MEASURING BUILDING QUALITY OF SHOPPING CENTERS IN SURABAYA BY ANALYTICAL HIERARCHY PROCESS (AHP)

by:

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ABSTRACT

Quality has been an important factor for shopping centers in competitive conditions. However, quality measurement has no standard. In Surabaya, only two regional shopping centers will be measured in this research. The objective is assessing quality of shopping centers building using Analytical Hierarchy Process (AHP) method and calculating the Building Quality Index.

An overall ranking of Hierarchy priorities of quality criteria founded as a result from AHP analysis. Access and Circulation became the highest priority in affecting quality of shopping centers building according to respondents' perception of quality. Weightened value as a result from comparison between two shopping centers as follows: Tunjungan Plaza get 0,732 point and Surabaya Plaza get 0,268 point. The first shopping center got higher weight than the second shopping center. The BQI for Tunjungan Plaza is 66% and for Surabaya Plaza is 64%.

Keywords: Building Quality Index, shopping centers, Analytical Hierarchy Process (AHP), Surabaya

BACKGROUND

Nowadays, customer of modern shopping center not only concern about tenant mix and facilities provided in the shopping center but also Building Quality which provide comfortable environment for them. The building quality include the facilities, exterior and interior design of the building. Each elements has different importance level for the tenants. Neufert (1990) mentioned that size of shopping center would determine the required facilities and goods that are provided in the shopping center.

Measuring building quality is very difficult because it multi dimension perspectives. Multi Criteria Decision Making, such as: Analytical Hierarchy Process (AHP), could be utilized to solve this problem. AHP could be used for determining priorities and for measuring the building quality of shopping center.

This paper will build model of building quality factors of shopping center. AHP will be used to measure the influence of those building quality factors to the quality of shopping center. Building Quality Index of shopping centers in Surabaya are calculated base on the above factors and weight,

THEORETICAL FRAMEWORK

Yudiyanti (2002) identified important criteria in design a shopping center. In the main building, interior and exterior design, layout of shopping center, access, signage, HVAC (Heating, Ventilating and Air Conditioning System), electrical and lighting system are considered by architects in design process (Hall, 1988 and Arismunandar, 1995). Parking facilities, security system and other additional facilities are also vital factors in shopping center (Scott, 1989; Mc Cluskey, 1978; and Redstone, 1973). However, each criteria might not contribute the same weight for representing the building quality.

Therefore, a Multi Criteria Decision Making (MCDM) is necessary to measure building quality. MCDM could solve either Multi Objective Decision Making or Multi Attribute Decision Making.

Building quality measurement requires both quantitative and non-quantitative response. Analytical Hierarchy Process (AHP) is a suitable tool to include both tangible and intangible factors in decision making process. Moreover, AHP could be utilized to establish priorities in solving the Multi Attribute Problems.

Saaty (2001, p.23) mentioned that "AHP is used to derive ratio scales from both discrete and continuous paired comparisons in multilevel hierarchic structures". The initial hierarchy is the goal, then criteria and alternatives in the final level (see Figure 1). As a result, AHP produce priorities rank which indicate preference for each alternative.

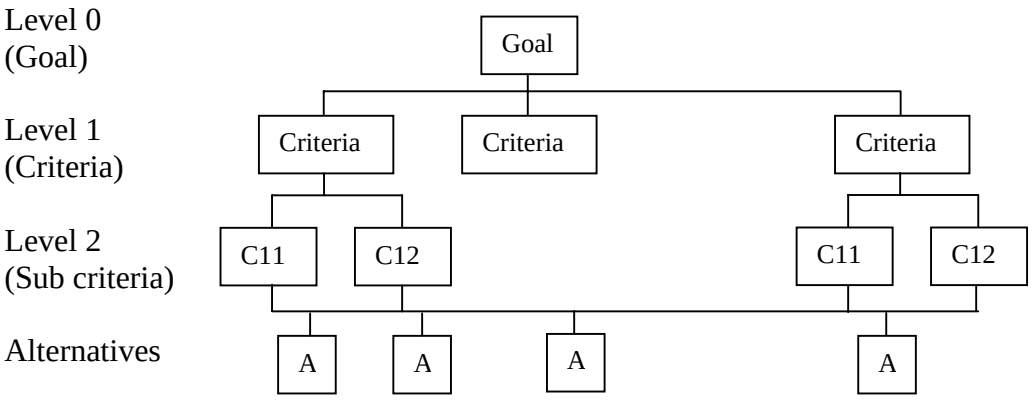

Figure1. Structure Model two level AHP with n factors and m alternatives
Source: Yudiyanti (2002, p.41) and Saaty (2001)

Ho (1999) and Ho (1997) utilized Analytical Hierarchy Process (AHP) to measure building quality of offices in Sydney. The office buildings were analyzed by six categories that are presentation, management, functionality, service, facilities, access and circulation. Each category was classified to five sub factors. This

study adopted similar factors with some modifications to suit the shopping center building characteristics.

A pairwise comparison adjustment in AHP is utilized for homogeneous elements. Table 1 shows the fundamental scale for calculating weight in comparative adjustment process.

Table 1 Fundamental Scale

Intensity of importance	Definition	Explanation
1	Equal importance	Two activities contribute equally to the objective
2	Weak	--- Between Equal and Moderate
3	Moderate importance	Experience and judgment slightly favor one activity over another
4	Moderate plus	--- Between Moderate and Strong
5	Strong importance	Experience and judgment strongly favor one activity over another
6	Strong plus	--- Between Strong and Very Strong
7	Very Strong or demonstrated importance	An activity is favored very strongly over another; its dominance demonstrated in practice
8	Very, very strong	--- Between Very Strong and Extreme
9	Extreme importance	The evidence favoring one activity over another is of the highest possible order of affirmation
Reciprocals of above	If activity *i* has one of the above numbers, when compared with activity *j*, then *j* has the reciprocal value when compared with *i*	If x is 5 times y, then y = 1/5 x

Source: Saaty (2001, P. 26)

The usage of above scales in a questionaire are shown in Figure 2. Each paired criteria (C1 and C2) is tested with 17 options.

C1	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	C2

Figure 2. Pairwise Comparison Model

Source: Yudiyanty (2002, p. 42)

Building Quality Index (BQI) is calculated by the below equation:

$$BQI = \sum_{i=1}^{6} \left(CategoryWeight * \frac{\sum FactorScore * FactorWeight}{\sum FactorWeight} \right)$$

RESEARCH METHODOLOGY

Problems are structured by theoretical framework for shopping center design and management. The multilevel hierarchic structures are evaluated by shopping center expert in Surabaya. This preliminary survey is conducted to include the designers', tenants' and shopping center managers' point a view.

As a result, the combination of determined factors/ criteria are used for setting up a questionnaire. The questionnaires are distributed to shopping centers' developer and tenants. Each respondent only compared two criteria at a time in pairwise comparison adjustments. Expert Choice software is used to synthesize the priorities.

Additional questionnaire is needed to determine the factor score (raw score). The questionnaire is multiple choice for 0 to 3. The explanation of raw score is shown in the Table 2.

Table 2. Factor Score of Quality Factors

Score	Definition	Explanation
0	None	Not applicable
1	Poor	Below average
2	Average	Average
3	Excellent	Above average

RESULT AND DISCUSSION

AHP model measure the building quality of shopping center in Surabaya could be seen in Table 3. The weight factors for all levels and alternatives are listed in Appendix. Total weighted value for Tunjungan Plaza (TP) is 0.732 and for Surabaya Plaza (SP) is 0.268.

Table 3. Quality Factors

Level 1 *Category*	Level 2 *Factor*	Level 3 *Sub Factor*	*Alternative*
1. Building Presentation	Exterior Design	Façade design	Tunjungan Plaza (TP)
		Main entrance design	
	Interior Design	Hall design	Surabaya Plaza (SP)
		Corridor design	
		Finishing material specification	
		Total floor	
2. Management	Security and access	Security and parking access control	
		Security and indoor access control	
	Maintenance	Cleaning service	
		Maintenance of services and access	
	Parking management		
3. Functionality	Structural design	Ceiling height	
		Column layout	
		Load	
	Room size	Corridor width	
		Public area	
		Shop size	
4. Service and Tenancy	Tenant mix		
	Effective space		
	Air Conditioning		
	Toilet		
	Power supply		
	Lighting system		
5. Access and Circulation	Circulation for person	Performance of elevator for shoppers	
		Circulation of vehicle in parking building	
		Escalator	
		Parking capacity	
	Circulation for merchandise	Merchandise lift design	
		Loading dock design	
	Accessibility	Location of parking space and access to main building	
		Accessibility to building	
	Signage		
6. Facilities	Garden		
	Restaurant, food court		
	Bank, ATM		
	Playground		
	Temporary store room		

Access and circulation has very important priorities for consumers and for developers, especially for signage. Signage is more important in Tunjungan Plaza than in Surabaya Plaza. The least important category is management and the least important sub factors from this category is cleanning service.

Table 4 and 5 show the calculation of BQI for Tunjungan Plaza. Table 4 shows the calculation of first category. The same calculation should be done for other categories. Furthermore, Table 5 uses all categories data and summation the score of BQI for Tunjungan Plaza. Then, the score is divided by 3 and multiply by 100% to get the final BQI. The final BQI for Tunjungan Plaza is 66%. The same calculation is utilized for Surabaya Plaza and the final BQI is 64%.

Table 4. Category Score calculation for Category one of Tunjungan Plaza

Category	**Raw Score (0-3.00) A**	**Factor Weight (0-1.00) B**	**Weighted Factor Score (0-3.00) A x B**
1. Building Presentation			
1.1 Exterior Design			
1.1.1 Façade design	2	0.012	0.024
1.1.2 Main entrance design	1	0.006	0.006
1.2 Interior Design			
1.2.1 Hall design	3	0.01	0.03
1.2.2 Corridor design	2	0.014	0.028
1.2.3 Finishing material spec.	2	0.005	0.01
1.2.4 Total floor	2	0.036	0.072
TOTAL		0.083	0.170
CATEGORY SCORE (1)			2.05

Table 5. BQI calculation for Tunjungan Plaza

Category	**Category Score (0-3.00) A**	**Category Weight (0-1.00) B**	**Weighted Category Score (0-3.00) A x B**
1	2.05	0.120	0.24600
2	1.44	0.112	0.16128
3	1.92	0.182	0.34944
4	2.54	0.113	0.28702
5	1.64	0.299	0.49036
6	2.51	0.174	0.43674
Overall BQI		1	1.97084
Percentage BQI			66%

CONCLUSION

Overall ranking for factors in building quality are listed below:

1. Access and circulation 0.299
2. Functionality 0.182
3. Facilities 0.174
4. Building presentation 0.120
5. Service and tenancy 0.113
6. Management 0.112

Tunjungan Plaza has better quality compare to Surabaya Plaza. The building quality is reflected by weight factors of each shopping center. The weight factors which are calculated by AHP, are 73.2 % for Tunjungan Plaza and 26.8 % for Surabaya Plaza. The BQI for Tunjungan Plaza is 66% and for Surabaya Plaza is 64%.

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Level 1 *Category*		Level 2 *Factor*		Level 3 *Sub Factor*		*Alternative* TP	SP
1. Building Presentation	0.12	Exterior Design	0.041	Façade design	0.022	0.012	0.01
				Main entrance design	0.018	0.006	0.012
		Interior Design	0.079	Hall design	0.012	0.01	0.002
				Corridor design	0.017	0.014	0.002
				Finishing material specification	0.006	0.005	0.001
				Total floor	0.044	0.036	0.009
2. Management	0.112	Security and access	0.047	Security and parking access control	0.023	0.018	0.005
				Security and indoor access control	0.024	0.018	0.006
		Maintenance	0.043	Cleaning service	0.017	0.013	0.004
				Maintenance of services and access	0.026	0.02	0.006
		Parking management	0.023			0.018	0.005
3. Functionality	0.182	Structural design	0.109	Ceiling height	0.046	0.037	0.009
				Column layout	0.034	0.021	0.014
				Load	0.029	0.016	0.013
		Room size	0.072	Corridor width	0.022	0.019	0.005
				Public area	0.018	0.016	0.003
				Shop size	0.032	0.027	0.005
4. Service and Tenancy	0.113	Tenant mix	0.015			0.013	0.002
		Effective space	0.021			0.017	0.004
		Air Conditioning	0.019			0.014	0.004
		Toilet	0.007			0.006	0.002
		Power supply	0.023			0.018	0.005
		Lighting system	0.028			0.022	0.006
Level 1		Level 2		Level 3		*Alternative*	

Category		*Factor*		*Sub factor*		TP	SP
5. Access and Circulation	0.299	Circulation for person	0.072	Performance of elevator for shoppers	0.012	0.009	0.004
				Circulation of vehicle in parking building	0.019	0.011	0.008
				Escalator	0.013	0.009	0.004
				Parking capacity	0.027	0.022	0.005
		Circulation for merchandise	0.029	Merchandise lift design	0.016	0.012	0.004
				Loading dock design	0.013	0.006	0.006
		Accessibility	0.051	Location of parking space and access to main building	0.031	0.02	0.011
				Accessibility to building	0.02	0.012	0.008
		Signage	0.147			0.125	0.022
6. Facilities	0.174	Garden	0.033			0.012	0.021
		Restaurant, food court	0.057			0.047	0.009
		Bank, ATM	0.029			0.006	0.022
		Playground	0.043			0.036	0.007
		Temporary store room	0.012			0.009	0.003