction, Liu, (1999) applied Factor Analysis Test to identify the groups of aspects of building function, which includes correlated aspects. Then, Liu, (1999) gave names for nine groups of aspects of building function that had strong correlation. As concurred to produce aspects of building function, the nine main aspects of Liu, (1999) are similar nine main aspects of building function of Voordt, (2004). This again proved that the nine main aspects of building of Voordt, (2004) are sufficient for a building evaluation, Appendix 2. Finally, to predict a relationship between aspects of the building and the overall satisfaction of the user, Liu, (1999) applied Multiple Regressions with stepwise model to find out the five main aspects (Flexibility, Location, Privacy, Maintenance and Layout) that correlated the overall satisfaction of users. For application, Liu, (1999) suggested that these factors are as indicators of user satisfaction in the carrying out of the planning and development of housing estates.

In short, the regression equation is useful in identifying the major factors, which affect residential satisfaction and can be incorporated into the subsequent phases of the POE process. Thus, Multiple Regression is a statistical technique to analyze the relationship between variables that were applied in POE.

d. Summary of Data Analysis

In summary, the statistical techniques, which are applied in POE procedure, could be classified into three type objectives. In particular, 1- Descriptive Statistic identify the advantage and disadvantages of the building; 2- ANOVA test and Mean Comparing identify the different satisfaction level of user groups; 3- Multiple Regression of step-wise model could predict the relationship between aspects of

building function and the overall satisfaction of users. Below table is the summary of statistical techniques, the three objective types of statistical techniques that are according to the three objectives of POE, (table 2-5)

Table 2-5: The Summary of Statistic Techniques Conducted Three Types of POE Objectives.

		Statistical Objectives			**Researcher used**
		Describe a single population	**Compare Populations**	**Analyze Relationship between variables**	
Type of data	Interval data	Descriptive Statistic: Mean, Rank, Frequency, Percentiles	T-test compare mean, ANOVA	Spearman Rank correlation test, factor analysis test, multiple regression	Nasar, (2000) Liu, (1999) Sugur, (1998) Leifer, (1998)
	Nominal data	Descriptive Statistic	Chi-squared test of contingency,	Chi-squared test of contingency, Logistic Regression	Erkip & Kaya, (2001)
	Ordinal data	Descriptive Statistic		Spearman Rank correlation test	Leifer, (1998)
Main objectives of the POE		Investigate advantage/ disadvantage aspects of building function	Investigate differences of satisfaction between user groups	Investigate relationship between the satisfaction for aspects of buildings and the overall satisfaction	

2.3.8 On-site Data Collection

After data analysis, the research could infer the results of POE; however, this inference from out data should be confirmed by re-data collection for strong evidence. The interview is a suitable method to expose the implication of the results of data analysis. Normally, the frequent responses of the interviewees are used to explain the attention-point results of data-analysis step, (Wener, 1994). Beside, Nasar, (2000) suggested that facility walk-though tour to capture photos for evidences also is necessary for the evidences.

2.3.9 Result Presentation

Wener, (1994) suggested that the results of POE should be presented to the planner of project or management before report writing. Aim of this action is to get their opinions on the draft results of the POE; then they could point out the applicable results that are very useful for the project or the management. However, the aim of this thesis book is to present research results to an academic committee, therefore, the result presentation with project planner should be done as an interview in step 8 of on-site data collection. Hence, the name of step 8 could be changed to be the interview.

According to reviewed POE results, this step presents content of three results of POE, which are inferred from out put of the three objectives of statistical techniques. The results of POE are:

- Advantage/Disadvantage aspects of building function
- Differences of satisfaction between user groups
- Relationship between the aspects of buildings and the overall satisfaction

2.3.10 Suggestion & Report Writing

According to Presier & Nasar, (2008), the suggestions of POE should be separated into three terms, which are short-term, medium-term and long-term.

Short-term suggestion reports the implications or reasons of advantages and disadvantages of building to the current project. Then, the building manager/ or project planner, who can improve the disadvantages and maintenance the advantages of the building, (Nasar, 2000). The architects, who may design the same type of the evaluated building, should avoid repeating the mistakes/disadvantages and develop

the strong point/advantages of aspects of the building (Leifer, 1998). Normally, the Indicative POE will guide the Investigate and Diagnostic POE to solve or explain specific problems.

The Medium-term suggestion suggests information of result implication to the next phase of building performance, such as the differences of opinions/satisfaction of the user will help the planner and the policy maker avoiding conflict between the differed groups and designing a suitable plan or policy to different groups of users, (Sugur, 1998). Project planner/ or investor could have an effective investment when they only focus on the positive aspects of building that is related to user's satisfaction. This application of the planner is to aim to get the highest possible satisfaction of the user, which could relate to the acceptance of users in their next decision for option choices Liu, (1999). However, this suggestion also depends on the funds of the project

The Long-term suggestion is the formal suggestion of POE to the project planner or building manager that the role of POE in building performance is always necessary when they want to improve the quality of a building with the satisfaction of user. Beside, the POE should be applied in other projects that relate to the evaluated building of the project.

Finally, a report of POE could be written formally to the administration in the ten executed steps of POE.

2.4 Summary of Literature Review

The literature review provided the implication that the procedure of POE is the suitable approach for the users' evaluation on functional aspects of the Dong Da

building as well as other redevelopment projects of the old buildings (subsidized apartments) in Vietnam.

In detail provisions of literature review, first, POE is the method of the users' evaluation of the building in use is selected for case of the Dong Da apartment complex. Secondly, the ten steps of the POE guidelines of Wener (1994) created clarity for procedures of research methodology. The reviewed 10 steps of POE procedure and relevant POE researches showed that questionnaire designing and the user satisfaction with27 sub-aspects of nine main aspects of building function of Voordt (2004) could be used to evaluate the functional quality of buildings of the Dong Da apartment complex. Finally, three type objectives of POE are found by the classified statistical objective of Keller, (2001), which are Descriptive Statistic, the ANOVA and mean comparing and the Multiple Regression.

Table 2-6: The derived method of reviewed POE research for the POE Dong Da

Research Objective	Measurement of User Evaluation	Data Collection	Types of Statistic Analysis
Advantage/Disadvantage aspects of building functions	User Satisfaction	Questionnaire with 7 grade scale, interview, photo capture	Descriptive Statistic
Differences of satisfaction between user groups			ANOVA and mean comparing
Relationship between the aspects of buildings and the overall satisfaction			Multiple Regression

The following chapter, the research methodology will describe POE more specific, which was applied for the Dong Da apartment complex and how it fulfilled the research objective by the details of POE procedure.