

# Measuring Perceived Service Quality for Intelligent Living Space Showroom – Living 3.0 in Taiwan

Ming-Wen Hsu, Yaw-Kuang Chen, Che-Ming Chiang, and Shin-Ku Lee

**Abstract**—This research explores visitor's expectations of service quality in intelligent living space showroom – Living 3.0 in Taiwan. Based on the five dimensions of PZB service quality, a specialist questionnaire is utilized to establish a complete service quality evaluation framework for Living 3.0. In this research, analysis hierarchy process (AHP) is applied to find the relative weights among the criteria. Finally, the service quality evaluation framework and evaluation results can be used as a guide for Living 3.0 proprietors to review, improve, and enhance service planning and service qualities in the future.

**Keywords**—Analysis Hierarchy Process (AHP), Service quality, Intelligent living space.

## I. INTRODUCTION

WITH the rapid development and popularity of the information and communication technology (ICT) in recent years, people's everyday lives have closely connected to the ICT. In view of this, at the Strategic Review Board (SRB) Meeting in 2005, the Executive Yuan, Taiwan especially focused on industry mix between the ICT industries (high-tech electronics, electrical engineering, materials, information and communication, etc.) and traditional construction industry. It discussed the issue of "the developmental strategies of intelligent living space", making use of present technical advantages in electrical engineering, electronics, materials, information, communication, automation and control industry to detect developmental trend and opportunities in the intelligent living space technology. Based on the conclusions of the SRB Meeting of the Executive Yuan in 2005, the Architecture and Building Research Institute (ABRI), Ministry of the Interior, Taiwan facilitates networking between Taiwan's ICT and construction industries, encouraging them to develop intelligent building. The result is the intelligent living space showroom – Living 3.0, demonstrating technology with a human touch to the public. It showcases the added comfort and convenience created by integrating buildings with intelligence.

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The launch aims to improve the overall living environment for citizens, as well as increasing the competitiveness and visibility of related domestic industries.

Living 3.0 represents a new era of intelligent living space, evolving from the eras of Living 1.0 and 2.0. Living 1.0 refers to the houses we have built that satisfy human needs. Living 2.0 refers to living with electronics, particularly household appliances we have invented. Living 3.0 refers to an intelligent lifestyle, which focuses on infrastructure, safety, healthcare, convenience, comfort, and sustainability.

The objectives of Living 3.0 are described as follows:

1. Provide our nationals with to experience the model of intelligent living space of or localized life, and for work requirements.
2. Demonstrate technical capability and development advantage of Taiwan, and open up the brand new niche of opportunity for the industry of living space.
3. Facilitate quality enhance of living space within the country to achieve the objectives of safety, security, health caring, convenience and coziness, and energy-conservation.
4. Fully display the objectives of niche advantage, competitive edge, universal design, and universal price regarding the industry of intelligent living space within the country.

Living 3.0 is a free-accessed exhibition center. At present, over 30,000 people have visited Living 3.0 since 2009. However, the concept of intelligent living styles has not been clearly understood and applied in real cases. To stand out in the ICT and Intelligent building industry, good service quality has become the most important issue in Living 3.0. Therefore, the purpose of this research is to discover what services must be offered by Living 3.0 to raise visitor satisfaction and to encourage visitor to use these technologies and facilities in their home. This research aims to evaluate and rank the service qualities of Living 3.0 from the visitor's standpoint using the evaluation criteria for service quality we established based on the five major dimensions of PZB service quality [1]. In this paper, an expert questionnaire survey was used to construct a hierarchy framework system for service quality assessment model. Questionnaire survey was conducted in order to complete an AHP pairwise comparison assessment [2, 3], with weighted factor dominant values and determined assessment criteria and priority of items.

## II. RESEARCH METHOD

This study used AHP as the research method for service quality assessment model. AHP considers multiple objectives or the standard decision method, and aims to divide complex problems into a hierarchy of several elements. This study was divided into two stages. First, opinions of five experts were collected, and complex factors of PZB service quality were simplified into an element hierarchy framework in order to construct an AHP hierarchy framework diagram for PZB service quality in Living 3.0. Next, in the second stage, nominal scale was used as a pairwise comparison basis of hierarchical elements and AHP questionnaires. After establishing a pairwise comparison matrix through questionnaire survey, the eigenvector of the matrix was determined. The eigenvector was used as priority of the elements; the eigenvector of the pairwise comparison matrix can be used to assess consistency of the matrix. The consistency can serve as the indicator for decision choices or reassessments. In this study, AHP was divided into six steps: (1) problem analysis and list of assessment factors; (2) construction of hierarchy framework; (3) establishment of pairwise comparison matrix; (4) determination of eigenvalue and eigenvector; (5) consistency check of pairwise comparison matrix; and (6) determination of weighting of factor dominant values.

## III. ESTIMATE MODEL CONSTRUCTION

### A. Definition of Estimate Model Framework

This study intended to construct the service qualities of Living 3.0 assessment model through AHP. First, a complex multiple-objective problem was expressed by a tree hierarchy, and was decomposed into various assessment criteria. The entire decision process was judged by criteria, sub-criteria, and the hierarchies, as proposed by different design schemes. This study selected assessment items that can reflect the characteristics of service quality in Living 3.0, with decidability, no repetitiveness, and independence as the selection criteria. According to the purpose and preference of visitors, the evaluation criteria of the service quality of Living 3.0 should be established in accordance with the different characteristics of the PZB dimensions, including tangibles, reliability, responsiveness, assurance, and empathy. To ensure that these criteria are representative and comprehensive, this research applied the Delphi method [4] to gather group opinions using specialist questionnaires. We were then able to add or delete criteria to ensure their suitability. This study divided an assessment framework into three layers, as shown in Figure 1. 'Tangibles' are the physical facilities, equipment, and appearance of personnel. When visitors walk into the Living 3.0, it is the interior decorations and hardware facilities which determine first impressions of the Living 3.0. In addition, website and visiting brochure appear to be the required items that influence visitors' perceptions of the tangible service qualities. 'Reliability' is the ability to perform the promised service dependably and accurately. The expertise for guide instructions and instant services provided by the service

personnel are also factors which should be taken into consideration. With regard to the dimension of 'responsiveness', the quick problem-solving ability of the service personnel is a good opportunity to impress the visitor. An exhaustive description of service items by the service personnel makes the visitor feel respected, and definitely enhances the visitor's appraisal of Living 3.0. Assurance is guaranteeing the process of performing services, such as a courteous and friendly attitude, at the right moment remind etc., not only fulfill the visitors' needs and increase their satisfaction, but also enhance the service quality of the Living 3.0. Living 3.0 should also provide additional services with regard to the dimension of 'empathy'. These can include special promotions, to allow the visitors with limited time to also enjoy the visiting, to bring more visitors to the Living 3.0. If the visitor is located in a remote district, whether the Living 3.0 provides a convenient traffic route suggestion will influence visitor desire to go to the Living 3.0. In addition, provision of assistance for those suffered an accident could raise the satisfaction level of customers.

### B. Questionnaire Design and Sample Analysis

After the construction of a complete hierarchy, AHP questionnaire design was conducted. The questionnaire contains seven parts, as follows, description letter, instruction for completion and examples, importance strength criterion, indicator hierarchy, explanation, and questions. In the subsystem, pairwise importance comparison was made. The measurement scale can be divided into five scales, namely, equal importance, weak importance, essential importance, very strong importance, and absolute importance, with assigned measurement values of 1, 3, 5, 7, and 9, respectively. Additionally, the five basic scales have four grades, assigned as 2, 4, 6, and 8. The scale to the left means that left factors are more important than the right factors. Contrarily, the scale to the right means the right factors are more important than the left factors. In the sample collection, because AHP adopted the expert questionnaire method, only the experts who provided replies to the questions were selected. An unconventional questionnaire survey applied quantitative statistics. A total of 10 questionnaires were distributed to academic research institutes and relevant governmental departments.

Questionnaire analysis used Power Choice to construct the above-mentioned assessment framework model, and then the judgment results of each respondent were input in a pairwise comparison matrix in order to calculate eigenvectors and eigenvalue for consistency, and to determine the relative weights of indicators. Weight results of each questionnaire were analyzed and the consistency ratio was tested, and then, was applied to data processing of one respondent. The consistency ratio was represented by an inconsistency ratio ( $I.R$ ), where the result should be smaller than or equal to 0.1. Consistency testing of overall questionnaire hierarchy depended on the overall consistency ratio of C.R.H. In this study, based on a critical value of  $\leq 0.1$ , consistency check was conducted for collected questionnaires. For these 10 effective

questionnaires, if *C.I.* of individual criteria was greater than 0.1 in pairwise comparison of indicators, weighing was not carried out for this item. After collection of the questionnaires, results of assessment items were analyzed. Hierarchy and weighted value of assessment items were normalized upon calculation and analysis. The results are shown in Table I. In the assessment indicators, the weight of “Tangible” (30.51%) was the highest, followed by “Assurance” (27.27%). The overall inconsistency ratio *I.R.* was less than 0.1, and the overall consistency ratio was  $C.R.H. \leq 0.1$ . The results show the overall hierarchy assessment is accepted.

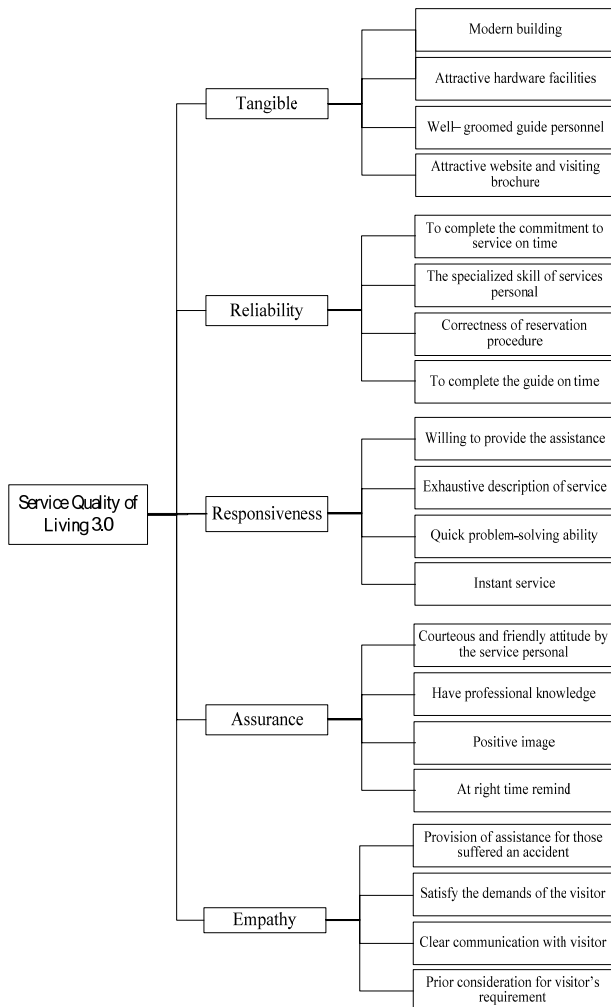


Fig. 1 The hierarchy tree for service quality of Living 3.0

#### IV. RESULTS AND DISCUSSION

The pairwise comparison results of the main criteria using AHP are illustrated in Table I. As seen, respondents suggested that “Tangible” is the most important factor, accounting for 30.51%. It is often discussed and taken into account in service quality. For Living 3.0 weak in the dimension of tangibles, enhancement of the landscape design and the appearance of

Living 3.0 and modification of the interior space, planning, and facilities layout to form a good impression for visitors is recommended.

Secondly, among all the assessment items, “Assurance” comprised 27.27%. With regard to the improvement of the dimension of assurance, Living 3.0 service personnel should focus on providing visitors with a pleasant experience.

According to weights, “responsiveness”, “Reliability”, and “Empathy” were sequenced from high to low. In regard to the dimension of responsiveness, it is suggested that more training programs and education for service personnel, to cultivate their abilities to solve customers’ problems efficiently and effectively, be provided. According to the assessment weights, experts and scholars believed that “Empathy” is the last factor to be considered in the case of service quality of Living 3.0.

The pairwise comparison results of sub-criteria under each assessment item and overall weight value are illustrated in Table I. The results are as follows:

1. Tangible: “Attractive hardware facilities” (60.96%) has the highest weight, the second is “Attractive website and visiting brochure” (17.13%), and the last is “Well-groomed guide personnel” (10.92%).
2. Reliability: “The specialized skill of services personal” has the highest weight (47.47%), followed by “To complete the commitment to service on time” (20.76%), “To complete the guide on time” (18.10%), and “Correctness of reservation procedure” (13.68%).
3. Responsiveness: “Exhaustive description of service” (46.12%) has the highest weight, followed by “Willing to provide the assistance” (32.31%), “Quick problem-solving ability” (13.70%) and “Instant service” (7.84%).
4. Assurance: “Have professional knowledge” has the highest weight (47.69%), followed by “Courteous and friendly attitude by the service personal” (26.41%), “Positive image” (17.61%) and “At right time remind” (8.29%).
5. Empathy: “Clear communication with visitor” had the highest weight (35.81%), followed by “Satisfy the demands of the visitor” (31.50%), “Prior consideration for visitor’s requirement” (17.33%) and “Provision of assistance for those suffered an accident” (15.40%).

Finally, the overall weight can be defined as the product of weight assessment items and weights of its assessment criterion, with ranked values, as shown in Table I. Based upon the overall weight, relative importance of all the assessment sub-criteria for service quality of Living 3.0 can be known. The value of “Attractive hardware facilities” (18.60%) ranked the first, followed by “Have professional knowledge (13.00%)”, “Courteous and friendly attitude by the service personal (7.20%)”, “Exhaustive description of service” (7.19%), and “The specialized skill of services personal” (6.90%).

#### V. CONCLUSION

This study used AHP of multiple decision analysis and attempted to suggest an assessment decision method for the evaluation of service quality in the intelligent living space showroom– Living 3.0. In this study, the questionnaire results

showed that, the highest priority is given to “Tangible” in assessment criteria priority, followed by “Assurance”, and “Responsiveness”. “Empathy” is the last factor to be considered. In the relative importance of all assessment sub-criteria for service quality of Living 3.0, the “Attractive hardware facilities” (18.60%) ranked the first, followed by “Have professional knowledge (13.0%)”, Courteous and friendly attitude by the service personal (7.20%), “Exhaustive description of service” (7.19%), and “he specialized skill of services personal” (6.90%). The proposed results are expected to provide a valuable reference for Living 3.0 proprietors to

review, improve, and enhance service planning and service qualities in the future.

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TABLE I  
RELATIVE PRIORITIES OF THE SELECTION CRITERIA OF SERVICE QUALITY IN LIVING 3.0

Objective level	Local weight (1)	Local Priority	Sub-criteria	Local weight (2)	Local Priority	Global weight (3=1x2)	Global Priority
Tangible	30.51%	1	Modern building	10.99%	3	3.36%	11
			Attractive hardware facilities	60.96%	1	18.60%	1
			Well-groomed guide personnel	10.92%	4	3.33%	12
			Attractive website and visiting brochure	17.13%	2	5.23%	6
Reliability	14.54%	4	To complete the commitment to service on time	20.76%	2	3.02%	13
			The specialized skill of services personal	47.47%	1	6.90%	5
			Correctness of reservation procedure	13.68%	4	1.99%	18
			To complete the guide on time	18.10%	3	2.63%	14
Responsiveness	15.59%	3	Willing to provide the assistance	32.31%	2	5.04%	7
			Exhaustive description of service	46.12%	1	7.19%	4
			Quick problem-solving ability	13.70%	3	2.14%	16
			Instant service	7.87%	4	1.23%	20
Assurance	27.27%	2	Courteous and friendly attitude by the service personal	26.41%	2	7.20%	3
			Have professional knowledge	47.69%	1	13.00%	2
			Positive image	17.61%	3	4.87%	8
			At right time remind	8.29%	4	2.26%	15
Empathy	12.10%	5	Provision of assistance for those suffered an accident	15.40%	4	1.86%	19
			Satisfy the demands of the visitor	31.50%	2	3.81%	10
			Clear communication with visitor	35.81%	1	4.33%	9
			Prior consideration for visitor's requirement	17.33%	3	2.10%	17

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