APPLYING SERVQUAL FOR ASSESSING INTERNAL QUALITY OF MAINTENANCE SERVICE – ANALYSIS OF THE RELIABILITY AND VALIDITY OF THE INSTRUMENT

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Abstract. *The importance of measuring internal customer satisfaction on the business profitability has motivated researchers to deepen into the subject. This work consists in an application of the instrument SERVQUAL for measuring internal customer satisfaction. SERVQUAL is an instrument for measuring service quality based on the difference between expectation and performance using a number of service quality dimensions. This paper presents the results from checking the reliability and validity of the instrument in order to apply it for assessing internal service quality supplied by the maintenance department to the manufacturing cells of an industrial unit. The company where the study is to be applied is engaged in the manufacture of industrial, professional and consumer products including saws, precision tools and measurement instruments. By statistical analysis, the findings of this research showed that reliability and validity is satisfactory. This is the first and necessary step to apply SERVQUAL for measuring service quality of internal customer.*

Key-words: *Quality dimensions; service quality, internal customer, SERVQUAL*

1. INTRODUCTION

Service quality is one of the major issues facing operations managers[1]. The economy of many western nations has become a service economy. For example, in the USA service accounts for approximately three-quarters of the gross domestic product (GDP) and nine of the tem jobs the economy creates[1]. In other countries like Brazil, service correspond to more than 52% of the GDP[2].

In this context, extensive research has been conducted on the characteristics and quality of organizational effectiveness from the perspective of those who are the organization's external customers[3-8]. Much less has been reported about organization effectiveness from the perspective of internal customer satisfaction. Nevertheless, a number of published materials is available[9-12].

Measuring internal quality service is relevant because to attain sustained excellent external customer support requires internal systems that are aligned to serve the external customer, with each internal subsystems adding value to others within the organization. So, effective internal supplier-

to-customer relations are essential requirements of quality service that yield sustained external customer satisfaction, loyalty, retention and long term financial success[11].

In this sense, the purpose of this article is to present the reliability and validity of a SERVQUAL instrument, used to apply it for measuring quality of an internal maintenance service in a manufacturing company. To do so, a conceptual background is initially presented to provide an overview on SERVQUAL concept and internal service quality assessment. Then, the research methodology is presented in addition to some preliminary results. The findings show that the instrument is indeed reliable to capture the characteristics of internal customer service by using a set of understood quality dimensions.

2. CONCEPTUAL BACKGROUND

Service quality assessment is a relatively young discipline only boasting about three decades of research. Research initiatives have been mainly related for measuring external services, i.e. assessing service experience in terms of outcome of the service under the customer perspective. The models for measuring external service quality is either viewed as the degree of discrepancy between consumers' perceptions and expectations[5] or by assessing the perceived quality[13]. Yet, further alternative models have been offered by other authors[6,14]. A literature review on these models can be found in Miguel and Salomi (2004). One of the mostly applied instrument is SERVQUAL (see Parasuraman et al. [5]). It consists of a 22-item instrument for assessing customer's perceptions, defined by: [5]

$$Q = P - E \quad (1)$$

In equation (1), Q represents the perceived quality, P and E are, respectively, the ratings on the corresponding perception and expectation statements (in the questionnaire instrument). The perceived quality is assessed based on service quality dimensions. These dimensions correspond to the criteria used by consumers in assessing service quality. There are 10 potentially overlapping dimensions: tangibles, reliability, responsiveness, communication, credibility, security, competence, courtesy, understanding/knowing the customer, and access. A description of the those dimensions can be found in Parasuraman et al.[4] as well as in Miguel and Salomi[2]. These dimensions were reduced to five (tangibles, reliability, responsiveness, assurance, empathy) as illustrated in Figure 1.

The specification of service quality is the gap between customers' expectations and perceptions[4]. After introducing SERVQUAL, a two-part instrument developed for measuring service quality[5], and latter refined[15], there has been a extent debate whether the perception-minus-expectations specification would be appropriated or assessing perception alone would be sufficient. Some concerns about the SERVQUAL instrument were raised by Cronin and Taylor[6] and Teas[13]. In response, Parasuraman et al.[15] claimed that many of those concerns are questionable and offered a set of research directions for addressing unresolved issues and adding to the understanding of service quality assessment.

Despite the criticism against SERVQUAL, a great number of publications have become available. The large majority of those deals with measuring service quality under the point of view of a external customer. Then, there has been an effort to attempting to use the SERVQUAL instrument to measure internal service quality. Some of these investigations are described next.

SERVQUAL DIMENSIONS					
Original 10 Dimensions	Tangibles	Reliability	Responsiveness	Assurance	Emphaty
Tangibles					
Reliability					
Responsiveness					
Competence					
Courtesy					
Credibility					
Security					
Access					
Communication					
Understanding the Customer					

Figure 1. Correspondence between SERVQUAL Dimensions and Original Ten Dimensions for Evaluating Service Quality[16].

2.1 Measuring Internal Service Quality

For the past years, one of the issues which has attracted a great deal of attention has been the concept of measuring internal service quality, which motivated researchers to conduct studies on internal service quality. Some of these experiences are described in this section.

Kuei[10] proposed a model to describe the interactions between internal organizations and process they serve. An empirical study is conducted based on such a model. The author identified determining variables for internal service quality such as quality-oriented climate, problem resolution capability, keeping customers' best interests in mind, and instilling customers' confidence. The author concluded that SERVQUAL instrument (without the tangible dimension) is useful for evaluating internal service quality.

Gilbert[11] identified two empirically derived measures of internal customer support used to access team effectiveness from the perspective of the team's internal customers. The measures, personal service and technical competence, were based on analysis of the responses of 465 individuals representing 150 internal customer teams. The findings revealed that members of work teams tend to over estimate the effectiveness of their team's performance when compared with the ratings the same teams received from their internal customers.

Frost and Kumar[17] developed a conceptual model called INTSERVQUAL, based on the SERVQUAL scale proposed by Parasuraman et al.[5]. The study was conducted in a major international airline for measuring expectations and perceptions of internal customers. According to the authors, the two scales exhibited adequate validity as separate measures of front-line staff (customer-contact personnel) expectations of support services and their perceptions of the support staff's performance. The results indicated that the scales can be successfully used to assess the magnitude of the gap between front-line staff perceptions and expectations.

Kang et al.[12] described an attempt to use the SERVQUAL (see Parasuraman et al. [5]) instrument as a tool for measuring internal service quality. The study modified the instrument for a service setting. It has been empirically tested and confirmed that it is appropriate for measuring internal service quality.

As can be seen in the previous experiences, most of the applications makes use of SERVQUAL instrument. Therefore, this investigation can also be considered as an attempt to use it for measuring internal quality service provided by a maintenance department in a manufacturing company. Next section outlines the research methodology to conduct such study, from which results are presented later.

3. RESEARCH METHODOLOGY

Data were collected from employees working at a manufacturing company which produces and sells 5,000 items such as precision tools and gages, saw blades and accessories, metrology systems (optical comparators, CMM systems, video measuring systems), construction tools, webber gauge blocks, granite products as well services (calibration and repair). It is a private American company with a work force of 2,800 employees from which half of it is based in Brazil, located in the State of São Paulo. Annual sales are about US$ 225 million and the Brazilian unit respond to half of this revenue. In the beginning of the 90's, the company implemented organizational changes, introducing Material Requirement Planning (MRPII) and reorganising its lay out and production flow in manufacturing cells. In 1995, the company was certified by ISO 9002, 1994 version, and, in 2002, by the ISO 9001, 2000 version.

The director and staff were initially contacted regarding the project and consensus was received to conduct the study. The participants were shop floor employees from 9 manufacturing cells that use the maintenance service in a day-to-day basis. The maintenance department employed 13 people in addition to a subcontractor company with 50 professionals. A total of 209 employees were invited to participate. Data collection were carried out in two stages. The first one was a pilot test used to clarify the overall structure and approach to the project whilst validating the measuring instrument to be used. The pilot study involved 17 questionnaires from one manufacturing cell; 11 of which did not answer a question about overall satisfaction. These respondents were asked why this happened confirming a lack of understanding. Then, this question was modified. Other problems of misinterpreting other questions occurred resulting in improving the questionnaire in both form and content.

One of the authors of this paper was in charge of collecting the data. Information was gathered by having him reading and explaining the questionnaire to employee groups from the manufacturing cells (5 to 12 people). This form was used to maximise participation and minimise doubts about how to fill in the questionnaire when taking time from their work to fill out such an instrument. A total of 106 questionnaires (91.4%) were reviewed for completeness and deemed appropriate for the data analysis

The instrument was a 3-page questionnaire, formatted in A4 pages, with 41 questions that could be completed in approximately 20,. The answers were offered using a seven-point Lickert-type scale anchored by "1 – strongly disagree" and "7 – strongly agree". Respondents were also asked to rate their "overall satisfaction with internal service quality". In order to do this, a seven-point semantic differential scale ranging from "1 – totally unsatisfied" to "2 – totally satisfied" was used to assess an individual's overall satisfaction with internal service quality provided by the maintenance department. This questionnaire was similar to Parasuraman's[5]. The SERVQUAL items were modified to measure the employees' perception of internal quality service. As in Zeithan et al.[16], in developing the instrument for measuring customers'perceptions of service quality, well-established procedures for designing scales to measure constructs that are not directly observable were followed. Eighteen items capturing four from the five dimensions of service quality were developed (the original SERVQUAL questionnaire considered 22 items). The dimension "tanglibes" were not considered. Such a decision is based upon the absence of contact between the internal customer with the maintenance service area and equipment. In addition, there is no previous knowledge by the person who requires the service where the service/repair will be carried out. The possibility to omit this dimension is corroborated by other researchers[10,14].

Each item was recast into a pair of statements – one to measure expectations and the other to measure perceptions about a particular item. A sample of an expectation statement is: "an excellent maintenance department performs the job right in the first time". On the other hand, a sample of an equivalent perception statement is: "the maintenance department performs the job right in the first time". The expectation statements were located in the first page in the questionnaire while the perception statements were located in the third page. The second page considered the level of importance of each dimension, i.e. a weighting factor if the dimensions have differentiated weights (see Teas[13]). This is not the subject of this paper and, for that reason, this analysis is omitted. In addition, the question about overall satisfaction with internal service quality, mentioned earlier, was in the third page.

The instrument also considered a header where the respondent could indicate its manufacturing cell in addition to an short instruction on how the questionnaire should be filled out. Each service quality dimension was associated to a number of statements, namely: reliability: statements 1 to 5; responsiveness: statements 6 to 9; assurance: statements 10 to 13; and empathy: statements 14 to 18.

3.1 Data Analysis

Two important concepts are associated to the overall quality of the instruments constructed for gathering data in this kind of application: the reliability and validity[18]. The concept used to provide an assessment on how reliable the instrument is, can be done by computing reliability coefficients, which is based on the internal consistency of the items. This can be performed by calculating Cronbach's coefficient alpha that indicated how the items in a questionnaire are interrelated[18]. It can be calculated using the variance of individual items and covariance among them. The second concept, validity, refers to the degree to which evidence supports the inferences made from scores derived from measures, or the degree to which the scale measures what it is designed to measure. The three methods used with this intent, referred as validity-related strategies, are:[18] content-related strategy, criterion-related strategy, and construct-related strategy. Considering the nature of this investigation, the criterion-related strategy was used. It is concerned with examining the systematic relationship, usually in the form of a correlation coefficient, between scores on a given scale (in this study, the 18 items considered in the 4 dimensions) and other scores it should predict (in this case, the question related to the overall satisfaction with internal service quality provided by the maintenance department).

When determining the results for each dimension, data was also analysed in order to make a comparison among the service quality dimensions. So, strengths and opportunities for improvement could be identified, considering the differences among the dimensions of internal service quality. These opportunities for improvement could then generate corrective (and preventive) actions in order to enhance the service provided by the maintenance department. This is, in fact, a future step in this research project.

4. PRELIMINARY FINDINGS AND DISCUSSION

Firstly concerning the reliability of the instrument for the internal service quality scores, the Cronbach's alpha resulted in 0.919. This is a similar result as found in the literature. Parasuraman et al.[5] found out 0.920, Croning and Taylor[6] stated 0.900 and Frost and Kumar[17] cited 0.927. Therefore, the results of total scale for the developed instrument can be considered as reasonably reliable, according to those previous investigations.

In order to evaluate the validity, a linear regression was conducted. The regression analysis involved perception-minus-expectations as the predictor variable and the overall satisfaction with internal service quality provided by the maintenance department as the dependent variables. The result of the regression analysis can be seen in Figure 2. In order to compare the results of R^2 of this study (0.47) with the literature, Cronin and Taylor[6] have found values in the range from 0.31 to 0.46. Therefore, the validity can be considered adequate for the present investigation since the value is similar and slightly higher than those from Cronin and Taylor[6].

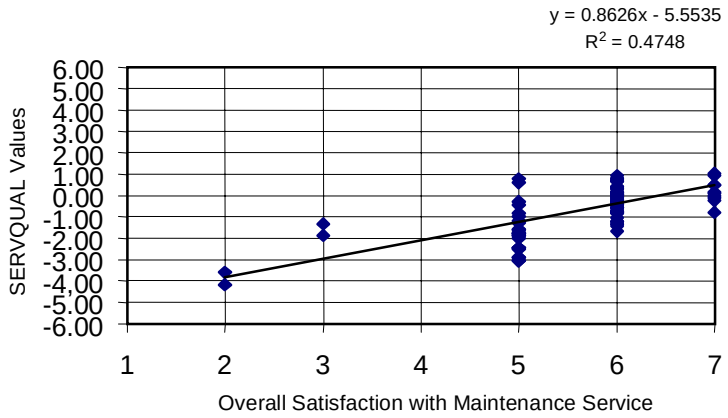

Figure 2. Linear Regression Analysis for Internal Service Quality.

Nevertheless, the results from this study is based on the assumption that data are normally distributed. By evaluating the residuals, the study shows a linearity in the residual probability density function, indicating a characteristic of normality for the values of internal service quality. When analysing the outliers from the linear regression curve in Figure 2 (results from overall satisfaction equal to 3), R^2 is improved when eliminating those point values (from $R^2 = 0.47$ to $R^2 = 0.51$). However, this improvement cannot be considered significant.

From these results (reliability and validity), the instrument can be considered suitable for the intended application. Next step of this investigation is the application of SERVQUAL for assessing the internal service quality provided by the maintenance department. This is to be done in the near future.

5. CONCLUDING REMARKS

This study has aimed at contributing further towards measuring internal service quality by developing an internal service quality measuring instrument. So far, the instrument has been found to comply with the reliability and validity, both necessary conditions for its application. Concerning reliability, the Cronbach alpha coefficient was found to be satisfactory when comparing it to other results from the literature. Further, the validity was found to be adequate as well. The residuals test has shown that the data are truly Normal. Yet further, the R^2 coefficient is in accordance to those from the literature, therefore, demonstrating the required validity for the instrument.

Future research will be required to identify which service quality dimensions play a bigger role in internal service quality, or whether there are manufacturing cells that are better served by the maintenance department. The work will intend to analyse the results of the SERVQUAL instrument with regard to perception-minus-expectations. In terms of specific dimensions, it aims at finding out which one influences internal service quality the most. Such results could provide information on service quality dimensions which more attention is needed, i.e. so that corrective and preventive actions should be implemented.

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