

ESTIMATES OF THE CONSUMER SATISFACTION INDEX USING THE POST OCCUPANCY EVALUATION

Kyungsook Kim¹, Jeong hack Kim², Hana Kim³, and Jaejun Kim⁴

¹ Associate Professor, Department of Interior Architecture, Tongwon College, KyungKi, Korea

² Manager of Business Re-engineering Team, Lotte Construction & Eng Co., Ltd

³ Department of Architectural Engineering , Hanyang University, Seoul, Korea

⁴ Associate Professor, Department of Architectural Engineering, Hanyang University, Seoul, Korea,

ABSTRACT : The evaluation items to assess the consumer needs are thought to be varied depending on their age, education and income. It should be noted that consumer needs are getting too diversified to notice them in time due to the rapid economic, social and cultural development. It is, therefore, considered improper to try to assess the level of consumer satisfaction and correct consumer needs by employing one evaluation method for the vastly diversified consumer types. This research is going to conduct a written questionnaire survey to the apartment dwellers in order to identify like dweller groups according to their age, income and education. Then the scope of personal characteristics of each group will be identified and the importance assessment model will be developed. Then the items on the POE will be weighted according to the assessed importance. Finally a method of developing the customer satisfaction index will be produced to quantify how much the consumers are satisfied with the project.

Key words : POE, Consumer Satisfaction, Index

1. INTRODUCTION

1.1 Background and Objective of Research

The desires of consumers have become diverse as a result of an increase in income, an improvement in the quality of life, and recent change in lifestyle. As various as these desires, there are many different factors that affect the housing satisfaction of consumers including that coming from housing itself like the floor plan and site plan. Moreover conditions of the surrounding environment such as transportation, school districts, and the quality of the neighborhood are connected to and influence each other in a complicated manner. Therefore a method of research that can integrate such complicated factors is called for. In addition there needs to be a numerical index that can measure the satisfaction of consumers, like consumer price index which is extensively used as a combined index that represents numerous economic conditions. This research will derive consumer satisfaction index assessment model. This consumer satisfaction index will become an important factor in understanding the level of consumer satisfaction with commodity housing produced by construction firms.

1.2 Method and Contents of Research

This research will present methodology to derive consumer satisfaction index and thereby present basic material to comprehensively estimate the actual level of housing satisfaction.

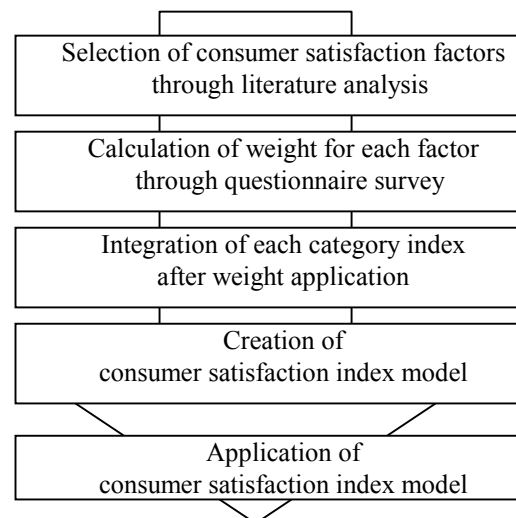


Figure1. Research Process

The process for the indexation of consumer satisfaction is divided into two steps. First, subordinate factors which have been selected through literature analysis are divided into categories such as transportation, floor plan, and site plan, and then category indexes are calculated. Second, the importance of each category is weighted and then integrated into general index.

In addition, by utilizing the model presented in this research, consumer satisfaction indexes corresponding to the apartment brand awareness are calculated and compared.

2. LITERATURE ANALYSIS

2.1 Concept of Consumer Satisfaction Factor

Generally a factor is prepared by first converting an abstract phenomenon or concept into variables with certain attributes, and then converting them again to a means that can be measured and assessed. Consumer satisfaction factor is a means that can assess present situation by examining some representative elements among diverse elements consumers can feel. Consumer satisfaction factor focuses on dwellers and their needs, and provides an insight into the previous design decisions and building performance. This research compared POE items¹ of which the objective was to lay out firm groundwork to create better buildings for the future, and the satisfaction level of housing needs in the light of dweller expectation, aspiration, and experiences. Then integrated were those assessed items of the housing satisfaction level² which represented the degree of satisfaction with present housing situation.

2.2 How to Derive Index³

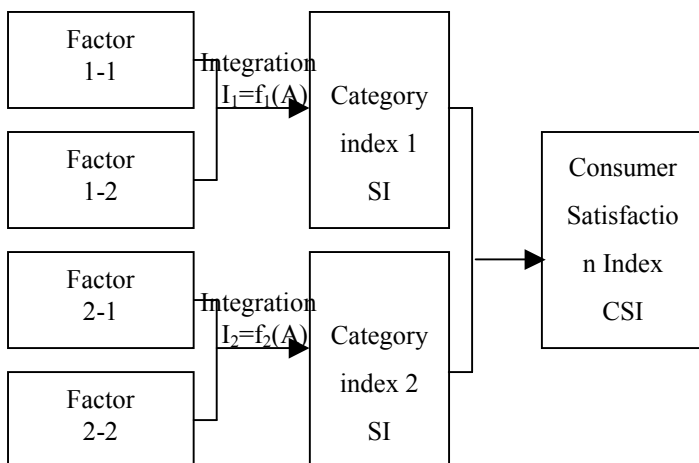


Figure2. Preparation of Consumer Satisfaction Index

¹ Wolfgang F. Preiser, (poe) Structure Assessment Methods

² Kim Tae Jin, A Study on the Optimum Development Density in Multi-Family Housing by Residential Satisfaction Analysis

³ Chung Yung Geun, Indexation of Sustainable Development Factor

When two measurements are of the same phenomenon, and, for example, A is given the referential value of 100, an index is a means to represent B in the formula of $100 \cdot B/A$.⁴ The preparation of an index goes through the steps of the variable selection, factor selection, regularization and integration, during which most critical is deriving an index that most accurately represents the present satisfaction level of consumers. For this to be achieved, deriving a consumer satisfaction factor that sufficiently explains each category is essential.

In order to prepare a consumer satisfaction index, a function for the category index SI_j must first be prepared. To prepare a category index by integrating some consumer satisfaction factors, a function can be constructed as follows.

$$\text{Category index } SI_j = f_j(X_i), \quad i=1,2,\dots,n \\ j=1,2,\dots,m \quad (1)$$

X_i = I consumer satisfaction factor

SI_j = j category index

In the formula above, each element of j category index function, $f_1(x_1), f_2(x_2), \dots, f_m(x_n)$ represents the characteristics of each consumer satisfaction factor, which can be expressed in various formulas.

The next step is the integration of category indexes, which can be said the most important step in calculating the index. In the process of integration, information is usually reduced and simplified, which naturally incurs most of the errors that can occur. Thus, to get an idealistic general index, it is essential to reduce the loss in the integration step, and represent the characteristics of each category index to the maximum.

As mentioned above, once calculated, the indexes of all categories are combined to derive the general index. The consumer satisfaction index is obtained by integrating the weight of each standardized category index as follows.

$$CSI = SI_1 \cdot W_1 + SI_2 \cdot W_2 + \dots + SI_n \cdot W_n \quad (3)$$

CSI : general index

SI_j : standardized j category index

W_j : weight of j category index

2.3 Present Status of the Development of Consumer satisfaction Index

The most common general indexes are those used in economics such as consumer price index and manufacturer price index. Consumer satisfaction index has been continually developed not by academic circles but by industry, not of the building structure but of the products of other industry. In 2001 the Association of Housing Culture⁵ developed HCSI, housing

⁴ Dusan World Encyclopedia

⁵ <http://www.pluspia.com>

consumer satisfaction index with the purpose of utilizing it as national and industrial factors in estimating the quality of domestic housing, and as bench marking data for the housing and other related industries. General index was developed by first dividing the categories into nine areas such as housing environment, design, material, construction, pre- and post-maintenance, information technology, investment, management, and brand. Next a weight was estimated on the regression coefficient given by the regression. This does not seem to, however, fully represent the characteristics of the consumers

because the regression coefficient was derived simply by applying the regression model rather than reflecting the weight from what consumers actually consider as important factors. Therefore this research conducted questionnaire survey to find out firsthand opinion of consumers, and based on the survey result the weight of each category was estimated and a consumer satisfaction index model was designed according to that weight.

Table 1. Housing Satisfaction from Literature Analysis of POE Items

| Subordinate Factors By Categories | | Frequency of Items | | | | | | | | |
|--------------------------------------|--|--------------------|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | |
| Parking | parking plan like area & location | ○ | ○ | | ○ | | ○ | | | 4 |
| Site Plan | exterior space plan like onsite green area | | ○ | ○ | | | ○ | | | 3 |
| | exterior and color | ○ | ○ | | | ○ | ○ | | ○ | 5 |
| | Security/safety | ○ | ○ | | ○ | | | ○ | ○ | 5 |
| | Onsite play area for children & rest area | ○ | ○ | | | | ○ | | | 3 |
| | exposure | | | | | ○ | ○ | | | 2 |
| | Consumer price of the neighborhood | ○ | | | | ○ | | | ○ | 3 |
| | Spacing between buildings | ○ | | | | | ○ | | | 2 |
| | Building Maintenance | ○ | ○ | | | ○ | ○ | | | 4 |
| | View | ○ | | | | | ○ | ○ | | 3 |
| Floor Plan | Area | ○ | | ○ | | ○ | ○ | | | 4 |
| | Floor plan | ○ | | | | | ○ | ○ | | 3 |
| Interior Finish /Environment | Lighting | ○ | | | | | ○ | ○ | | 3 |
| | Ventilation | ○ | | | | ○ | ○ | ○ | | 4 |
| | interior design | ○ | | | | | ○ | | | 2 |
| | sanitation | | | | | ○ | | | | 1 |
| | Fire safety | | | | | ○ | | | | 1 |
| Transpor-tation | accessible public transportation | ○ | ○ | ○ | ○ | ○ | ○ | | | 6 |
| Surrounding Environment | neighborhood environment | ○ | ○ | | | ○ | ○ | | | 4 |
| | Convenience of Public Facilities | | | ○ | ○ | | | | | 2 |
| | Medical/Culture Facilities | ○ | | | ○ | | | | | 2 |
| | Convenient Shopping | ○ | ○ | ○ | | | | | | 3 |
| School District | Quality of school /school district | ○ | ○ | ○ | ○ | | | | | 4 |
| Investment value | Worth of Investment | | | ○ | | ○ | | | ○ | 3 |
| | Convenient Transaction | | ○ | | | | ○ | ○ | | 3 |

1. Kim Jae Ik 1998.04 2. Lee Chun Ho 2000.01 3. Yuu Wann 2002 4. Ministry of Construction and Transportation
5. Ahn Kyung Hwan 1993.08 6. Lee Kang Hee 1995.11 7. Kang Bu sung 2004.05 8. Kim Chi Hwan 2001.06

2.4 Selection Criteria for Consumer satisfaction Factor

Since so many factors influence consumers' housing satisfaction, there are great difficulties in integrating and translating these factors. In addition, because POE items are limited to the performance of building itself, items of surrounding environment which effect housing satisfaction were also included through literature survey. The selected satisfaction factors are those with their frequencies equal to or above 2⁶. The purpose of this research is to examine the level of consumer satisfaction in apartment houses. The 2000 survey of netizens conducted by Naiwae Business News found that brand name was on the 5th priority of consideration when purchasing an apartment, and the 2004 survey done by LG Economic Research found it the most influential factor. Thus, it is knowledgeable that brand names are, till today, an important factor in the apartment market. Since the research results show that consumer satisfaction is much affected by brand names, social status and self-esteem that the brand names give to the consumers were included in the satisfaction factors.

Table 2. Selection of Consumer Satisfaction Factors

| Categorical Factors | Subordinate Factors |
|-------------------------------------|--|
| Transportation | Connectedness with Mass Transportation |
| Surrounding Environment | Apartment Environment, Convenience of Public Facilities, Convenient Shopping, Security/Safety, Prices of Commodities, quality of Neighborhood |
| School District | Educational Facilities |
| Investment value | Worth of Investment, Convenient Transaction |
| Parking | Area and location of Parking |
| Site Plan | Exterior space Plan, Apartment Exterior/color, Play & Rest Area for Children, Exposure, Spacing, View, Lighting, Building Maintenance, Internet Accessibility, Onsite Accommodations |
| Floor Plan | Area, Floor Plan, Convenient Housekeeping |
| Interior Finish/Housing Environment | Ventilation, Quality of Air & Water, Interior design, Interior Finish |
| Brand | Social Status & Pride that Brand-Names give |

3. CONSUMER SATISFACTION INDEX MODEL

As mentioned above, a consumer satisfaction model is created by first estimating category indexes through the integration of category factors, and then integrating these to yield a general satisfaction index. In the weight assessment of category factors, the existence of too many items prevented effective survey, and therefore weight was estimated using a regression coefficient by executing regression. With these values, the category indexes were integrated, and then the

⁶ Out of research papers submitted to the Korean Architectural Society from 1995 to 2004, samples were selected based on the relevance to housing satisfaction and POE.

weight for each category index was calculated using the results from the survey.

3.1 Selection of Factors for Preparation of Consumer Satisfaction Index

In the regression of the research data, multicollinearity occurs⁷, and the solution of this problem is prerequisite to trustworthy results of regression. In the actual survey process, it is impossible to control an independent variable, and collected data should be used as they are regardless of the value. In such cases, multicollinearity can be reduced to some degree by excluding variables with high relevance. However, if the excluded independent variable actually effects a dependent variable, the derived result may be deviant from the actual one, since an important factor was not part of the calculation.

To estimate the level of multicollinearity, circumstance factor, eigen value, and variance ratio were analyzed corresponding to surrounding environment, school district, investment value, brand, parking, site plan, floor plan, and interior finish/housing environment.⁸ The result showed that all items didn't have any multicollinearity, and the result of regression seemed to be trustworthy. Therefore the weight was assessed using the regression coefficient.

3.2 Creation of Consumer satisfaction Index Model

3.2.1 Collecting and Processing Samples

As mentioned above, in 2000, brand names were acknowledged for the first time as important factors in apartment purchase. For this reason, a survey was conducted on the dwellers of the apartments that were sold after 2000 and with dwelling period of at least over a year.

Basic components of survey questionnaire were as follows. First, in order to divide the elements that influence consumer satisfaction into 8 subordinate category indexes (which are transportation, surrounding environment, school district, investment, brand name, parking lot, site plan, and floor plan), the satisfaction level of each category was surveyed. Second, a survey was conducted to investigate satisfaction level for each factor using 7-point scale and general satisfaction of subordinate categories, and weight was assessed by regression.

3.2.2 Weight Assessment of Each Category

According to the result of regression, the weight of each subordinate category is as follows.

⁷ Multicollinearity exists when random linear relation is formed between explanatory variables.

⁸ Multicollinearity is interpreted to exist when circumstance factor is above 30, and variance ratio is above 80~90%.

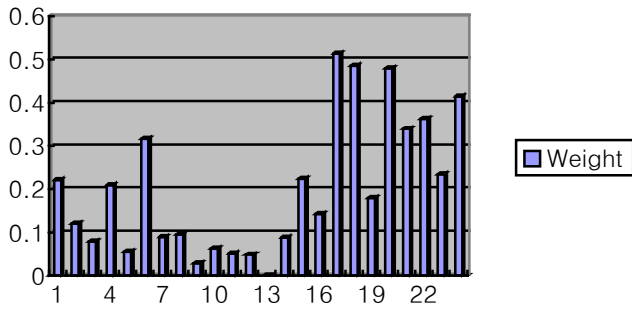


Figure 3. Weight of Each Subordinate Item⁹

1. Surrounding environment (parks, walking path, etc.)
2. Convenience of public facilities
3. Convenient shopping of daily necessities
4. Security/Safety
5. Prices of commodities
6. Quality of neighborhood
7. Conditions of surrounding environment like onsite green area
8. Apartment exterior/color
9. Play area for children and rest area
10. Exposure of apartment
11. Spacing between buildings
12. Building maintenance
13. Lighting
14. View
15. Internet accessibility
16. Accommodations for inhabitants
17. Investment
18. Convenient transaction
19. Floor space(area)
20. Connection and location of rooms
21. Convenient housekeeping
22. Inside Ventilation
23. Quality of air/water

According to the regression results, in the surrounding environment category, the weight for the quality of neighborhood(0.317) was the highest, and the weight for prices of commodities(0.0356) was the lowest. In the investment category, the weight for worth of investment(0.514) was much higher than that of convenient transaction, and in site plan category, internet accessibility had the highest weight of 0.224. In floor plan category, the connection and location of rooms, and in the interior/housing environment category, accommodations for inhabitants had the highest weight of 0.48 and 0.414, respectively.

3.2.3 Satisfaction Index Models for Each Category

Each of the subordinate category indexes that compose the consumer satisfaction index is formed by combining the factors which constitute the category indexes and their weights.

The categorical weights derived from survey results are shown in Figure 4.

Transportation was the most influential factor, whereas

interior finish/housing environment had the least effect on consumer satisfaction.

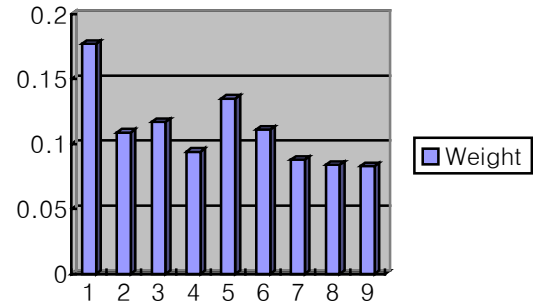


Figure 4. Weight of Each Category

1. Transportation
2. Housing and Surrounding Environment
3. School District
4. Investment
5. Brand name
6. Parking Lot
7. Site Plan
8. Floor Plan
9. Interior Finish/Housing Environment

3.2.4 Consumer Satisfaction Index Model

In this research, the surveyed level of consumer satisfaction is assessed with a referential value of 100. The consumer satisfaction index model is expressed as follows.

$$CSI = 0.477SI_1 + 0.371SI_2 + 0.025SI_3 + 0.029SI_4 + 0.0197SI_5 + 0.0192SI_6 + 0.0219SI_7 + 0.0204SI_8 + 0.0249SI_9 \quad (3)$$

SI₁: Transportation Category Index

SI₂: Housing and Surrounding Environment Category Index

SI₃: School District Category Index

SI₄: Investment Value Category Index

SI₅: Brand Name Category Index

SI₆: Parking Lot Category Index

SI₇: Site Plan Category Index

SI₈: Floor Plan Category Index

SI₉: Interior Finish/Housing Environment Category Index

3.3 Application of Consumer satisfaction Index Model

As mentioned above, recent researches show that apartment brand names have established themselves as an important factor in housing choice. Apartments with highly recognized brand names are dealt at a significantly higher price than those with lesser known brand names, despite having almost similar characteristics in categories other than brand. This research investigated whether these cost differences are proportioned to the overall consumer satisfaction. In addition, in order to examine the application of the model proposed in part 3.2. of this paper, the level of consumer satisfaction that comes from the difference in recognition of brand-names was compared using the model.

⁹ SPSS11.0 was used in analysis.

3.3.1 Assessment Results of Category Index

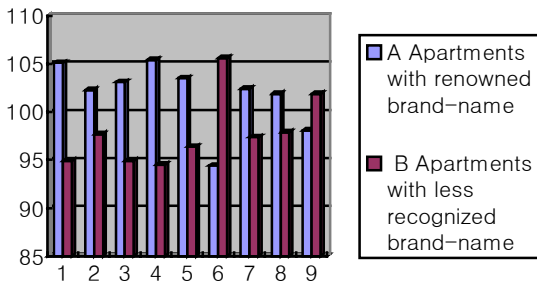


Figure 5. Assessment Results of Category Index

1. Transportation
2. Housing and Surrounding Environment
3. School District
4. Investment Value
5. Brand name
6. Parking Lot
7. Site Plan
8. Floor Plan
9. Interior Finish/Housing Environment

A survey was conducted on two apartment complexes that are identical in all categories except brand name. The results are shown in Figure 5.

As indicated in the bar chart, the apartment with the highly renowned brand name had a higher category index in all categories except the interior Finish/housing environment and parking lot categories.

3.3.2 Assessment Results of Consumer satisfaction Index

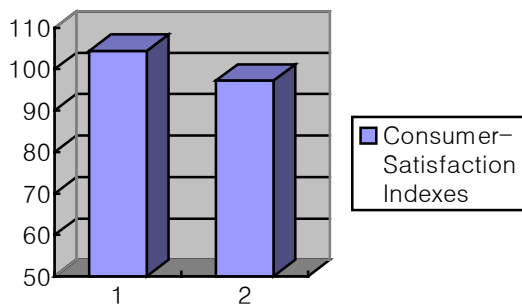


Figure 6. Comparison of Consumer satisfaction Indexes

1. A Apartment Complex with renowned brand name
2. B Apartment Complex with less known brand name

Comparing these two groups, it is clear that apartments with highly recognized brand names have a higher satisfaction index than those with less known brand names.

4. CONCLUSION

For the preparation of a general index in this research, the two-step method employing category indexes to calculate a general consumer satisfaction index was applied. In addition, for the preparation of category indexes, 27 factors

of 8 categories were selected from literature about POE and housing satisfaction.

These factors were integrated to yield a consumer satisfaction index model, shown below.

$$CSI = 0.477SI_1 + 0.371SI_2 + 0.025SI_3 + 0.029SI_4 + 0.0197SI_5 + 0.0192SI_6 + 0.0219SI_7 + 0.0204SI_8 + 0.0249SI_9 \quad (4)$$

- SI₁: Transportation Category Index
- SI₂: Housing and Surrounding Environment Category Index
- SI₃: School District Category Index
- SI₄: Investment Value Category Index
- SI₅: Brand Name Category Index
- SI₆: Parking Lot Category Index
- SI₇: Site Plan Category Index
- SI₈: Floor Plan Category Index
- SI₉: Interior Finish/Housing Environment Category Index

Using this index, we can estimate the level of satisfaction in several categories such as transportation, surrounding environment, school district, brand name, investment, parking lot, site plan, floor plan, etc. In addition, the combination of these indexes provides useful information about understanding the general level of consumer satisfaction with housing. This can also be a useful means in determining the consumer needs in future housing development projects.

In part 3.3 of this paper, we examined how the difference in the level of recognition of the brand name affected the level of consumer satisfaction by applying the consumer satisfaction index model. It was confirmed that consumers who chose apartments with highly renowned brand names had a higher level of satisfaction in almost all of the categories, compared to those who chose apartments with less known brand names.

Research concerning consumer satisfaction will be continuously needed in the construction field. The consumer satisfaction level estimated in this research is of 2005. Since the factors that affect the index are prone to change, continuous research complying to that change is required.

REFERENCES

- [1] Wolfgang F. Preiser, (poe) Structure Assessment Methods
- [2] Ahn Kyung Hwan(1998.03), POE Methods for Apartment Environment Planning
- [3] Kang In Ho(1998.07), Facts and Value of POE
- [4] Seo Yu Suk(1998.12), Theory of POE Research System
- [5] Kim Chi Hwan(2001.06), Correlated Application System of POE and BPE
- [6] Seo Kyung Hwa(2004), Application of QFD on Evaluation of Post-Residential Apartments
- [7] Chung Yung Geun, Indexation of Continuously Developing Factor