

Measuring Performance for Building Maintenance Providers

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Abstract: A building maintenance scheme was introduced in Hong Kong Housing Authority in January 2006 which employed contractors to provide inspection inside the public housing tenants' units and arranged necessary repair works. This study aims to assess the contractor service quality performance. A method of assessment is devised based on the SERVQUAL approach to measure the public housing owner's frontline representatives' expectations and perceptions of the contractors' performance. The outcome indicates that the deficiencies of service quality variables are related to the willingness of the contractors to provide prompt responses to requests from the tenants or the owner's frontline representatives, and the availability of sufficient resources to perform the promised service dependably and accurately in terms of time, cost, and quality. The outcome of this study helps to identify the weaknesses of the contractors and allows them to properly allocate resources to those urgently needed variables. The implications from this study are considered and recommendations for industrial practices and further research are made.

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Introduction

Nowadays the tenants of Public Rental Housing (PRH) place a great concern on the living environment. The Hong Kong Housing Authority as the largest landlord in Hong Kong is obliged to monitor the maintenance quality of aged PRH. Although the public housing landlord in Hong Kong is able to schedule timely maintenance and repairs for the public areas in the estates, the past maintenance programs mainly relied on the tenants to report on defects inside the housing units before it could make any rectification [Hong Kong Housing Authority (HKHA) 2006]. A number of complaints related to maintenance and repair services were received in the past and the standard of maintenance inside public housing flats was less satisfactory (HKHA 2005). In order to meet the rising expectations from the public rental housing tenants, a proactive customer-oriented building maintenance scheme was introduced in January 2006. A customer-focused service requires the measures of service quality (SQ) to be based on expectations and perceptions from the customer's point of view (Samson and Parker 1994). The objective of this study is to base on the expectation and perception of the owner's front-line representatives to assess contractor performance on SQ issues. This study includes the literature review on the background of the maintenance scheme and the theoretical framework underlying contractor service performance measurement, external customer concept, and

SQ nature. The SERVQUAL model, as developed by Parasuraman et al. (1988), is adopted to develop a questionnaire for data collection to measure the gaps in perception. It is expected that the analytical results will furnish answers to the following research questions:

1. What kinds of services quality determinants will the owner's frontline representatives expect the contractor to provide for implementing the building maintenance scheme?
2. What kinds of services quality determinants will the owner's frontline representatives perceive that the contractor has already provided for implementing the building maintenance scheme?
3. To what extent has the contractor achieved the required services quality determinants in the implementation of the building maintenance scheme?

The survey results finally indicate that the perceived SQ performance is below expectations.

Background of the Building Maintenance Scheme

This building maintenance scheme provides a comprehensive one-stop maintenance service to all public housing tenants over a 5 year period. The purpose of the scheme is to carry out inspection to all the domestic flats in the public housing estates one by one in order to prevent dilapidation, eliminate health and safety hazards, minimize breakdowns, and avoid unnecessary expenses on major corrective maintenance. The inspection to inside domestic flats is called as "in-flat" maintenance inspection which is carried out by a team of 3 persons, i.e., the owner's front-line representative, and two maintenance contractors' representatives, the work coordinator and a building maintenance worker. The owner's front-line representative acts as the team leader to diagnose defects, provide explanation about the probable cause of the defects, suggest remedial methods, and provide preventive advice to avoid defects from reoccurrence or becoming serious again. In carrying out the "in-flat" maintenance inspection, the owner's

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front-line representative liaises with the tenants at the inspection, records the in-flat conditions, and instantaneously issue an inspection report to the tenants. The one-stop services approach enables the inspection and repair work to be carried out quickly. For those minor repair works, which can be finished immediately, the work coordinator from the contractor's side will supervise the building maintenance workers to finish the simple handy works on the spot. For the more complicated works, work order will be issued immediately for the work coordinator to follow up the repair works to be completed the soonest possible, and the owner's front-line representative will need to monitor the repair work progress and certify completion on every repair work order. Prior to the commencement of all repair works, contractors are required to provide sufficient enhanced protection works. These requirements ensure that the contractors provide prompt and minimum disturbance services to the tenants when carrying out the works. The owner of the public housing estates envisages that this proactive one-stop service approach will enhance service to tenants' requests for repairs and achieve higher level of tenant's satisfaction.

Measuring Contractor Performance

Time, cost, and quality are the three basic project goals and project performance is a function of how well these goals have been accomplished (Chang and Ibbs 1998). Performance measurement in construction has predominantly focused on project performance in the form of time, cost, and quality (Ward et al. 1991; Love and Holt 2000; Kagioglou et al. 2001). Kagioglou et al. (2001) emphasized that the traditional measures of the performance of construction projects are not sufficient to assess their true performance. Performance measurement does not adopt the result-oriented approach, i.e., the concern on the quality of the end products only, but also the focus on the process of delivering the product. According to Yasamis et al. (2002), a construction quality approach is proposed to deal with both the service (as received by the owner) and product (as received by the end-user). This suggests that quality from the building maintenance scheme should be dealt with in 2 areas, i.e., the service as perceived by the owner's organization and the product as perceived by the tenants. Evaluating the quality performance of the contractor will improve the quality of the construction process and the levels of customer satisfaction. These involve the interrelationships between the owner, i.e., the owner's organization and the end-user of the construction, i.e., the public housing tenants. The gap analysis approach developed by Parasuraman et al. (1985) focuses on the measurement of the perception between the service that customers expected and their perception of what they actually got, which concerns both the total process of service delivery and customer satisfaction (Winch et al. 1998). In the construction area, empirical surveys have been conducted on measuring quality of consultant services (Cravens et al. 1985; Hoxley 1994; Samson and Parker 1994; Hoxley 1998; Love et al. 2000; Hoxley 2000), refurbishment services (Holm 2000), and SQ in maintenance works (Siu et al. 2001). These studies reflected that the SQ in the construction industry is more crucial than had previously been thought.

Parasuraman et al. (1985) listed five broad dimensions of SQ (i.e., tangible, reliability, responsiveness, assurance, and empathy) that are applicable to any service organization. In this regard the following five dimensions have been modified to suit the context of the building maintenance scheme, i.e.,

- **Tangibles:** these relate to the facilities, equipment and all other necessary resources, e.g., sufficient manpower to complete handy repair and works order items, which the contractor will allocate for the implementation of the scheme.
- **Reliability:** this is the ability of contractor personnel to perform agreed tasks up to the client's standard and within the agreed time schedule.
- **Responsiveness:** refers to the willingness of the contractor personnel to provide prompt services to the tenants and the internal customer of the building maintenance scheme, i.e., the owner's front-line representative.
- **Assurance:** this includes the knowledge and courtesy of contractor personnel to handle enquiries and the ability to inspire trust and confidence to various stakeholders, such as the Management Advisory Committee in each estate and the Housing Managers in the owner's organization.
- **Empathy:** this relates to caring, understanding and sharing of feelings of the customers, e.g., tenants and the owner's front-line representative.

In order to achieve product quality, identification of customer at each stage of the process is very important. The following section attempts to identify who is the customer in the building maintenance scheme organization.

Application of the External Customers Concept

The "customer" concept in total quality management (TQM) emphasises that everyone has a customer both within (internal) and outside (external) the organization and everyone should seek to identify what his/her customer needs (requirements and expectations) in all the processes (Low and Peh 1996). The next step is to plan how the customer requirements and expectations can be fulfilled. The following review attempts to base on the concept of customer in TQM theory to identify who is the service provider and to whom the output of maintenance works is passed to within the building maintenance scheme organization.

Generally, there are three major different parties that will be involved in the building maintenance scheme, e.g., the owner's front-line representative, tenants, and contractors. The owner's organization is the employer of the maintenance contractors and is also a direct external customer of the contractor. Tenants are the direct external customers of the owner's organization who are the end-users (but not the direct external customers of the contractor) of the finished maintenance works provided by the contractors. Contractors are expected to follow the instructions of the owner's front-line representative, thereby providing a comprehensive one-stop service that ensures a safe working environment inside the tenants' premises. The owner's front-line representative should provide constant-monitoring services to assure the quality of maintenance works and provide a customer service to the external customers of the owner's organization (i.e., the tenants). As the owner's front-line representatives carry out day-to-day monitoring on contractor performance, they serve different roles with respect to the owner's inside and outside organization. The owner's front-line representative is the direct internal customer of the managerial staff in the owner's organization and also serves as an external customer of the contractors. This chain of customer concepts explains that the reporting system exists from one level to the other above.

In order to avoid dissatisfied services being provided to the external customer, i.e., the public housing tenants, the concept of internal customers is significant since the organization cannot

meet the needs of external customers if each output that passes between the front-line staff within the organization is deficient. Understanding the internal customer perception and expectations on the service provider will help meet the need of the external customer, i.e., the tenants. In general, quality is defined by the external and internal customers and fulfilling the customer's needs and expectations are the strategic goal of TQM (Tanner and DeToro 1993).

The above review illustrates that the identification of customers is of great importance in order to ensure the reliability of comments from the parties and the consequent assessment of the level of performance of the services providers when endeavoring to improve the SQ of the maintenance works.

The scheme's organization contains many participants with different backgrounds and interests, e.g., the contractor as the "performer" and the owner's front-line representative as the front-line assessors. These assessors act as the front-line supervisory personnel representing the public housing owner and can be viewed as the external customers of the contractor. All the participants will contribute toward ensuring quality output products for the end-users, i.e., the public housing tenants. The interactions and inter-relationships between the participants largely determine the overall performance of a construction project (Smith and Wilkins 1996; Egan 1998). As the scheme has only been implemented for some 16 months, it would be more prudent at the outset to obtain the view of the frontline staff since properly identified key performance determinants will enable contractors to develop an awareness and understanding of the issues that matter most to their customers and on which they can subsequently focus their attention (Soetanto et al. 2002). This will encourage more effective levels of contractor performance, leading to greater satisfaction levels and reduced adversarialism among the participants (Soetanto et al. 2002).

Critical Review of the Building Maintenance Scheme from a SQ Perspective

Researchers and practitioners have suggested various definitions of service (Siu et al. (2001). Gronroos (1990) defines "service" as an activity or series of activity of more or less intangible nature that normally, but not necessarily, take place in interactions between the customer and service employees and/or physical resources or goods and/or systems of the service provider, which are provided as solutions to customer problems. The following review attempts to analyze the characteristics of services and examine how they could be applied to the building maintenance scheme.

The owner organization of the public rental housing envisages that the building maintenance scheme would cultivate a new service-oriented culture and build up partnering relationship among the tenants, owner's front-line representative, and maintenance contractors for providing quality maintenance services. This expectation supports that the scheme does not only concern on the quality of maintenance works, but also the quality of customer services. In achieving this expectation, the maintenance scheme becomes more intangible in nature which cannot be counted, measured, standardized, inventoried, or verified in advance to assure quality. Because of intangibility, the service providers may find it difficult to understand how consumers or clients perceive their services and evaluate SQ (Zeithaml 1981). Sasser et al. (1978) identified three different dimensions of service performance, i.e., levels of materials, facilities, and person-

nel. This implies that maintenance SQ involves not just the outcomes, e.g., the maintenance products, but also includes the manner in which the maintenance service is delivered. This concept of SQ coincides with the technical and functional quality model as suggested in Gronroos (1990) which defined technical quality as what the customer or client actually receives during the interaction with the service provider, while functional quality was referred to as the technical outcome. Applying this Gronroos' model on the building maintenance scheme leads to the question of what factors clients consider to be more important to quality of service and whether there are any significant differences in emphasis between service providers and clients.

As suggested in Parasuraman et al. (1985), the second characteristic of services, especially for services with high labor content, is heterogeneous. Services are considered to be heterogeneous in that variations in performance can occur from producer to producer, from customer to customer, and from day-to-day (Parasuraman et al. 1985). The context of the building maintenance scheme also appears to be heterogeneous and the evaluation on the SQ relies on the services provided by the workers of the maintenance contractors and perception of the owner's frontline representative and the tenant. Because of the personal involvement of the worker of maintenance contractor, owner's frontline representative, and the public housing tenants, the services provided from the maintenance contractors are also difficult to standardize.

The third characteristic of services is that production and consumption of many services are inseparable (Carman and Langeard 1980; Gronroos 1978; Regan 1963; Upah 1980). In labor intensive services, such as the maintenance services, quality occurs during service delivery, usually in an interaction between the client and the contact person from the service firm [Lehtinen, U., and Lehtinen, J. R. (1982). "Service quality: A study of quality dimensions," unpublished working paper, Service Management Institute, Finland OY, Helsinki, Finland). In the context of the building maintenance scheme, SQ occurs in the interaction between the owner's frontline representative, the tenants and the workers of maintenance contractor and managerial control from the maintenance contractor company may not be imposed in the process.

The above review on the characteristics of services suggests the following three underlying themes with respect to the building maintenance scheme:

1. Maintenance SQ is no longer to be evaluated on the final maintenance product quality only.
2. SQ perceptions result from the comparison of client expectations with perceived service performance.
3. Quality evaluations are not made solely on the outcome of a service, but also involve evaluations of the process of service delivery, e.g., in the interaction between the client and service provider.

In the past, the maintenance contractor may have an intuitive feeling that the final maintenance product is more important, whereas nowadays the main concern from the client may be different, e.g., prompt and timely service provided; less disruption to tenants and politeness, etc. (Low and Peh 1996; HKHA 2008). Whether or not this proposition is proved to be correct, it would certainly be of benefit for the management to know what factors and to what extent clients consider important to quality of service. This study is therefore based on the perception of the owner's frontline representative to address whether the contractor has fulfilled the basic objective of the scheme after being implemented for 16 months. It will attempt to formulate an improvement plan

for the contractor to supplement any deficiencies identified from the study.

By adopting the theories of the services industry, the concepts of internal and external customers are well-defined within the owner's organization and illustrate the role of the different parties. Similarly, this approach highlights the importance and contribution of internal assessment within the scheme's organization. Hence, this study analyzes the assessment of the effectiveness of the scheme and provides a benchmark for the maintenance industry. The outcome of the study should enhance continuous improvement for contractors and help develop a yardstick or standard method of assessing contractor performance.

Questionnaire Survey

The above review illustrates that the services characteristics are present in the building maintenance scheme. The building maintenance scheme is the service provided by the contractors to the owner of the public housing estates and the maintenance process has a major impact on the tenants' day-to-day lives. Application of "customer" concept in TQM as stated above illustrates that the front-line supervisory personnel representing the public housing owner will be the external customer of the contractor and the tenants will in turn be the external customers of the owner's front-line supervisory personnel. Therefore, measuring the SQ of the contractors is intuitive to be the preventive measure to assure tenant satisfaction with the maintenance works. The measures of SQ are largely based on expectations and perceptions (Samson and Parker 1994). The SERVQUAL model developed by Parasuraman et al. (1985) has been extensively applied for SQ measurement on how the delivered service level matches customer's expectations (Wisniewski 2001). SERVQUAL has been widely applied and is highly valued (Buttle 1994). Kang et al. (2002) confirms that the SERVQUAL instrument is not only used extensively to assess external SQ, but can also be modified to assess the quality of the internal services provided by distinct organizational units or people working in these departments or other units within the organization. The results of this study deduce strongly a proposition to adapt the SERVQUAL model to fit an internal context such as the building maintenance organization in this case for measuring SQ provided by the contractors. This proposition is further supported by a number of articles which have adopted this SERVQUAL instrument with suitable modification on measuring SQ of construction professionals in the construction area. They are summarized as follows:

- Cravens et al. (1985) made reference to the SERVQUAL model to evaluate architectural services quality.
- A study by Hoxley (1994) made reference to the SERVQUAL model to compare the attitudes of 169 firms and 126 clients to 22 items which were considered important to the overall quality of service provided by building surveying firms.
- Samson and Parker (1994) adopted the SERVQUAL survey with substantial amendments to accommodate the characteristics of the construction industry to measure client expectations and perceptions of the SQ provided by consulting engineers to determine the relative importance of the service features.
- Siu et al. (2001) used the SERVQUAL approach to investigate the SQ in the maintenance services.
- Hoxley (2000) based on the SERVQUAL scale to develop a 26-item scale which was referred as SURVEYQUAL for assessing SQ in a U.K. construction professional service context. The above studies reflected that the SERVQUAL approach has

been widely adopted for measuring SQ in the construction and maintenance industry. These studies coincided with Parasuraman et al. (1985, 1988, 1991, 1993, 1994) that SERVQUAL is suitable, with some adaptation, in a variety of situations including architectural, construction and maintenance services. According to Parasuraman et al. (1985), quality is a comparison between expectation and performance. Therefore, using SERVQUAL to assess the quality of service involves computing the differences between the ratings customers assign to the paired expectation/perception statements (Siu et al. 2001). As the owner's front-line representative is also treated as the customer of the maintenance contractor (i.e., the service provider) in the building maintenance scheme organization, the writers therefore have the strong belief that the Parasuraman's SERVQUAL model is suitable to be adopted to formulate a questionnaire that explores the expectation and perception of the owner's frontline representatives on measuring contractor performance when implementing the scheme.

This study therefore attempts to base on the SERVQUAL model to develop a questionnaire which consists of 23 variables suitable for the implementation of the scheme. The 23 variables were developed based on the experience of the second author who was the frontline supervisory personnel and got the actual involvement in the supervision and inspection of the maintenance contractor works under the building maintenance scheme at the time for carrying out the study. The 23 variables are devised to reflect the characteristics and requirements of the maintenance contractor works under the scheme and are also categorized into one of the five major dimensions as used in the SERVQUAL model (Table 1) (Pang 2007). These five specific dimensions (tangibles, reliability, responsiveness, assurance, and empathy) of SQ are considered to be applicable to all service-providing organizations (Siu et al. 2001). The categorization into one of the five dimensions is made based on the understanding of the second author on these 23 variables which is related to the interpretation of these five dimensions as stated in Siu et al. 2001.

Respondents were requested to answer both sides of each variable, i.e., on the left hand side to measure the respondents' expected level of service for implementing the scheme, and correspondingly on the right hand side to measure the respondents' perception of the current level of service offered by the maintenance contractors. With reference to Hoxley (1996), both sets of items were provided with 5 ranges of different answer categories in a Likert-type scale, ranging from 5 to 1 representing strongly agree, agree, neutral, disagree, or strongly disagree. The Likert-type scale comprises a form of "closed questions" that are constructed to force respondents to choose between limited ranges of possible answer, thus giving a more discriminating answer.

The mean score for each construct scales (i.e., the scale for expectation scores and the scale for the perceived level of services) for the SQ variables were calculated and ranked in descending order to furnish answers to the Research Questions 1 and 2 as stated above.

The perceived SQ is computed along the variables of the five dimensions by subtracting perception scores from expectation scores, giving an SQ score for each variable ranging between -4 and $+4$. A negative SQ score indicates that the service provided in that particular area exceeds the respondents' expectations. Similarly, a positive score indicates that the level of respondents' expectations in that particular area is higher than that already provided by the contractors. This SQ gap is expected to deduce the answer for the third research question.

At the time of conducting the questionnaire survey, the public

Table 1. Questionnaire Content

Tangible	<ul style="list-style-type: none"> • Sufficiency and adequacy of replacement components and repair equipments • Visually appealing
Reliability	<ul style="list-style-type: none"> • Provide sufficient manpower to complete the works order • Availability on ancillary equipment and tools • Conformance to owners' requirements on supply quality • Provide their services at the time they promise to do so <ul style="list-style-type: none"> • Progress of works (handy-work items) • Progress of works (work order items) • Competence of the work coordinators or fitters • Competence of assistance services manager/site agent <ul style="list-style-type: none"> • Site safety implementation
Responsiveness	<ul style="list-style-type: none"> • Give prompt services to tenants • Timely and quality submission of required documents and information (e.g., site instructions, extension of time or certify completion) • Willingness to help tenants
Assurance	<ul style="list-style-type: none"> • Courteous with tenants or owner's frontline representatives • Have knowledge to answer tenants or owner's frontline representatives' enquiries • Assuring the quality of works up to standard • Cooperate with owner's frontline representatives to solve problem • Cooperate with members of Management Advisory Committee in different estates <ul style="list-style-type: none"> • Cooperate with Housing Managers
Empathy	<ul style="list-style-type: none"> • Operating hours convenient to tenants <ul style="list-style-type: none"> • Tidiness after repair works • Enhanced services protection work

housing owner's organization has employed 79 frontline representatives to carry out "in-flat" inspection in different estates. Accordingly, the sample size of this survey was 79. The questionnaire was dispatched by post to all the owner's frontline representatives in different estates. A total of 63 questionnaires were returned, which included 3 that had not been answered, thereby providing a sample size of 60 that were valid for further statistical analysis. The return rate was about 80% of the estimated sample size.

Findings and Analysis

Each construct scale for the contractor performance variables was tested for interitem reliability using Cronbach's α test. Reliability is concerned with the internal consistency of the scale, i.e., "Does the scale behave similarly when administered by different people?" (Hoxley 2000). The Cronbach's α reliability coefficient is the most widely used which can range from 0 to 1, with higher figures indicating better reliability (Hoxley 2000). The Cronbach's α for the measurement scale of expected and perceived level of contractor services quality performance variables ranges from 0.900 to 0.903 and 0.904 to 0.908, respectively, (see Table 2). The overall scale α figure is 0.901 and 0.906. These results indicate a very good reliability and consistency with reference to

Madu and Kuei (1994) that the minimum reliability coefficients should be higher than 0.7. Nunnally (1967) also suggests that in exploratory result such as this, reliability coefficients of 0.6 will be sufficient (Black and Porter 1996). As the reliability of each measurement is high enough, all the measurements could subsequently be taken out for statistical analysis by ranking the mean score of each quality service determinant variables.

The mean of the expectations for each SQ variable is calculated and ranked in descending order of importance as illustrated in Table 3. The mean scores range from 4.433 to 3.517 in the 5-point Likert scale. There are 18 variables with mean scores higher than 4, which reflect generally that respondents' expectations tend to the higher side. The seven most important variables are all related to time, costs and quality issues which are consistent with the traditional concern for measuring contractor performance. In addition, two more variables that are considered of equal importance are related to customer focus and help to minimize the disturbance imposed on the tenants. These results depict that the respondents' expectations are consistent with the agenda of the building maintenance scheme.

The least four important variables, (which owner's frontline representatives expect the contractor should have), are to cooperate with the members of the Management Advisory Committee; to cooperate with Housing Managers in the owner's organization; to have visually appealing; and readily available on ancillary equipment. These four variables, although considered as less important, still have a mean score higher than 3.5 on the 5-point scale. These ancillary variables reflect the importance of the staff attitudes, e.g., communication with other concerned parties.

Similarly, the mean scores for the construct scales of each variable of the perceived level of SQ already achieved by the contractors were calculated and ranked in descending order of importance. The results are illustrated in Table 4. The mean scores of the perceived level of SQ range from 3.517 to 3.017. This finding indicates that the perceived performance level is around the average level. The most important variables of the perceived level of SQ are related to the human behavior and the attitudes of contractor personnel. These indicate that the contractors selected from the public housing owners have adapted to the culture inside the owner's organization, thereby building up a customer services orientation approach to communicate with tenants and the staff of the owner's organization.

In contrast to this, the four variables with the lowest mean scores not satisfied by the owner's frontline representatives include:

1. Cooperate with members of the Management Advisory Committee in different estates;
2. Provide services at the time they promise to do so;
3. Timely and quality submission of required documents and information; and
4. Maintain good progress of works.

These variables are those pertaining to issues of project administration, timeliness and management.

SERVQUAL Score

According to Parasuraman et al. (1985), quality is a comparison between expectation and performance. It is defined as the difference between the client perception of the service delivered and the client expectation of the service (Samson and Parker 1994). Therefore, the SERVQUAL gap is computed by

Table 2. Cronbach's Alpha and Mean Value of Expectation and Perceived Level of Contractor Services Quality Performance

		Perceived level of satisfaction		Degree of expectation	
Question number	Factors	Cronbach's Alpha	Mean	Cronbach's Alpha	Mean
Tangible					
Q1	Sufficiency and adequacy of replacement components and repair equipments	0.906	3.250	0.902	4.233
Q2	Visually appealing (e.g., wear tidy uniform, neat appearance, etc.)	0.905	3.233	0.902	3.867
Q3	Provide sufficient manpower to complete the works order	0.908	3.183	0.901	4.433
Q4	Availability on ancillary equipment and tools (e.g., digital camera, computer)	0.904	3.350	0.902	3.900
The overall mean of tangible factor		0.906	3.254	0.902	4.108
Reliability					
Q5	Conformance to owners' requirements on supply quality	0.905	3.233	0.901	4.083
Q6	Provide their services at the time they promise to do so	0.906	3.017	0.901	4.300
Q7	Progress of works (handy-work items)	0.907	3.233	0.901	4.117
Q8	Progress of works (work order items)	0.908	3.083	0.900	4.317
Q9	Competence of the work coordinators or fitters	0.906	3.467	0.902	4.167
Q10	Competence of assistance services manger/site agent	0.907	3.217	0.902	4.083
Q11	Site safety implementation	0.906	3.100	0.901	4.033
The overall mean of Reliability factor		0.906	3.193	0.901	4.157
Responsiveness					
Q12	Give prompt services to tenants (e.g., setting up appointments quickly)	0.907	3.217	0.901	4.250
Q13	Timely and quality submission of required documents and information (e.g., site instructions, extension of time, or certify completion)	0.907	3.050	0.902	4.183
Q14	Willingness to help tenants	0.905	3.517	0.902	4.267
The overall mean of responsiveness factor		0.906	3.261	0.902	4.233
Assurance					
Q15	Courteous with tenants or owner's frontline representatives	0.904	3.450	0.902	4.083
Q16	Have knowledge to answer tenants or owner's frontline representatives' enquiries	0.905	3.483	0.902	4.150
Q17	Assuring the quality of works up to standard	0.905	3.317	0.902	4.267
Q18	Cooperate with owner's frontline representatives to solve problem (e.g., discuss the optimum solutions)	0.905	3.483	0.902	4.300
Q19	Cooperate with members of management Advisory committee in different estates	0.907	3.017	0.903	3.517
Q20	Cooperate with Housing Managers	0.906	3.117	0.903	3.533
The overall mean of assurance factor		0.905	3.311	0.902	3.975
Empathy					
Q21	Operating hours convenient to tenants	0.904	3.433	0.902	3.933
Q22	Tidiness after repair works	0.905	3.183	0.900	4.217
Q23	Enhanced services protection work	0.905	3.383	0.902	4.267
The overall mean of empathy factor		0.905	2.500	0.901	3.104

$$\text{SERVQUAL gap} = (\text{Expectation score} - \text{Perception score})$$

This gap measures how effectively the service provided compares with the service expected (Samson and Parker 1994). The result is illustrated in Table 5 and Fig. 1.

The gap values are all in positive figures which indicate that the perceived SQ performance does not match or exceed the customer's expectations. This result suggests that there is a service delivery shortfall in the perception of the owner's frontline rep-

resentatives. The consistent positive signs indicate that the contractors have, to some extent, lost touch with the owner's frontline representatives' needs and expectations. Clearly, the contractors need to work closer with the owner's frontline representatives to (1) align themselves better with owner's frontline representatives' expectations and (2) meet those expectations better.

The four variables with the highest gap scores which have the greatest effect in the Scheme are discussed and illustrated graphi-

Table 3. Ranking of Important Variables of Expectation of Contractor Services Quality Performance

Rank	Question number	Variables	Type	Mean
1	Q3	Provide sufficient manpower to complete the works order	Tangible	4.433
2	Q8	Progress of works (work order items)	Reliability	4.317
3=	Q6	Provide their services at the time they promise to do so	Reliability	4.300
3=	Q18	Cooperate with owner's frontline representatives to solve problem (e.g., discuss the optimum solutions)	Assurance	4.300
5=	Q17	Assuring the quality of works up to standard	Assurance	4.267
5=	Q23	Enhanced services protection work	Empathy	4.267
5=	Q14	Willingness to help tenants	Responsiveness	4.267
8	Q12	Give prompt services to tenants (e.g., setting up appointments quickly)	Responsiveness	4.250
9	Q1	Sufficiency and adequacy of replacement components and repair equipments	Tangible	4.233
10	Q22	Tidiness after repair works	Empathy	4.217
11	Q13	Timely and quality submission of required documents and information (e.g., site instructions, extension of time or certify completion)	Responsiveness	4.183
12	Q9	Competence of the work coordinators or fitters	Reliability	4.167
13	Q16	Have knowledge to answer tenant's or owner's frontline representatives' enquiries	Assurance	4.150
14	Q7	Progress of works (handy-work items)	Reliability	4.117
15=	Q5	Conformance to owners' requirements on supply quality	Reliability	4.083
15=	Q10	Competence of assistance services manger/site agent	Reliability	4.083
15=	Q15	Courteous with tenants or owner's frontline representatives	Assurance	4.083
18	Q11	Site safety implementation	Reliability	4.033
19	Q21	Operating hours convenient to tenants	Empathy	3.933
20	Q4	Availability on ancillary equipment and tools (e.g., digital camera, computer)	Tangible	3.900
21	Q2	Visually appealing (e.g., wear tidy uniform, neat appearance, etc.)	Tangible	3.867
22	Q20	Cooperate with Housing Managers	Assurance	3.533
23	Q19	Cooperate with members of management advisory committee in different estates	Assurance	3.517

cally in the profile analysis in Fig. 1. These include:

1. Provide their services at the time they promise to do so. As this variable has the highest gap scores, i.e., 1.283, this indicates its importance from the owner's frontline representatives' point of view because it is the direct factor affecting the end-user (tenants) and will have the direct impact on the image and efficiency of the scheme. The owner's frontline representative generally considers that contractor should arrange the appointment of inspection and repair work for the tenants.
2. Provide sufficient manpower to complete the works order. This variable has a gap score of 1.250 which is the second highest variable. It related to the support and resources of the contractor to complete the works order. The owner's frontline representative generally suggests that the contractors have not set aside sufficient manpower and resources to finish all the works order since the quantities required are extremely large. The contractor generally explains that there will be a shortage of manpower in the labor market. Hence, this variable needs to be improved.
3. Progress of works (work order items). This is the third highest gap variable with a mean value of 1.233, which corresponds with the issues as stated in 2 above since the contractor cannot provide sufficient manpower to digest the works order, i.e., complete the maintenance works within the

time frame. Overall, the progress of work cannot keep pace with the agreed schedule.

4. Timely and quality submission of required documents and information (e.g., site instructions, extension of time or certify completion).

This variable is also rated as a high expectation score from the owner's frontline representatives because any delay in submission will affect their progress to certify completion of the contractor works and ensue the inefficiency of the scheme's operation.

The SERVQUAL values for the five dimensions were obtained by averaging the respondents' mean scores of each variables categorized in each dimension. The overall mean score of the five dimensions is summarized in Table 6 and Fig. 2, which indicates that responsiveness and reliability dimensions incurred greater discrepancies between expectation and perception. Responsiveness is directly affected by professionalism and commitment (Siu et al. 2001). These pertain to the willingness or readiness of the service providers (i.e., the contractors) to provide prompt response to requests for the tenants or owner's frontline representatives.

Reliability was the second important factor with the second highest services quality gap scores in the evaluation of SQ, and is directly affected by the organization's resources base in terms of budgets and systems (Siu et al. 2001). These concerns relate to the ability of the service providers, (i.e., the contractors) to per-

Table 4. Ranking of Important Variables of Perceived Level of Contractor SQ Performance

Rank	Question number	Variables	Type	Mean
1	Q14	Willingness to help tenants	Responsiveness	3.517
2=	Q16	Have knowledge to answer tenants or owner's frontline representatives' enquiries	Assurance	3.483
2=	Q18	Cooperate with owner's frontline representatives to solve problem (e.g., discuss the optimum solutions)	Assurance	3.483
4	Q9	Competence of the work coordinators or fitters	Reliability	3.467
5	Q15	Courteous with tenants or owner's frontline representatives	Assurance	3.450
6	Q21	Operating hours convenient to tenants	Empathy	3.433
7	Q23	Enhanced services protection work	Empathy	3.383
8	Q4	Availability on ancillary equipment and tools (e.g., digital camera, computer)	Tangible	3.350
9	Q17	Assuring the quality of works up to standard	Assurance	3.317
10	Q1	Sufficiency and adequacy of replacement components and repair equipments	Tangible	3.250
11=	Q7	Progress of works (handy-work items)	Reliability	3.233
11=	Q5	Conformance to owners' requirements on supply quality	Reliability	3.233
11=	Q2	Visually appealing (e.g., wear tidy uniform, neat appearance, etc.)	Tangible	3.233
14=	Q10	Competence of assistance services manger/site agent	Reliability	3.217
14=	Q12	Give prompt services to tenants (e.g., setting up appointments quickly)	Responsiveness	3.217
16=	Q3	Provide sufficient manpower to complete the works order	Tangible	3.183
16=	Q22	Tidiness after repair works	Empathy	3.183
18	Q20	Cooperate with Housing Managers	Assurance	3.117
19	Q11	Site safety implementation	Reliability	3.100
20	Q8	Progress of works (work order items)	Reliability	3.083
21	Q13	Timely and quality submission of required documents and information (e.g., site instructions, extension of time, or certify completion)	Responsiveness	3.050
22=	Q6	Provide their services at the time they promise to do so	Reliability	3.017
22=	Q19	Cooperate with members of management advisory committee in different estates	Assurance	3.017

form the promised service dependably and accurately in terms of time, cost and quality. In general, the high services quality gap indicates that these dimensions have room for improvement since the perceived level is far below the expectation level, which is not satisfied by owner's frontline representatives. Since the expectation mean scores for these two dimensions are also the highest, the contractors as the service providers should look to improve in these two areas since the owner's frontline representatives as the external customers put a higher weighting on these dimensions. This study result is consistent with the similar studies carried out by Siu et al. 2001 dealing with building maintenance.

Conversely, assurance is the dimension with the lowest gap score and is related to the human factor. Though the perception score of this dimension is below the expectation score, the perceived level of performance is the highest one. This indicates that the contractor performance generally satisfies the owner's frontline representatives with regard to quality related aspects and fulfills their expectations.

The variables with the higher SERVQUAL gap score in each dimension are highlighted below to indicate the level of impact on these five dimensions and help prioritize the actions to be taken to alleviate the impact:

1. For the "Tangible" dimension, variables "provide sufficient manpower to complete the works order" and "sufficiency and adequacy of replacement components and repair equip-

ments" have the higher gap scores among the 4 variables in this dimension. These two variables, i.e., "provide sufficient manpower to complete the works order" and "sufficiency and adequacy of replacement components and repair equipments" are related to the insufficient contractor resources on manpower and materials.

2. For the "Reliability" dimension, it is obvious to indicate only 2 variables, i.e., "provide their services at the time they promise to do so" and "progress of works (work order items)" with gap scores higher than 1.2 which are much higher than the other variables in this dimension. These results reflect that the disturbance to tenants should have a greater concern when arranging maintenance works to the tenants' units.
3. For the "Responsiveness" dimension, variables "timely and quality submission of required documents and information (e.g., site instructions, extension of time or certify completion)" and "give prompt services to tenants (e.g., setting up appointments quickly)" have the higher gap scores among the 3 variables in this dimension. These two variables, i.e., "timely and quality submission of required documents and information (e.g., site instructions, extension of time or certify completion)" and "give prompt services to tenants (e.g., setting up appointments quickly)" are indirectly related to the insufficient manpower resources.

Table 5. Mean Value of SERVQUAL Gap and Its Ranking

Question number	Variables	Degree of Expectation Mean	Perceived level of satisfaction Mean	SERVQUAL gap mean	Ranking
Tangible					
Q1	Sufficiency and adequacy of replacement components and repair equipments	4.233	3.250	0.983	7
Q2	Visually appealing (e.g., wear tidy uniform, neat appearance etc.)	3.867	3.233	0.634	16
Q3	Provide sufficient manpower to complete the works order	4.433	3.183	1.250	2
Q4	Availability on ancillary equipment and tools (e.g., digital camera, computer)	3.900	3.350	0.55	18
The overall mean of tangible variables		4.108	3.254	0.854	
Reliability					
Q5	Conformance to owners' requirements on supply quality	4.083	3.233	0.850	12
Q6	Provide their services at the time they promise to do so	4.300	3.017	1.283	1
Q7	Progress of works (handy-work items)	4.117	3.233	0.884	10
Q8	Progress of works (work order items)	4.317	3.083	1.234	3
Q9	Competence of the work coordinators or fitters	4.167	3.467	0.700	14
Q10	Competence of assistance services manger/site agent	4.083	3.217	0.866	11
Q11	Site safety implementation	4.033	3.100	0.933	9
The overall mean of Reliability variables		4.157	3.193	0.964	
Responsiveness					
Q12	Give prompt services to tenants (e.g., setting up appointments quickly)	4.250	3.217	1.033	6
Q13	Timely and quality submission of required documents and information (e.g., site instructions, extension of time, or certify completion)	4.183	3.050	1.133	4
Q14	Willingness to help tenants	4.267	3.517	0.750	13
The overall mean of responsiveness variables		4.233	3.261	0.972	
Assurance					
Q15	Courteous with tenants or owner's frontline representatives	4.083	3.450	0.633	17
Q16	Have knowledge to answer tenants or owner's frontline representatives' enquiries	4.150	3.483	0.667	15
Q17	Assuring the quality of works up to standard	4.267	3.317	0.950	8
Q18	Cooperate with owner's frontline representatives to solve problem (e.g., discuss the optimum solutions)	4.300	3.483	0.817	12
Q19	Cooperate with members of management advisory committee in different estates	3.517	3.017	0.500	19
Q20	Cooperate with Housing Managers	3.533	3.117	0.416	20
The overall mean of assurance variables		3.975	3.311	0.664	
Empathy					
Q21	Operating hours convenient to tenants	3.933	3.433	0.500	19
Q22	Tidiness after repair works	4.217	3.183	1.034	5
Q23	Enhanced services protection work	4.267	3.383	0.884	10
The overall mean of empathy variables		4.139	3.333	0.806	

- For the "Assurance" dimension, the two variables "assuring the quality of works up to standard" and "cooperate with owner's frontline representatives to solve problem (e.g., discuss the optimum solutions)," which have the higher gap scores among the 6 variables are related to the ability of the maintenance workers to inspire trust from the owner's frontline representatives on the standard of their work output.
- For the "Empathy" dimension, variable "tidiness after repair works" which has the highest gap scores among the 3 vari-

ables in this dimension is related to the concern on the disturbance to the tenants.

The above analysis clearly explains that the two dimensions, "responsiveness" and "reliability," have greatest disparity between expectation and perception, which are in turn affected mostly by the 4 variables, "timely and quality submission of required documents and information (e.g., site instructions, extension of time or certify completion)" and "give prompt services to tenants (e.g., setting up appointments quickly)," and "provide

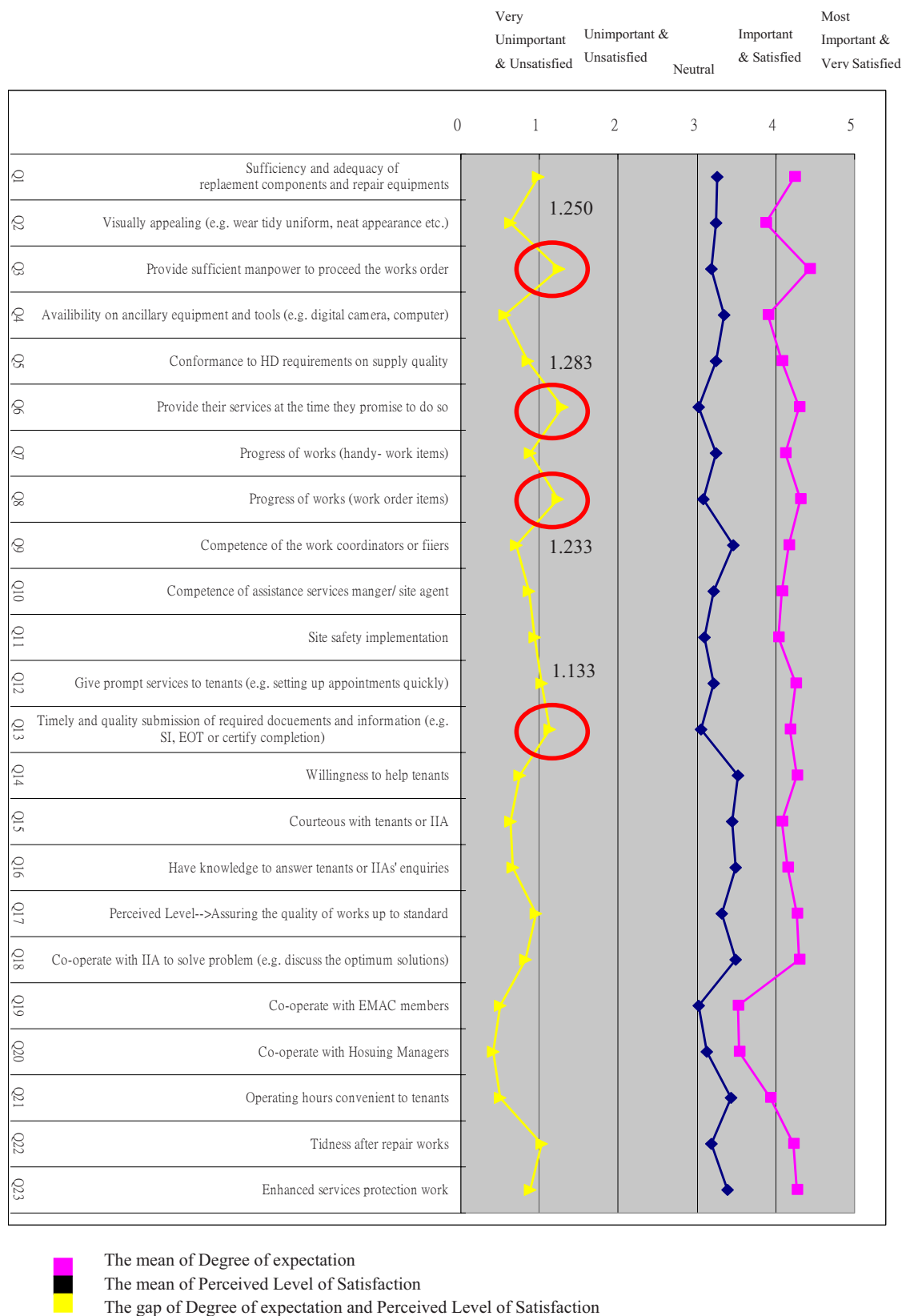


Fig. 1. Factors important to the overall quality of maintenance service (derived from Table 5)

their services at the time they promise to do so” and “progress of works (work order items),” respectively. Three out of these 4 variables, i.e., variables “provide their services at the time they promise to do so,” “progress of works (work order items),” and

“timely and quality submission of required documents and information (e.g., site instructions, extension of time, or certify completion)” also have the highest gap scores among the 23 variables which are mainly related to the great concern on the distur-

Table 6. SERVQUAL Values for the Five Dimensions

Dimensions	Expectation mean (E)	Perception mean (P)	Services quality gap (G) $G=E-P$	Rank
Tangible	4.108	3.254	0.854	4
Reliability	4.157	3.193	0.964	2
Responsiveness	4.233	3.261	0.972	1
Assurance	3.975	3.311	0.664	5
Empathy	4.108	3.192	0.916	3

bance to tenants and inadequate manpower resources. These findings clearly support that there are the urgent needs for the contractor to increase the manpower resources to minimize the disturbance to tenants and ensure the efficiency of the operation to the scheme.

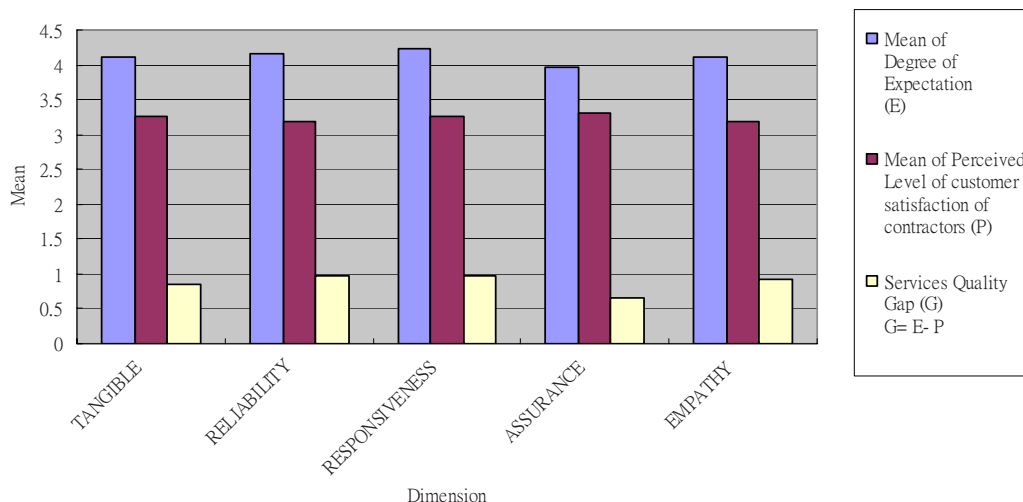
Conclusion and Recommendation

The SERVQUAL gap analysis indicates that the difference between expectation and perception of the service delivered is consistently positive which reflects a service delivery shortfall in the eyes of the owner's frontline representatives. This outcome clearly identifies a 'communication' problem between what the owner's frontline representatives expect and what they perceive as delivered by the contractors. There may be two plausible reasons for creating the communication problem. First, the owner's frontline representatives' expectations may be higher than what is a realistically available service. This implies that the true ability of the contractors is not fairly portrayed and presented to the owner's frontline representatives. Consequently there is an unreal anticipation of what can be delivered. Second, contractors' misinterpretation of the owner's frontline representatives' expectations is also a source of problems. Contractors may not fully listen to the desires of the owner's frontline representatives. This disparity reflects the difference between owner's frontline representatives and contractors in the ranking of importance of distinct service features. This is particularly obvious from the analyzed outcome of the four variables with the highest gap scores, which are all related to the customer focus and time factors to provide services within promised time frame and complete the works

order on time. In order to bridge the communication gap, more detailed discussion should occur during the contract stage between the owner's frontline representatives and contractors. This discussion should center on what the owner's frontline representatives need and how the contractors can provide the services. Nevertheless the disparity between the expected and perceived services can provide an insight for the contractors to realize the expectation level of the owner's frontline representatives on the various service variables and can identify the areas of shortfall that require improvement. This would particularly be the case with respect to increasing the manpower and resources to improve the timeliness and management for carrying out inspection and completing the maintenance works within the time schedule as well as maintaining timely submission of relevant documents for certification purposes.

The conceptual framework and the propositions emerging from it imply a rich agenda for the following industrial practices and further research:

1. The information of the perceived service performance could provide the necessary insights for the frontline representative to carry out supervision and management on the contractors' works. This would be particularly important for the three variables [i.e., variables "provide their services at the time they promise to do so," "timely and quality submission of required documents and information (e.g., site instructions, extension of time, or certify completion)," and "progress of works (work order items)"] with the lowest mean scores of the perceived SQ level and the highest gap scores.
2. Perceived quality is an antecedent of satisfaction (Siu et al. 2001). Continually conducting the SQ performance survey would provide a systematic benchmark for future improvement in matching service delivery with expectations. When the improvements can develop to a point where the expectations will be equal to or lower than the perceived levels, the SERVQUAL gap analysis can be applied to reveal the gaps in perceptions among the various parties, e.g., between actual service delivery (i.e., the contractors) and the management perceptions, or the external communications about service (i.e., the tenants as the end users' standpoints).
3. The outcome of this service performance survey could also be applied as an evaluation tool in the process of contractor selection that will motivate and guide the maintenance con-

**Fig. 2.** SERVQUAL values for the five dimensions

tractors to increase competition and maintain a continuous flow of business by producing higher process and product quality. The frontline representatives may expect a high quality service from contractors and a high maintenance product quality, which in turn satisfy the public housing owner organization and the end-users, i.e., the tenants. As a result, the overall level of quality in the maintenance scheme and the satisfaction of all concerned parties are likely to increase.

4. When the service performance survey is conducted regularly, the comparative results of these continual surveys would help render successful implementation of TQM in maintenance works since service performance measurement during process delivery already coincides with theory of TQM in two major areas, i.e., process-oriented rather than result-oriented and continuous improvement.
5. Parasuraman et al. (1985) indicated that expected services were affected by a variety of factors, such as word-of-mouth communications, personal needs and past experiences, and external communications can also affect both the consumer expectations about a service and consumer perceptions of the delivered service. Research focusing on these factors and different cultural belief with the western countries will have useful implications on any different international perspectives on service expectations or perceptions on maintenance works in other countries due to the cultural differences.

The major insights and implications from this study will hopefully spawn both academic and practitioner interest in maintenance SQ and serve as a framework for further empirical research in the abovementioned areas.

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