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A Method to Evaluate and Manage Client Requirements in Housing Projects

Jose de Paula Barros Neto, Yves Rabelo Mourao, Ana Augusta Ferreira de Freitas, Thais da Costa Lago Alves

ABSTRACT

Construction companies have been increasingly using questionnaires to understand their client requirements and to evaluate these clients' satisfaction regarding the products they offer. The companies' goals are twofold: improving the quality and performance of their products and complying with the government's demand for higher quality standards for housing projects. Along these lines, this paper discusses a method developed by researchers of the Federal University of Ceará (Fortaleza, Brazil) to evaluate and manage client's requirements in housing projects. The method was initially based on a qualitative research project developed at NORIE (UFRGS/Brazil) and was enhanced by the authors through the use of quantitative methods and tools (i.e., questionnaires, statistics) allied to qualitative methods (i.e., interviews, photos, direct observation). The authors discuss how the method evolved, its component parts, and the lessons learned during its use to collect data on more than 800 housing units in different projects.

KEYWORDS: Clients Needs Assessment, Housing, Brazil

1.1 INTRODUCTION

Construction companies have been increasingly interested in assessing their client's needs for housing projects as a means to provide solid information for new product development. Client's needs assessment questionnaires have been used by researchers as a tool to collect data that

helps in understanding client's needs and helps companies to develop products that are a better match to the client's needs.

The government aims to offer quality housing units, and construction companies aim to develop and build these projects according to governmental guidelines while making these an attractive source of profits. In this scenario, universities and their researchers help construction companies and the government by developing scientific studies to assess client's housing needs aiming at improving the quality of data collection and analysis.

Along these lines, GERCON, a construction research group in the Federal University of Ceará (UFC), has participated in a series of projects aiming at studying client's requirements for housing projects. In four years, the group has collected data from approximately 800 client's needs assessment questionnaires. The questionnaires were answered by clients in different income groups about housing units built by construction companies of different sizes. These four years of work resulted in a model which is explained in this article.

The article reviews the literature and the concepts used to develop the model. Two models used in client's needs assessment in construction are discussed. Finally, the article concludes with an explanation of the model.

1.2 LITERATURE REVIEW

1.2.1 Measuring Client's Satisfaction through Questionnaires

Satisfaction can be understood as a person's feelings resulting from the performance of a product as compared to this person's expectations (Kotler, 2000). Matching or exceeding the client's expectations result in a satisfied client. This can reflect on how loyal a client becomes to a provider or a brand and result in higher sales volumes, lower levels of sensitivity to price, and generates positive comments about the provider and the brand.

According to Speare cited in Freitas (2000), a person is satisfied with its housing when the housing conditions are not close to what researchers call "environmental stress", which is defined by Wolpert cited in Freitas (2000) as the discomfort in a level above the acceptable. According to the cited authors, the discomfort has the following causes: lack of safety, tranquility and green areas; traffic congestion and other causes that cause family mobility.

Cunha et al. (1998) stress that some studies on client's satisfaction ignore the level of importance different variables have for the client. By doing so, such types of research ignore basic principles of Marketing research such as market segmentation.

Questionnaires can be used to assess clients' needs and capture the importance different attributes have for the clients. Questionnaires can capture both quantitative and qualitative data, they help an organization to focus its attention on the clients and how they perceive the products and services it offers (Hayes, 2001). The first step to develop a questionnaire

to assess client's needs is to identify clients' needs regarding a product or service. These needs should be taken into account in the following phases to develop the questionnaire: development, evaluation, and use (Hayes, 2001).

1.2.2 Clients' Participation in New Product Development

Well developed costumer services consider how a client uses a product. Researchers can understand how clients behave and use a product by understanding the experiences a client goes through while using the product. This allows organizations to perceive what clients expect from the products and services they provide (Davis et al, 2001).

Hino and Melhado (1999) suggest that information used for product development purposes in the housing sector should be classified into two segments: data from interviews with users, and technical information from inspections in the housing units. According to these authors, information obtained from interviews with housing units users are used to feed the design process. This kind of information is used by designers to develop products that meet clients' requirements. Interviewing housing unit users brings new information for designers such as: types of changes made in the unit, size of rooms, how comfortable clients feel regarding a project, localization, among other factors.

Data from technical inspections can be directed to a data base kept by the engineering department. This data can be compared with the clients' requirements and the performance defined for the housing unit (Hino and Melhado, 1999).

1.2.3 Post-occupancy Evaluation

According to Brandstetter and Heineck (2004), the post-occupancy evaluation technique provides feedback about construction systems, which may cause clients' satisfaction to decline when problems occur, i.e., electrical, plumbing, and piping systems, and the unit's internal comfort.

According to Romero and Vianna (2002), the guidelines to develop a functional post-occupancy evaluation are:

- Contact the organization to identify the projects to be evaluated;
- Obtain socio-economic data and the project design;
- Visit the place to visualize and photograph the area;
- Formulate and apply questionnaires for a pre-test;
- Define the sample to be evaluated;
- Develop and apply the final version of the questionnaires;
- Analyze the design and specifications for the project;
- Pre-test the inspection checklists for technical aspects of the project;
- Apply the inspection checklists for technical aspects of the project;
- Compare the level of client's satisfaction against the technical performance of the building;

- Discuss results with the organization that requested the study;
- Write the final report;
- Make recommendations for future projects with similar characteristics.

However, this technique does not detect the causes that contribute to the client's declining levels of satisfaction and the search for new spaces to live. Therefore, other methods should be used alongside the post-occupancy evaluation to provide better scenarios regarding the clients' level of satisfaction regarding the unit evaluated.

1.2.4 Scales

Cooper and Schindler (2003) state that scales are used to judge objects without comparing them to other similar objects. According to these authors, scales can be classified as: simple categories; multiple choice with single or multiple answers; Likert; semantic differential; numeric; list with multiple classifications; constant sum; Stapel's; and graphic. In order to make the interviewee's answers more precise, research on client's satisfaction for housing projects use the Likert and numeric scales.

The Likert scale represents a group of statements that are presented to the interviewees so that they can agree or disagree with them. However, in the Likert scale, every answer has a number that reflects a certain level of agreement/disagreement regarding the statement presented and measures how strongly the interviewee agrees or disagrees with the statement (Mattar, 1996). A problem that may happen with the use of the Likert scale is the need to explain values every time a new statement is presented; this makes the questionnaire repetitive and prone to errors.

The numeric scale stands as an alternative to the Likert scale. According to Cooper and Schindler (2003), the numeric scale has similar intervals and the definition of its values is represented by the extreme values. In general, there are five, seven or eleven points. This scale allows for an absolute measurement of the item being investigated as well as an absolute comparison of this item with others in a questionnaire. This is a popular scale as it provides simple and linear answers.

1.2.5 Multi-dimensional Scaling

According to Malhotra (2001), the multi-dimensional scaling (MDS) graphically represents interviewees' perceptions and preferences. The relationships among the data are represented geometrically by dots in a multi-dimensional space. This technique has been used in Marketing research for different purposes, i.e., market segmentation, new product development, price analysis (Malhotra, 2001). According to Cooper and Schindler (2003), the MDS helps a researcher to understand constructs, i.e., quality, satisfaction, and desire, through the similarity and proximity of Cartesian points in a multi-dimensional space.

Slack et al. (1997) presents an example of multi-dimensional scaling used to assign priority to improve a defined project factor. The result of this analysis is an importance-performance matrix (Figure 1.1). The matrix positions each factor in different zones of priority as shown in Figure 1.

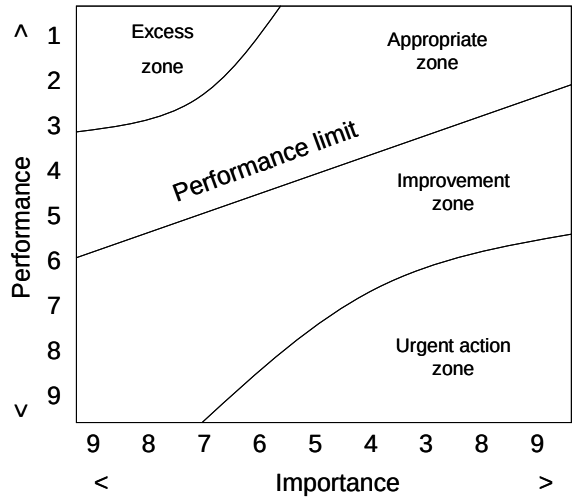

Figure 1.1 Importance-Performance matrix (Adapted from Slack et al., 1997)

1.2.6 Other Models Analyzed

Two other models to evaluate client's requirements developed by Miron (2002) and Leite (2005) were analyzed. Both researchers have worked on client's needs assessment research at NORIE, a construction research group at UFRGS (Porto Alegre, Brazil). Miron (2002) interviewed clients in housing and commercial projects. Two housing projects comprising respectively 25 and 7 housing units were investigated, totaling 28 people interviewed. Initially, the researcher applied a questionnaire subdivided in three main parts: open questions (comments, unit number, time living at the unit); closed questions (yes or no questions); and scaled questions (a five item scale varying from very unsatisfied to very satisfied). The questionnaire used by Miron aimed at investigating the costumer service provided by the construction company that had built the projecs, the quality of the projects as a whole, the quality of the housing units, and the global evaluation of the state. According to Miron, the results obtained unveiled the client's needs and expectations to be met in new housing projects.

Leite (2005) adapted Miron's (2002) questionnaire for low-income housing projects and discussed the adapted questionnaire with managers and engineers of the agency that had funded the housing projects

analyzed by both researchers. Leite also pre-tested the questionnaire with a group of clients. She innovated by including questions related to the client's profile, i.e., gender, level of education, number of people sharing the housing unit, number of kids, ownership of cars. She also included an open question to investigate the kinds of changes the client would like to carry out to modify the housing unit.

Both Miron (2002) and Leite (2005) investigated the aspects that clients had liked and disliked most and grouped the answers in a Pareto graph. Leite (2005) also used cluster analysis to analyze the data.

1.3 THE PROPOSED MODEL (GERCON'S MODEL)

The proposed model was developed based on the aforementioned studies in the literature review section. The model was enhanced through the use of Marketing research concepts and adapted to the needs of different research projects carried out by GERCON, which is a construction management research group at Federal University of Ceará, Fortaleza, Brazil.

Figure 1.2 presents the sequential phases followed in the model development and how critical aspects of the model evolved. The phases are discussed in detail in the following items.

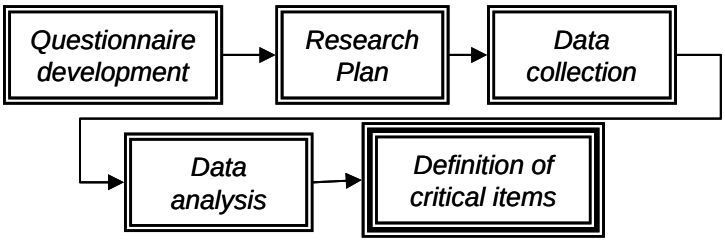

Figure 1.2 Phases of the model development

1.3.1 Questionnaire Development

The first questionnaire used by GERCON researchers was developed based on Miron's (2002) questionnaire with minor changes: an importance scale was included to understand how much the client valued different items. This innovation was analyzed alongside satisfaction levels and allowed a multi-dimensional scale analysis. Other innovations were: the use of the Likert scale to allow for statistical analysis; questions related to localization of the project, relationship between the client and the organization that had built the project. Finally, changes were made to accommodate regional expressions and terminology adopted in Fortaleza (Northeast Brazil) as opposed to those of Porto Alegre (Southern Brazil) where Miron and Leite had developed their work. At the end of the

questionnaire sheet, there was a field to register comments, suggestions or complaints of the interviewee regarding the project analyzed.

The questionnaire tackled different aspects of the housing units, i.e., fitness to use and finishing, external look, safety, localization, parking spaces, comfort, total area of the unit, as well as questions on windows and doors, electrical and piping systems.

The major difference of this questionnaire when compared to others previously used by the group, e.g., Miron's (2002) questionnaire, was the inclusion of a Likert scale to measure the client´s level of satisfaction with different items (Figure 1.3). In the end of this new questionnaire, clients had to list five items that they had liked the most and five items that they had disliked the most about the housing unit. Finally, the questionnaire had room to include pictures that would aid on the description of important facts noticed by the researchers or pointed by clients.

Rate your level of satisfaction regarding this item		
Very unsatisfied	0 1 2 3 4 5 6 7 8 9 10	Very satisfied
Rate the level of importance this item has for you		
Not important	0 1 2 3 4 5 6 7 8 9 10	Very important

Figure 1.3 Likert scale used in the questionnaire

1.3.2 Research Plan

After the questionnaire had achieved its final form, GERCON researchers met with construction companies' representatives to define the best times to carry out the client's satisfaction interviews. The group defined that the housing units should be visited two years after being handed over to their owners. At this point, clients had already gone through all the excitement phase that follows the housing acquisition and should be ready to discuss how adequate the unit was to their actual needs.

The initial population to be investigated with the new questionnaire comprised 938 units located in three different projects built by a single construction company. The 95% confidence level was chosen in order to define a reliable sample to carry out the interviews; as a result 273 households should be visited.

1.3.3 Data Collection

A group of Civil Engineering undergrad students was trained to apply the questionnaires. During the training session, GERCON researchers went through the questionnaire to explain each of its parts to the students as well as to answer the students' questions. After the training session, students were ready to carry out the interviews by themselves.

Before holding the interviews, each building manager was contacted to facilitate the researchers' access to the housing units. Also, the researchers were helped by doormen who used to schedule visits with

some of the projects' residents. Interviews were usually carried out at night and during weekends when residents were at home. The units were randomly chosen and indicated on a plan, which was given to each researcher. After data had been collected, results were inserted on an Excel® spreadsheet for analysis.

1.3.4 Data Analysis

The collected data was organized in a spreadsheet and their average values were calculated. Figure 1.4 shows the table used to analyze the average values obtained and to compare them to overall values for each item of the questionnaire and for the project as a whole.

The first column indicates the questionnaire items followed by the average values obtained for each item regarding the clients' level of satisfaction (column 2) and importance (column 3). Delta values, indicated on column 4, represent the difference between the levels of satisfaction and importance. Column 5 shows the pair of values (satisfaction, importance) to be indicated in the satisfaction-importance matrix. For instance, F.1-2 indicates that the average values obtained for the item fall within 1 and 2 standard deviations, whereas F.3-N indicates values are located above three standard deviations. On the upper right-hand corner, the value 0.92 indicates an index calculated for the entire condominium followed by the index for the item (-1.00). The maximum values for the deltas and the indexes are -10 and +10. The table also shows the average values relative to satisfaction and importance for each item and for the entire set of data.

Data analysis can be carried out in two different ways: by analyzing only the satisfaction average values or the indexes that relate satisfaction and importance. By using the second method, a detailed analysis can be carried out taking into account the client's priorities and requests, in addition to how satisfied or unsatisfied the client is with a specific item. It is worth mentioning that the benchmark for the deltas and the indexes is zero. In this case, there is a perfect relationship between what was expected and how satisfied the client is regarding an item.

When analyzed in an isolated fashion, the satisfaction ratings translate the products and services' quality as perceived by the client. Experts should adjust their design and specifications to meet the client's demands. The importance ratings translate the client's expectations regarding an item, or how important it is for the client's daily needs. Then, marketing experts should analyze importance ratings to check which items are more appropriate for different client profiles so that a perfect match between satisfaction and importance ratings (indexes and deltas equal zero) can be achieved.

		Condominium		***Index***	***0.92***
(1)	(2)	(3)	(4)	(5)	(6)

1. Condominium items and fitness to use	**Satisfaction**	**Importance**	**Delta**	**Graph**	**-1.00**
1.1 Acess (street, gates, sidewalk)	8.80	9.76	-0.96	F.1-2	
1.2 Parking lot and garages	8.08	9.44	-1.36	F.1-2	
1.3 Elevators	6.40	9.44	-3.04	<<F.3-N>>	
1.4 Recreation room	8.76	8.72	0.04	Central	
Average for the item	**8.05**	**9.05**			
(…)	(…)	(…)	(…)	(…)	
10. About the construction company	**Satisfaction**	**Importance**	**Delta**	**Graph**	**0.46**
10.1 Relationship during the construction phase	9.71	9.86	-0.14	Central	
10.2 Trustworthiness regarding time and compromises	9.05	9.95	-0.90	Central	
10.3 Engineers' and company employees' engagement to answer clients' demands	9.62	9.95	-0.33	Central	
Average for the item	**9.46**	**9.92**			
Global Average	**8.61**	**9.53**			
Standard Deviation	**1.07**	**0.70**			

Figure 1.4 Questionnaire items analyzed

1.3.5 Satisfaction-Importance Matrix

The first analyses of the questionnaire included the tabulation of frequencies for satisfaction and importance as the sole means of analysis. Later, the research group decided to carry out a cross-analysis including satisfaction and importance sets of data to develop matrixes including both ratings. The use of the multi-dimensional scale (MDS) technique (Slack et al., 1997) allowed researchers to analyze both satisfaction and importance data in a single matrix.

The analysis of the satisfaction-importance matrix is based on the concept of achieving the client's satisfaction while generating profits for the organization (Glynn and Jones, 2003). Experts and top-level management can define which items or features can be eliminated from a product or service without affecting the client's satisfaction. Glynn and Jones (2003) state that the main challenge for organizations is to understand how each of the product's or service's characteristics will influence the clients' behavior and their tendency to buy their products.

The analysis of the Satisfaction-Importance matrix (Figure 1.5) is carried out based on the following rules:

- Items with high values of deltas, expressed by the difference between satisfaction and importance ratings, represent an unbalanced pair of ratings, i.e., high importance, low satisfaction and vice versa. Therefore, these items should be analyzed carefully.
- Average values falling on the central diagonal represent a perfect match between satisfaction and importance; thus, the closer averages are to the central diagonal the better.
- The parallel lines to the central diagonal represent the limits defined by 1, 2, and 3 standard deviations for each side. Critical items are identified through the analysis of the items located in different areas inside and outside the diagonals
- Priorities, i.e., items that need action (1 meaning urgent action), are defined as: 1. averages beyond three standard deviations (F.3-N); 2. averages between the second and third standard deviations (F.2-3); 3. averages between the first and second standard deviations (F.1-2).

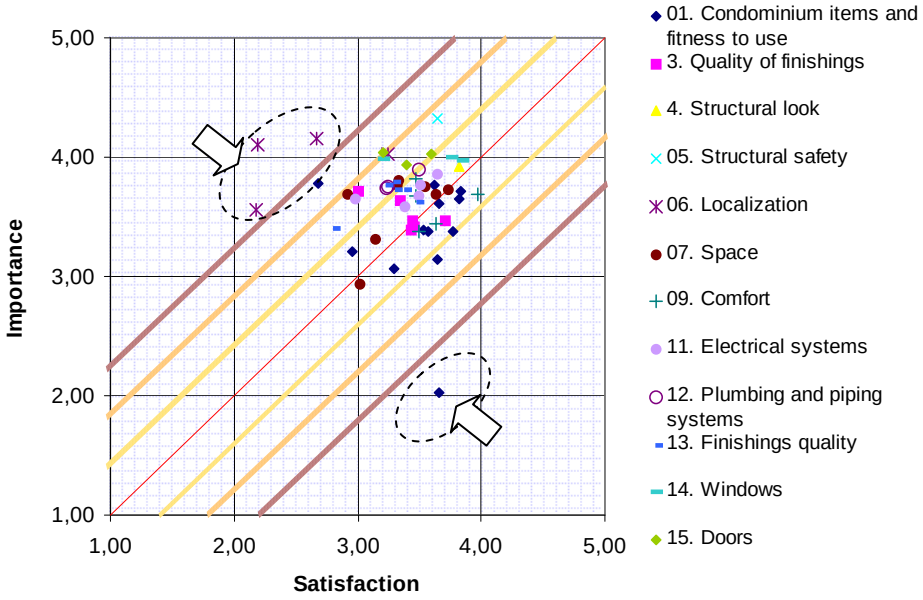

Figure 1.5 Satisfaction-Importance matrix

The analysis of figure 1.5 reveals that the localization of the project is very important for the clients; however, they indicate low levels of satisfaction regarding this item. The satisfaction vs. importance pair for this item falls outside of the three standard deviation limit. Another item that should demand more attention from the designers and top managers is related to the “condominium items and fitness to use”. This item received a low

importance rating and a high satisfaction rating, in other words, the organization invested in an item that the client does not really value. In the particular case shown in Figure 5, the construction company had included a sauna in a low-income housing project, and the item was not valued by clients. Based on these examples, we can attest the importance of the satisfaction-importance matrix as a tool to analyze the questionnaire results and to guide decisions regarding new product development in construction companies.

1.3.6 Qualitative analysis

The items that have presented the highest deltas or those pointed out as important ones by clients are selected to go through a detailed analysis. All the ratings regarding the item as well as the qualitative information gathered from the interviews and direct observation (including pictures) are analyzed together. This qualitative-quantitative analysis provides a broader understanding of both sets of data, i.e., numbers and words, gathered during the interview process and allows for a better informed decision-making process regarding new product development.

1.4 CONCLUSIONS

This article presented a method developed by a construction research group (GERCON) to carry out client's satisfaction research on housing projects. The model was based on previous work developed by Miron (2002) and Leite (2005) and included new items to allow for statistical and multi-dimensional analysis. The use of a Likert scale and questions regarding the importance each item had for the client are among the main innovations proposed by GERCON's questionnaire.

The satisfaction-importance matrixes that resulted from the analysis were used in conjunction with data regarding the client's profile to provide information to guide the development of new housing projects. The use of the data collected and its analysis allows for a higher level of integration between different sectors in a construction company and the development of products that are a better match to the client's requirements.

Other types of analysis, i.e., Chaid and Crosstab, have been tested to describe large populations. However, qualitative research is necessary to fill in the gaps that remain unanswered after a quantitative data analysis. The group has been testing new ways to analyze data collected with the method presented in this paper and intends to write about these results in future papers.

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